

Computer Organization
Introduction
Background

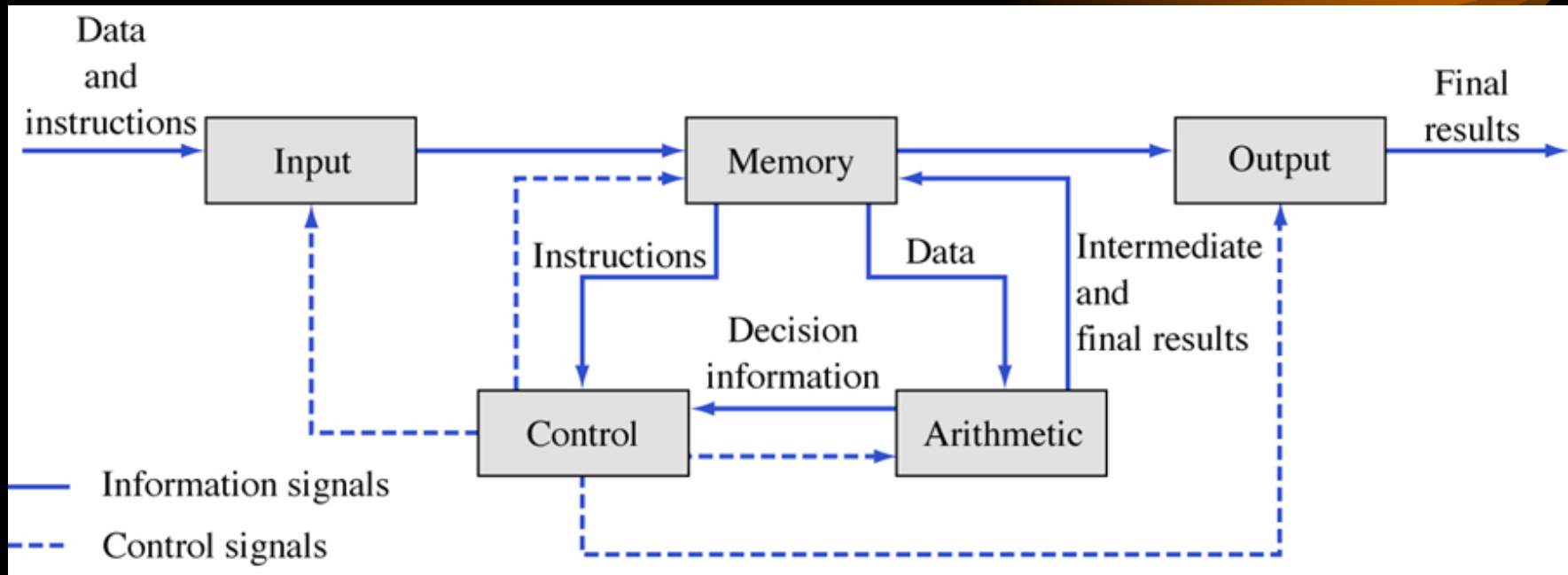


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Some definitions

- ◆ **program**: a set of instructions
- ◆ **computer**: a device that sequentially executes a stored program
- ◆ **microprocessor**: major functional blocks of a computer packaged in SINGLE chip
- ◆ **microcontroller**: a microprocessor PLUS a number of peripherals INTEGRATED into a SINGLE chip
- ◆ **computer architecture**: the arrangement and interconnection of its functional blocks
- ◆ **instruction set of a computer**: the set of operations the computer can be programmed to perform on data

Basic computer organization



von Neumann machine

◆ functional blocks of von Neumann machine

- ★ a **memory**, containing instructions and data
- ★ a **processing unit**, for performing arithmetic and logical operations
- ★ a **control unit**, for interpreting instructions

◆ basic sequence of operations

1. get the first program instruction from the memory, **fetch**
2. figure out what the instruction requires, **decode**
3. execute the instruction, **execute**
4. get the next program instruction, **fetch**
5. go to step 2

◆ cycle through: ***fetch, decode, execute***

Micro operations

- ◆ each step in the sequence of operations consists of many micro-operations
- ◆ Example

◆ Get the first program instruction from memory

1. find out the address where the instruction is located
2. send that address to the memory chip
3. enable the output of the memory chip
4. memory chip responds by placing the instruction on its “door”; get that instruction and bring it into a special register called the “**instruction register**”

- ◆ **program counter register**: a register that contains the address of the next instruction that the computer should execute (at start, it contains the address of the first instruction of the program)

Programming model

- ◆ control unit uses two registers called the **instruction register (IR)** and the **program counter (PC)** to get the first (and subsequent) program instruction(s) from memory.
- ◆ the “user” or programmer cannot access instruction register.
- ◆ **programming model of a computer**: the set of registers available to a programmer
 - ★ for a simple computer, the user can access the PC, **accumulator**, and **condition code register**
 - condition code register: n-bits, representing overflow, carry flags, ...
- ◆ real life programming models
 - ★ Alpha 21264 has 63 registers, each 64 bit wide
 - ★ Intel Pentium 4 has 32 registers of width varying from 32 to 128 bits
 - ★ Sun Sparc **can** have up to 520 registers!!!

Control unit



- ◆ orchestrates execution of the program
- ◆ consists of **IR**, **PC**, and **sequential** and **combinational logic**
- ◆ IR contains the current instruction
- ◆ PC contains the address of the next instruction to be executed
- ◆ **control unit tasks**
 - ★ **fetch**: read an instruction from memory
 - the instruction's address is in the PC
 - ★ **decode**: interpret the instruction, and then generate all those signals that tell the other components what to do to get the job done

Very simple view

