Information Systems
ISM 3011

Fall 2003
Unit 3A

Assignment for Next Class

- Read and prepare the case studies 1 and 2 (p. 127-128).

Hardware: Input, Processing, and Output Devices

Chapter 3

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.

Principles and Learning Objectives

- 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

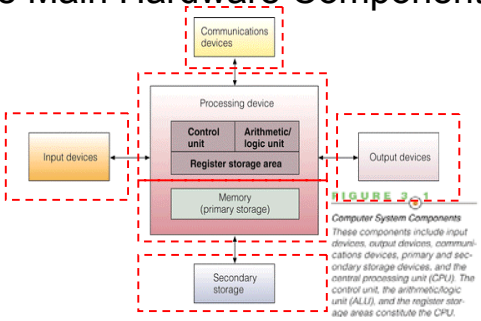
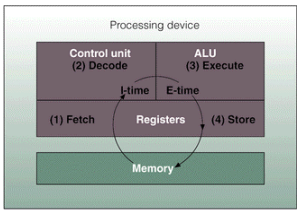


FIGURE 3-1
Computer System Components
These components include input devices, output devices, communications devices, primary and secondary storage devices, and the central processing unit (CPU). The control unit, the arithmetic/logic unit (ALU), and the register storage areas constitute the CPU.

Machine Language

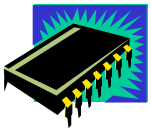
CLEAR A	000: 100
LOAD A, 7	001: 200 7
LOAD B, 5	003: 201 5
SUB A, B	005: 150
JUMP TO 034 IF ZERO	006: 170 034
	008:
Assembler	…
(Mnemonics)	034: …
	Machine Language

Hardware Components in Action



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

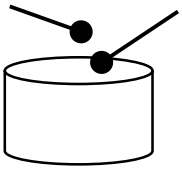
Processing & Memory Devices



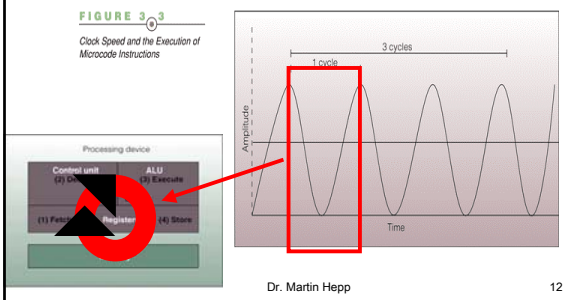
Processing Characteristics and Functions

- **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

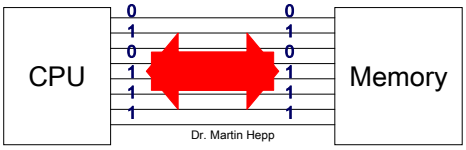


Processing Characteristics and Functions

- **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

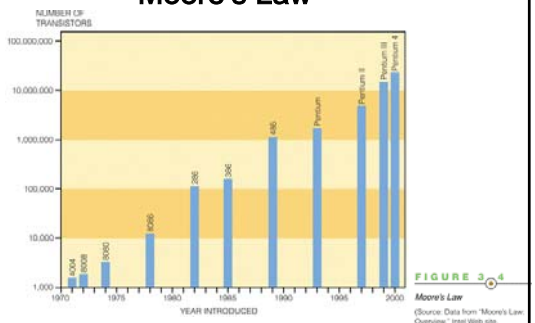


Physical Characteristics of the CPU

- 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

Storage Capacity

Name	Abbreviation	Number of Bytes
Byte	B	1
Kilobyte	KB	1,024 Bytes
Megabyte	MB	1,024 Kilobytes (about 1 million)
Gigabyte	GB	1,024 Megabytes (about 1 billion)
Terabyte	TB	1,024 Gigabytes (about 1 trillion)
Petabyte	PB	1,024 Terabytes (about 1 quadrillion)

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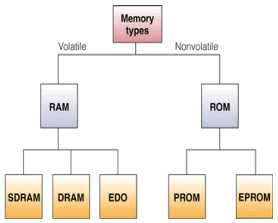
Types of Memory

FIGURE 3-5

Basic Types of Memory Chips



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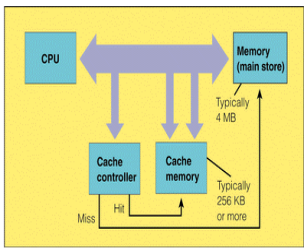
Cache Memory

FIGURE 3-6

Cache Memory

Processors can access this type of high-speed memory faster than main memory. Located near the CPU, cache memory works in conjunction with main memory. A cache controller determines how often the data is used and transfers frequently used data to cache memory, then deletes the data when it goes out of use.



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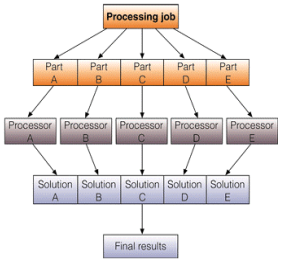
Massively Parallel Processing

FIGURE 3-7

Massively Parallel Processing

Massively parallel processing involves breaking a problem into various subproblems or parts, then processing each of these parts independently. The most difficult aspect of massively parallel processing is not the simultaneous processing of the subproblems but the logical structuring of the problem into independent parts.



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Secondary Storage

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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

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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)

Magnetic Disks

FIGURE 3-10

Hard Disk

Hard disks give direct access to stored data. The read/write head can move directly to the location of a desired piece of data, dramatically reducing access times, as compared with magnetic tape.

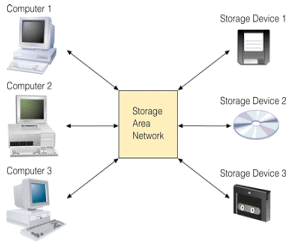
(Source: Courtesy of Seagate Technology.)

Storage Area Network

FIGURE 3-11

Storage Area Network

SAN provides high-speed connections between data storage devices and computers over a network using the Fibre Channel communications protocol.



Comparison of Secondary Storage Devices

TABLE 3-1

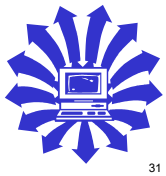
Comparison of Secondary Storage Devices

Storage Device	Year First Introduced	Maximum Capacity
3.5-inch diskette	1987	1.44 MB
CD-ROM	1990	650 MB
Zip	1995	100–250 MB
DVD	1996	17 GB

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!

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