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What is computer architecture

- Layout and interactions of a computer system

Major components of a computer

- CPU(centrel processing unit)
  运算速度与存储速度匹配
  - ALU
  - CU
  - Bus
  - Register
    - Special register
      1. CIR(current instruction register)
      2. MAR(Memory address register)
         a) When the next instruction is needed, its address is copied from the PC and placed in the MAR
      3. MDR(memory address regisrer)
      4. IR(index register)
      5. PC(program counter)
         - Storages the address of the next instruction to be fetched(指向下一条的指针)
           a) SCR(sequence control register)
    - general
    - 最快的存储
    - A location that can store data
    - Why register is faster than RAM
      1) Distance to CPU(short)
      2) Hardward design
      3) The way they work
- RAM（random access memory）
  - Volatile storage
  - Used to storage everything while computer is on
- ROM（read only memory)
  - Non-volatile
  - Often holds the computer's BIOS(basic input/output system) basic instructions when computer first loads
- Program counter
- Memory
  - Several ways to remember the state of a switch
    1. Electrical- RAM, flash memory, solid state drives, some ROM
    2. Magnetic- hard drives, magnetic tapes

3. Optical- CDs, DVDs, Blu-Ray
    1）波长：780nm，650nm，405nm
- Address and content(地址与数据)
- Cache
    - 速度介于Register和RAM之间
    - Located in front of main RAM
    - Size: around 1 MB
    - Level 1, 2, 3
- Virtual memory
    - If a program is too big for RAM, the hard drive is stared to be used to store data
        1）Prevent the computer from stalling
        2）But it is slow
- Hard drives
- Memory hierarchy levels
    i. Register <10ns
    ii. Caches <100ns
    iii. Memory
    iv. Disk
    v. Tape

冯诺依曼结构：

- 哈佛结构与冯诺依曼结构
    - 哈佛： 数据与指令分开
    - 冯诺依曼： 指令与数据储存在一起

- Fetch-decode-execute cycle（machine instruction cycle)
    a. Fetch instruction from memory
    b. Decode instruction in control unit(CU)
    c. Execute instruction(data may be fetched from memory)(ALU)
        i. accumulator
    d. Store results if necessary(CPU-RAM)
    e. Repeat
- Describe basic Von Neumann processor architecture
    a. Concept of a stored program
    b. Instructions and data use the same memory
    c. Use a single processor
    d. Follows a sequential set of instructions

1. PC stores the address of the next instruction to be fetched
2. When the next instrution is needed, its address is copied from PC and placed in the MAR
3. The contents are placed in MDR
4. The contents in MDR are copied to CIR
5. CIR holds the instruction that is about to be executed