Chapter 02: Computer Organization

Lesson 02:

Functional units and components in a computer organization- Part 1: Processor
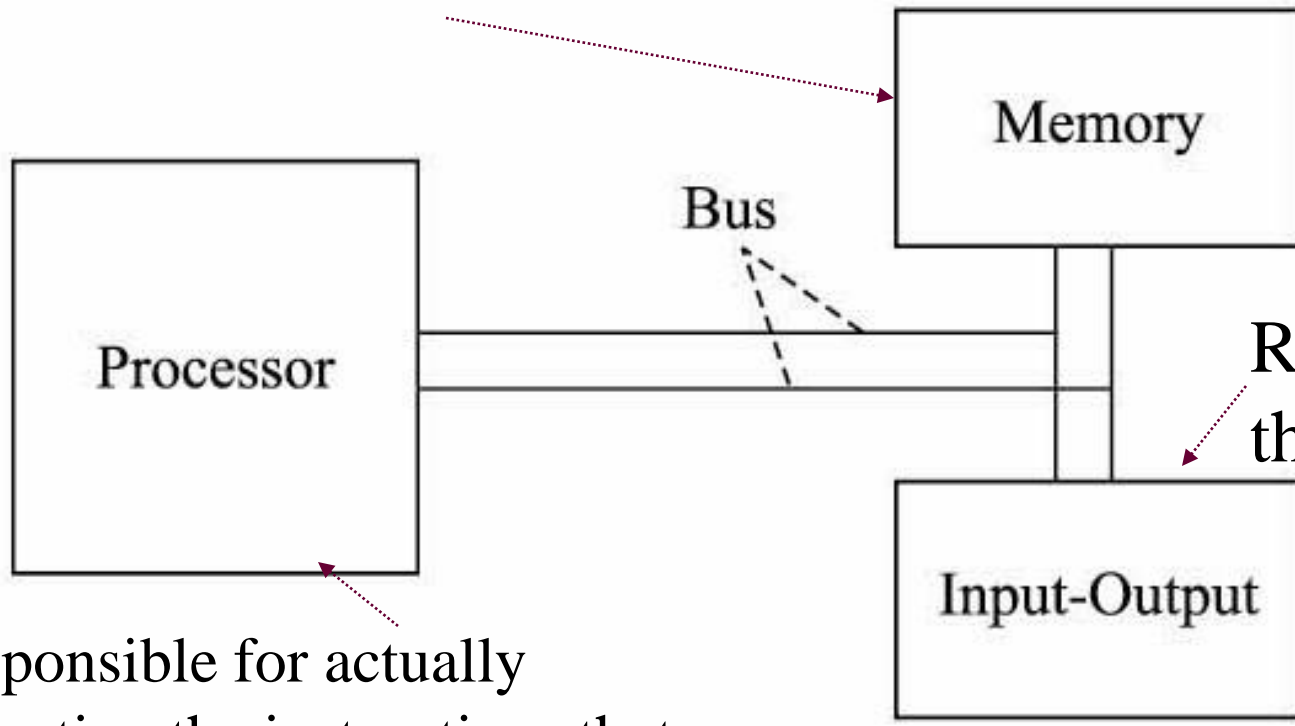
Objective

- Understand functional units in Processor

- Understand execution unit, register file and control logic

Functional Units and Components
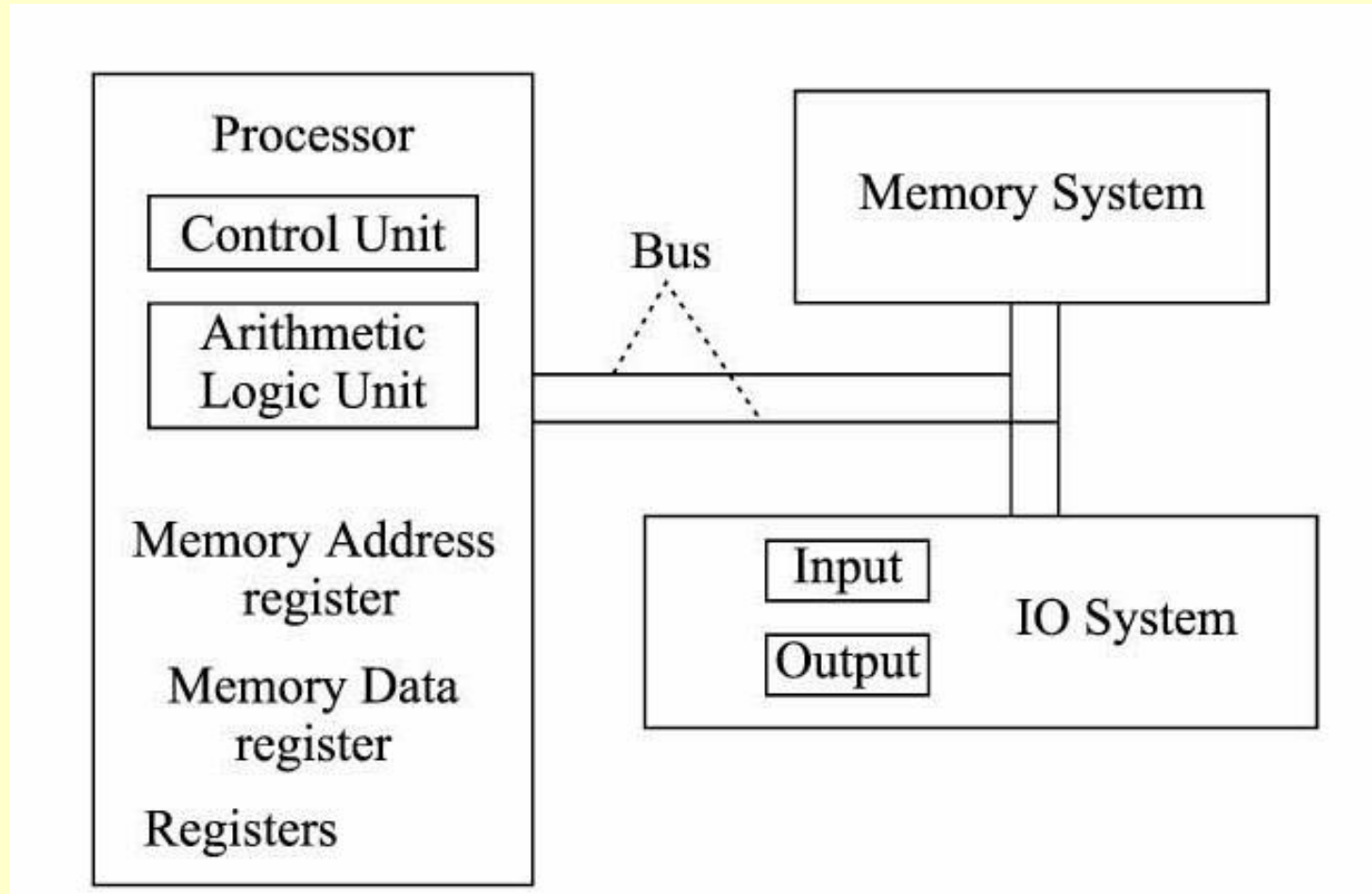
A simple view of Computer Organisation

Responsible for storing the the instructions and data for execution

Responsible for the IOs

Memory
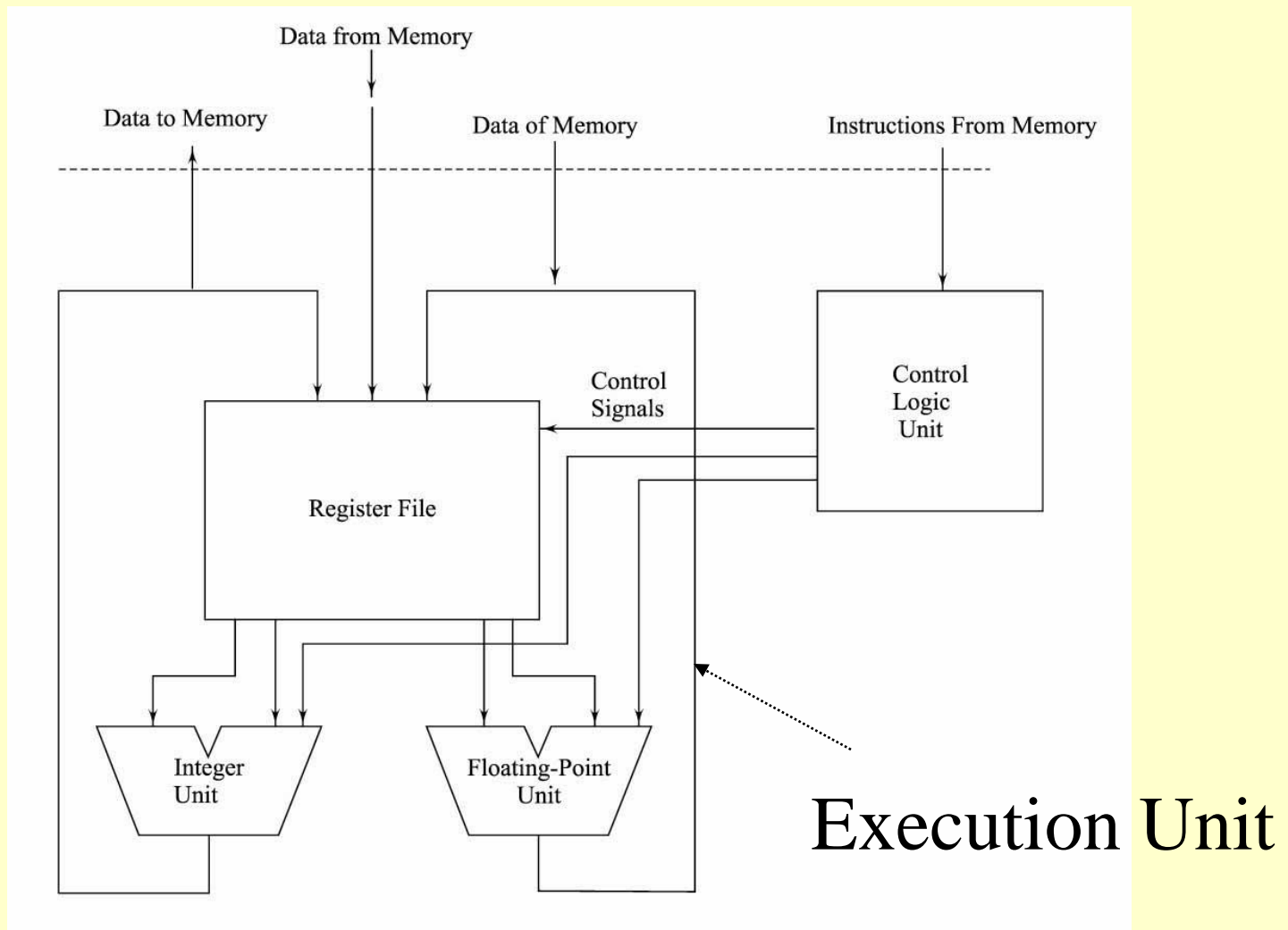
Bus

Processor

Input-Output

Responsible for actually executing the instructions that make up programs and operating system

Functional units and components for understanding computer organization

The Processor

Processor Block Diagram

Execution Unit

1. Execution Unit

Execution Unit

- Contains the hardware that executes instructions

- Includes the hardware that fetches and decodes instructions

- Does actual computation using the arithmetic logic unit(s) [ALUs]

Execution Unit

- Different in many processors

- May contain separate execution units for integer and floating-point computations

- Hardware required to handle the two data types, integer and floating point.

- Modem processors often use multiple execution units to execute instructions in parallel to improve performance

2. Register File (Set)

Register File

- GPRs

- Program counter

- Status register

- Other registers used for program execution

- Current program register file

Processor Operations using Registers

- Allows an operation, such as an addition, to read all of its inputs from the register file at the same time, rather than having to read them one at a time

- Values stored in the register accessed more quickly than data stored in the memory

- Support to simultaneous access of registers by the processor

Different processors

- Different processors access and use their register files in very different ways

- But virtually all processors have a register file of some sort

- Some processors support access to multiple registers and to a list of registers

8086 processor registers

- Four GPRs - AX, BX, CX, DX

- Four segment registers - CS, SS, DS, ES

- Four pointer index and registers - SI, DI, BP, SP

- One instruction pointer IP (to work as PC in conjunction with CS

ARM processor

- A register set of 15 GPRs, PC, CPSR, and SPSR (current program and saved program status registers)

- Values stored in the register accessed more quickly than data stored in the memory. The processor supports simultaneous access to multiple registers and a list of registers

3. Control Logic

Control Logic Unit

- Controls the rest of the processor

- Determining when instructions can be executed

- Controls what sequences of operations required to fetch and execute each instruction and store result of each instruction

Early processors' control logic

- Very small fraction of the processor hardware compared to the ALUs and the register file

New processors' control logic

- Complex control unit one of the more difficult parts of a processor to design

Summary

We learnt

- Functional units of a computer─ Processor, memory and IO systems

- Processor─ Execution and control units

- Execution unit includes the hardware that fetches and decodes instructions and does actual computation using the arithmetic logic units (ALUs)

- Control unit

We learnt

- Current program register-file or register-set

- Registers, IR, ID, MAR and MDR

- GPRs, program counter, status register, and other registers in the processor used by a program

- A complex control unit in the processor with large number of opcodes and multiple addressing modes

End of Lesson 02:
Functional units and components in a computer organization- Part 1: Processor