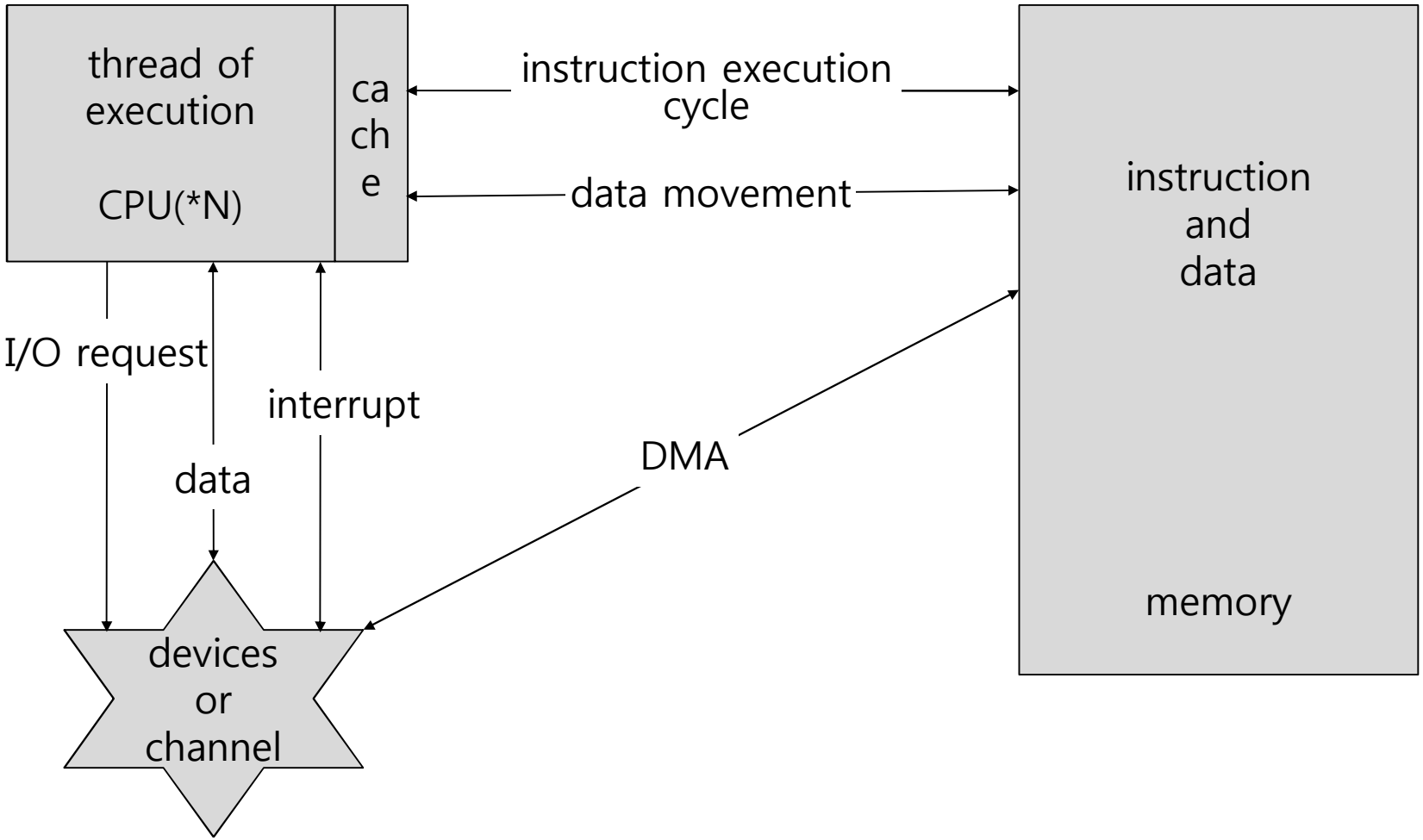
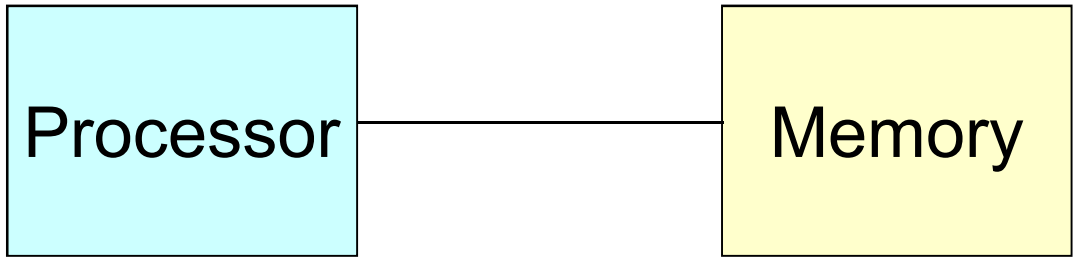
How a Modern Computer System Works



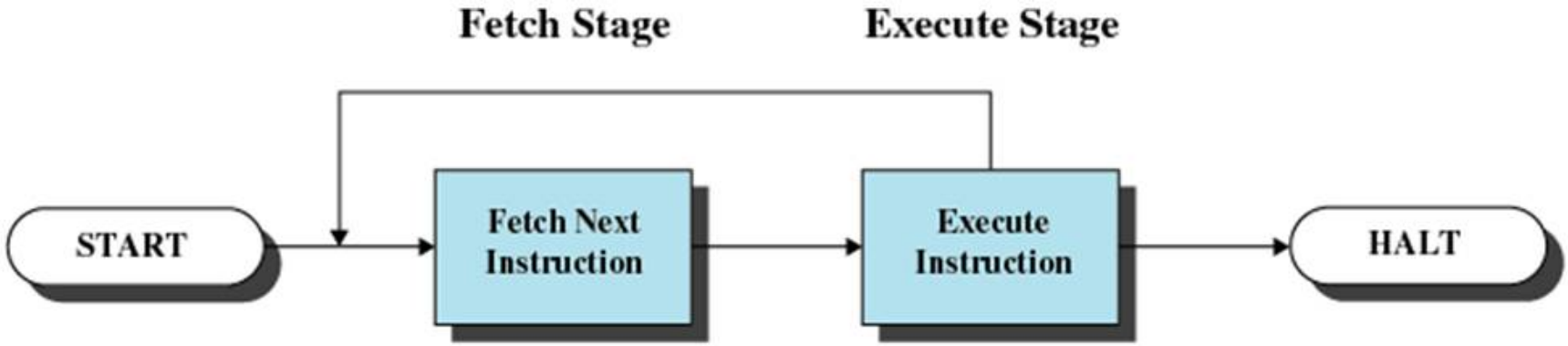
Stored Program Computer

- “Stored program" 방식의 컴퓨터
  - Von Neumann computer
  - 현재의 대부분의 컴퓨터
  - 계산(computation) -> 프로그램의 수행(running)을 의미
  - memory: 프로그램이 저장된 장소
  - processor or CPU: 계산을 수행하는 기계의 부분
  - computer program: list of CPU instruction



Fetch-Execution Cycle

- 프로세서에 의한 계산은 Fetch-Execution Cycle을 통해 이루어진다.
  - The processor fetches an instruction from memory
  - The processor executes the instruction
  - The processor cycles back to step “fetch”



Processor Registers

- User-visible registers
  - Enable programmer to minimize main-memory references by optimizing register use
- Control and status registers
  - Used by processor to control operating of the processor
  - Used by privileged operating-system routines to control the execution of programs

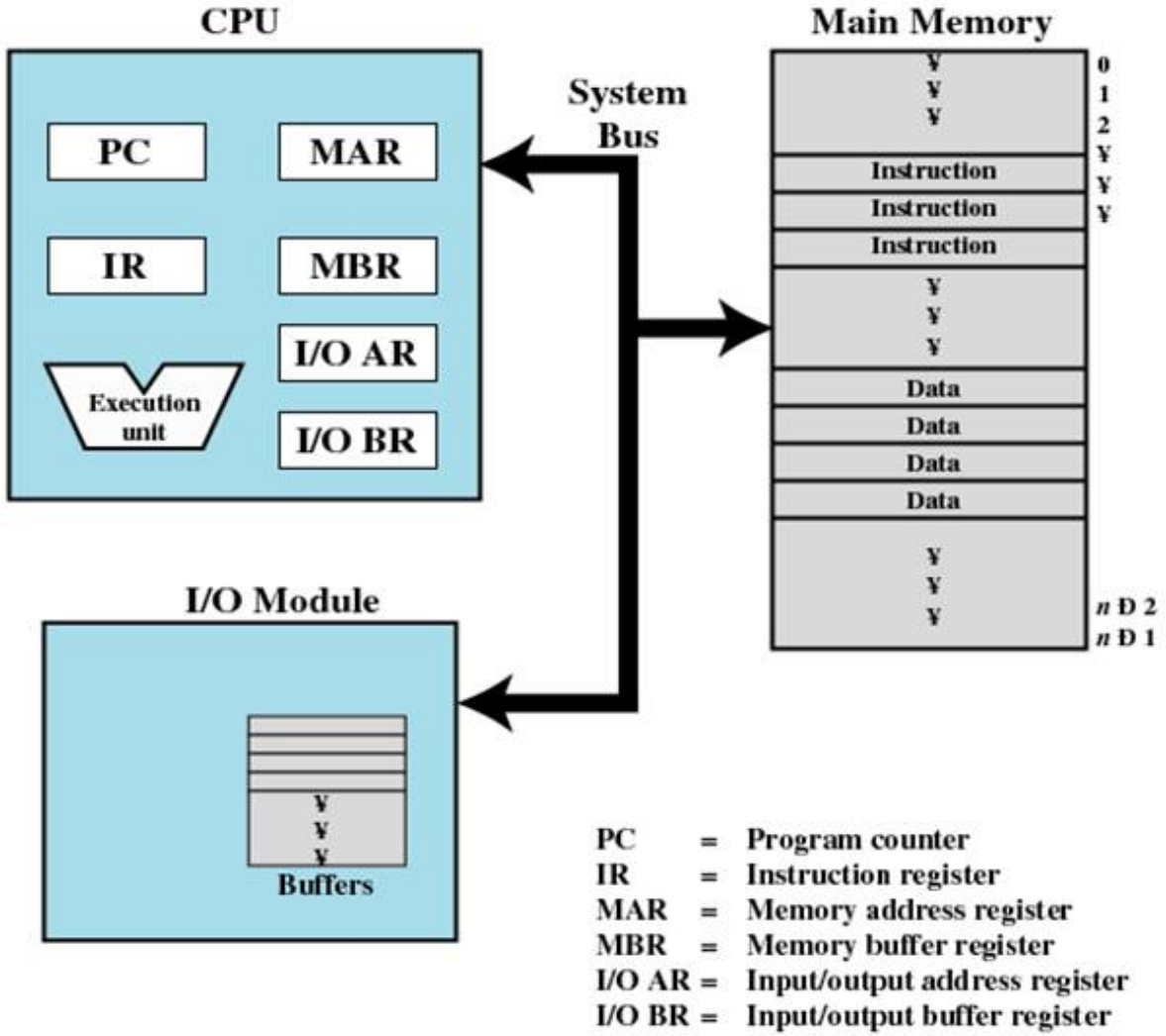
User-Visible Registers

- May be referenced by CPU instruction
- Available to all programs - application programs and system programs
- Types of registers
  - Data
  - Address
    - Index
    - Segment pointer
    - Stack pointer

Control and Status Registers

- Program Counter (PC)
  - Contains the address of an instruction to be fetched
- Instruction Register (IR)
  - Contains the instruction most recently fetched
- Program Status Word (PSW)
  - Condition codes
  - Interrupt enable/disable
  - Supervisor/user mode

Program Execution of a Hypothetical Machine

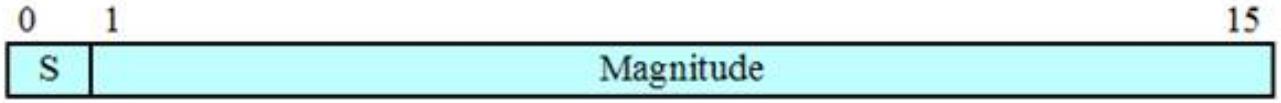


Processor Registers

- Memory address register (MAR)
  - Specifies the address for the next read or write
- Memory buffer register (MBR)
  - Contains data written into memory or receives data read from memory
- I/O address register
- I/O buffer register

Characteristics of a Hypothetical Machine

(a) Instruction format



(b) Integer format

Program Counter (PC) = Address of instruction
Instruction Register (IR) = Instruction being executed
Accumulator (AC) = Temporary storage

(c) Internal CPU registers

0001 = Load AC from Memory
0010 = Store AC to Memory
0101 = Add to AC from Memory

(d) Partial list of opcodes

Example of Program Execution