Introduction to Computer Programming

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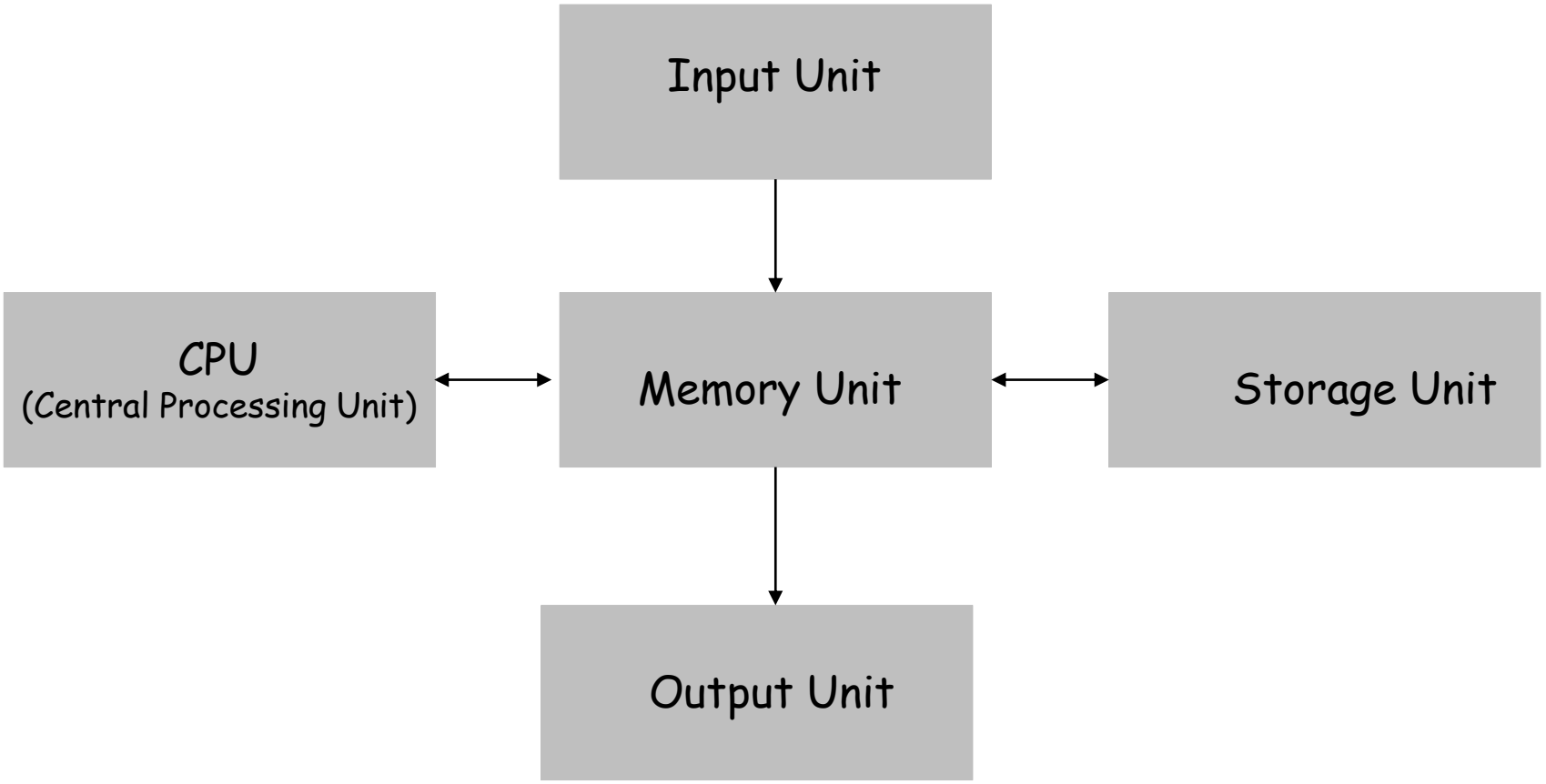
What is a computer?

- Definition: Device capable of performing computations and making logical decisions.
- Organization:



What is a computer?

- Input unit
  - Obtains information from input devices
  - Keyboard, mouse, microphone, scanner, etc.
- Output unit
  - Takes information processed by computer, which is used to control other devices
  - Places information on output devices
  - Printer, etc.
- Central processing unit (CPU)
  - Control unit: supervises and coordinates other sections of computer
  - Arithmetic and logic unit: performs arithmetic calculations and logic decisions

What is a computer?

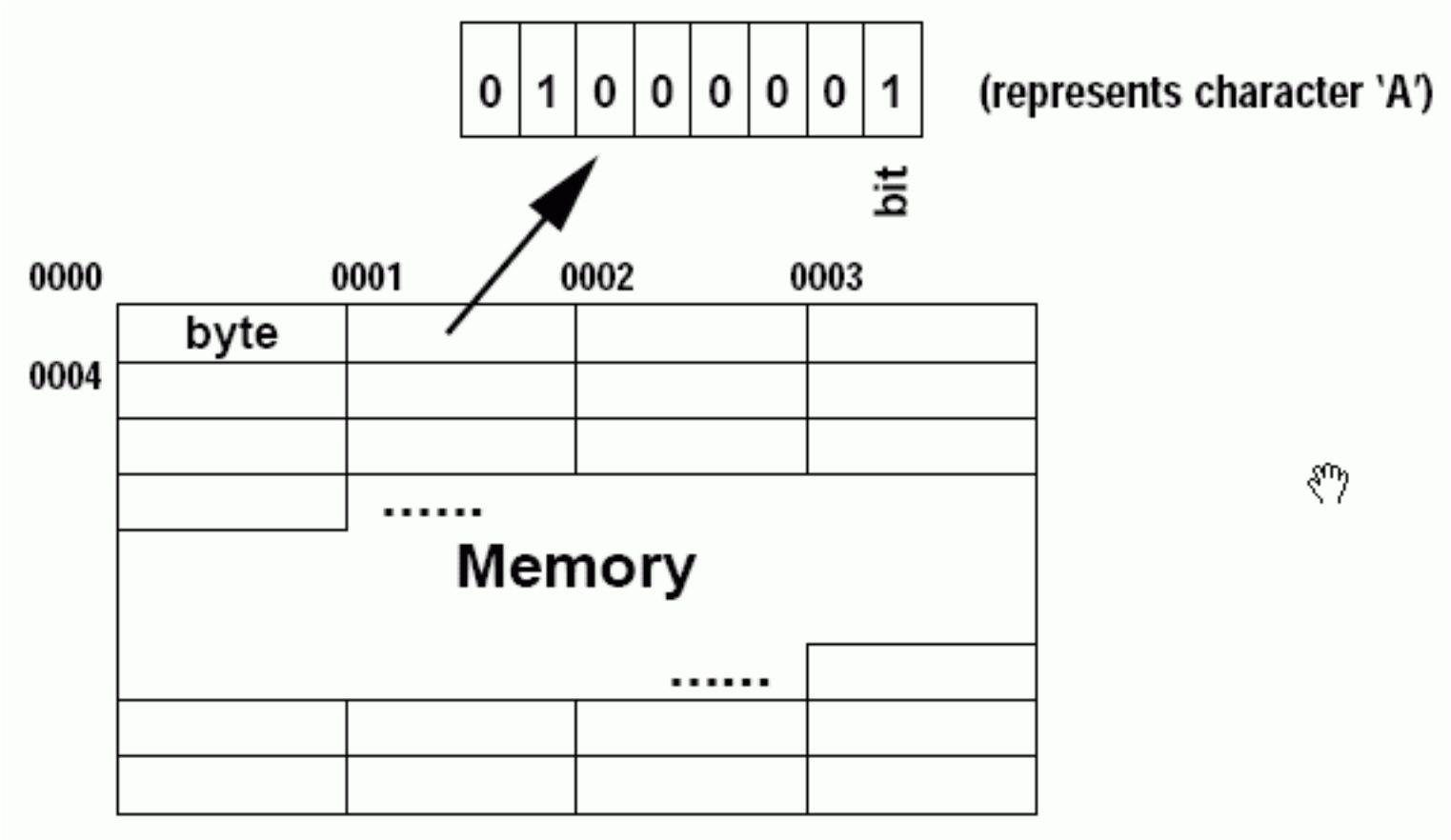
- Memory unit (or primary memory)
  - Refers to the random access memory(RAM)
  - Rapid access, relatively low capacity
  - Retains information from input unit so as to make it immediately available for processing
  - Retains processed information until placed on output devices
- Storage unit (or secondary storage unit)
  - Long-term, high-capacity memory section
  - Store data and programs that are not immediately needed.
  - Secondary storage devices such as disks and optical discs
  - Longer to access than primary memory
  - Less expensive than primary memory

Memory Organization

- In the lowest level, computers understand only 0 and 1.
- Computer memory stores a sequence of 0 and 1.
- Each such storage unit is called as a bit.
- Eight bits are grouped together to form a larger storage unit called a byte.

Memory Organization

- Each byte has a unique address for identification
- Computer memory can thus be viewed as a series of bytes.



What is a Computer Program?

- Sets of instructions that tells the computer how to process the data.
- Writing computer programs means writing sets of instructions in some languages that tell the computer what to do.

Machine Language机器语言

- Only language computer directly understands
- Defined by hardware design: machine-dependent
- Made up of 0s and 1s
- Instruct computers to perform elementary operations
- Example:

  00010101000101010100010110000001

  10100101011010101010101010101010

  00000011111100000011111100000010
- Difficult for humans to read and write

Assembly Language汇编语言

- Example:
  - Load Basepay
  - Add Overpay
  - Store Grosspay
- English-like abbreviations representing elementary computer operations
- Easier for humans to read and write
- Incomprehensible to computers
  - Translator programs (assemblers): convert to machine language
- Still quite troublesome to use

High-level Languages 高级语言

- Example
- Grosspay = basepay + overtimepay
- More English-like, use common mathematical notations
- Single statements accomplish substantial tasks
  - Assembly language requires many instructions to accomplish simple tasks.
- Translator programs (Compliers 编译器)
  - Convert your program to machine language
- Interpreter programs
  - Directly execute high-level language programs
- Different high-level languages: Basic, Pascal, C, Java，C++, etc.

Basics of a Typical C Environment

- Phases of C Programs:
  - Edit
  - Compile编译
    - Preprocess: invoke the processor to deal with the program code by including other files or making some changes (i.e., the use of #include or #define）
    - Compiler: invoke the complier to convert the program code to object code.
  - Link 连接
    - Invoke the linker to take one or more object files generated by a complier and combines them into a single executable file.
  - Execute
- Preprocess and compiling are commonly performed as one step during compilation.
- C is a general purpose programming language
- Small and relatively easy to learn.