

Computer Architecture

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Architecture & Organization 1



- Architecture is those attributes visible to the programmer
 - Instruction set, number of bits used for data representation, I/O mechanisms, addressing techniques.
 - e.g. Is there a multiply instruction?
- Organization is how features are implemented
 - Control signals, interfaces, memory technology.
 - e.g. Is there a hardware multiply unit or is it done by repeated addition?

Architecture & Organization 2



- All Intel x86 family share the same basic architecture
- The IBM System/370 family share the same basic architecture.
- This gives code compatibility
 - At least backwards
- Organization differs between different versions

Structure & Function



- Structure is the way in which components relate to each other
- Function is the operation of individual components as part of the structure

Function



- All computer functions are:
 - Data processing
 - Data storage
 - Data movement
 - Control



Functional View

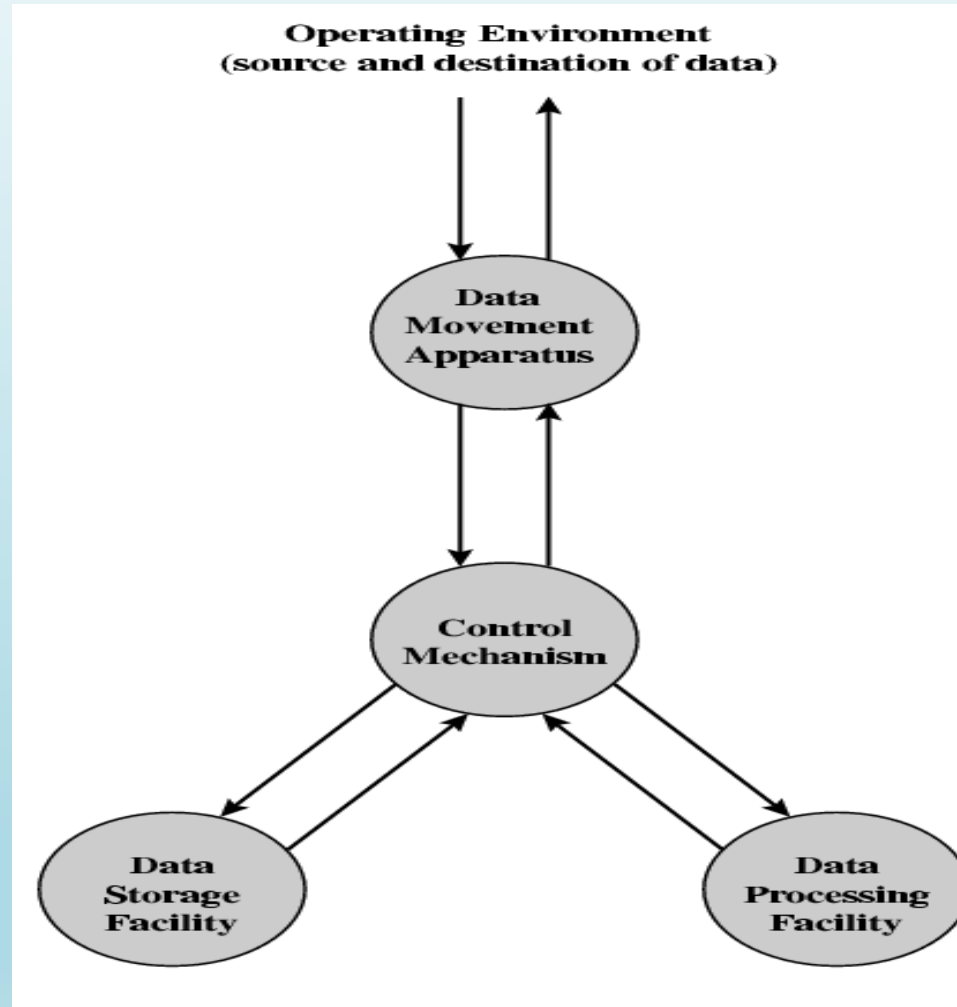


Fig. 1.1: Functional View

Computer Function



Both the structure and functioning of a computer are, in essence, simple. Figure 1.1 depicts the basic functions that a computer can perform. In general terms, there are only four:

- Data processing
- Data storage
- Data movement
- Control

Operations (a) Data movement

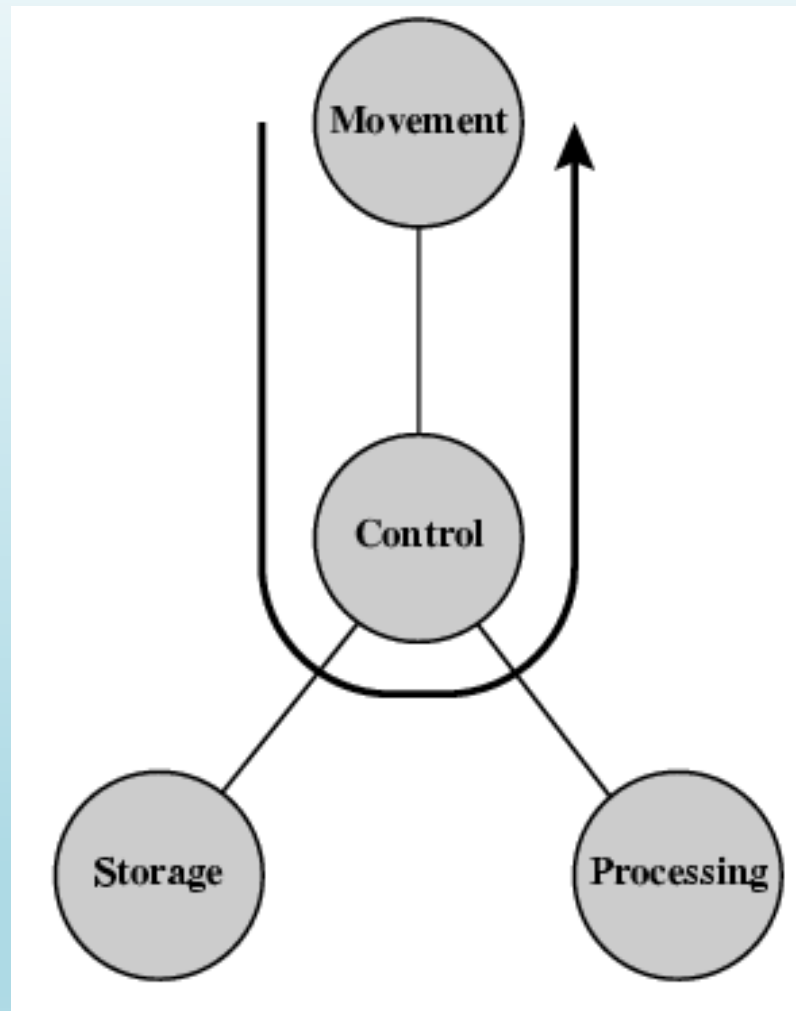


Fig.1.2: Data Movement

Operations (b) Storage

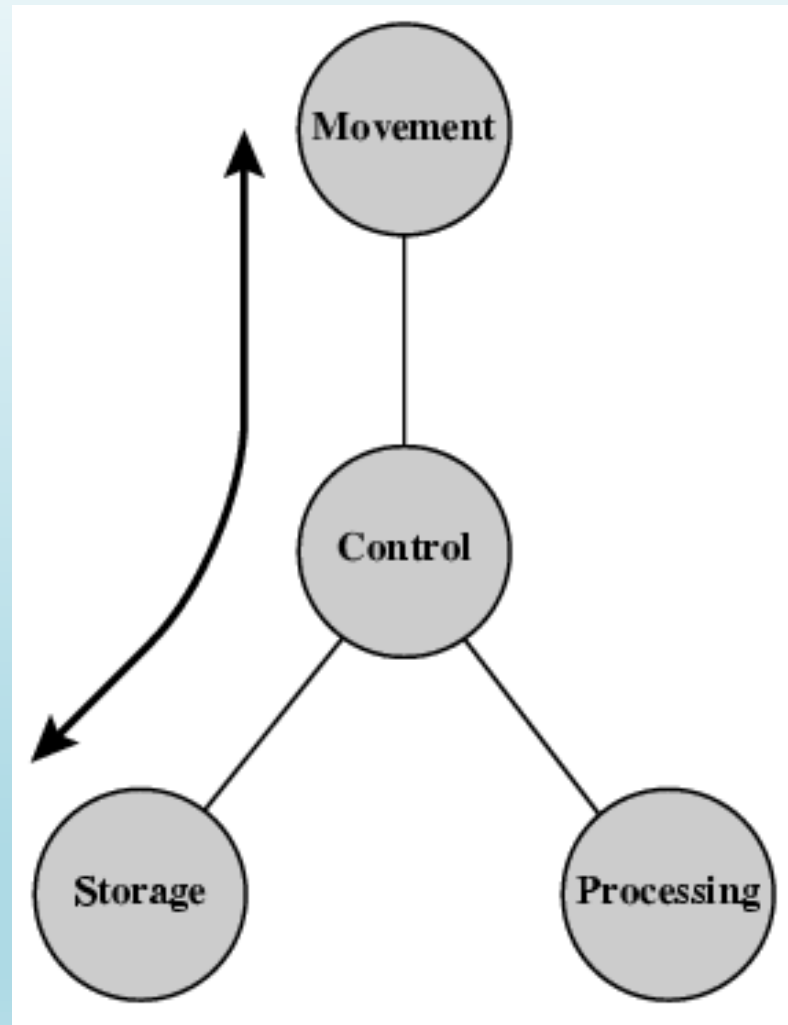


Fig.1.3: Storage

Operation (c) Processing from/to storage

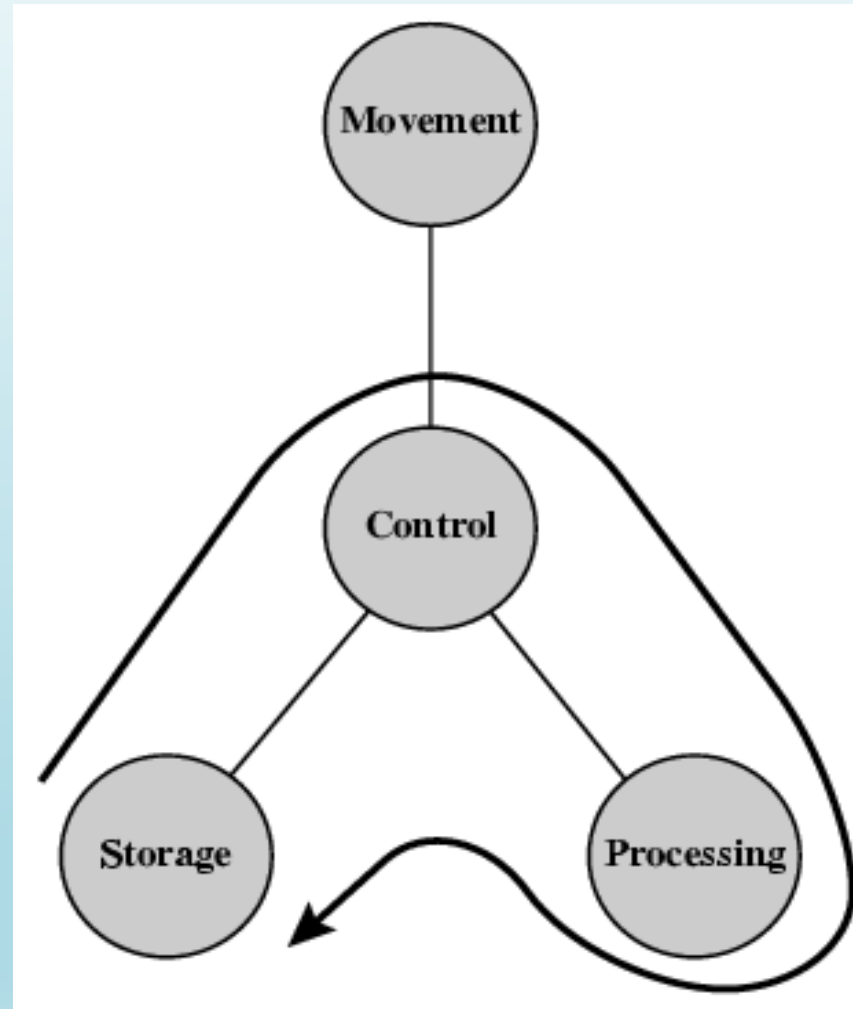


Fig.1.4: Processing from/to storage

Operation (d) Processing from storage to I/O

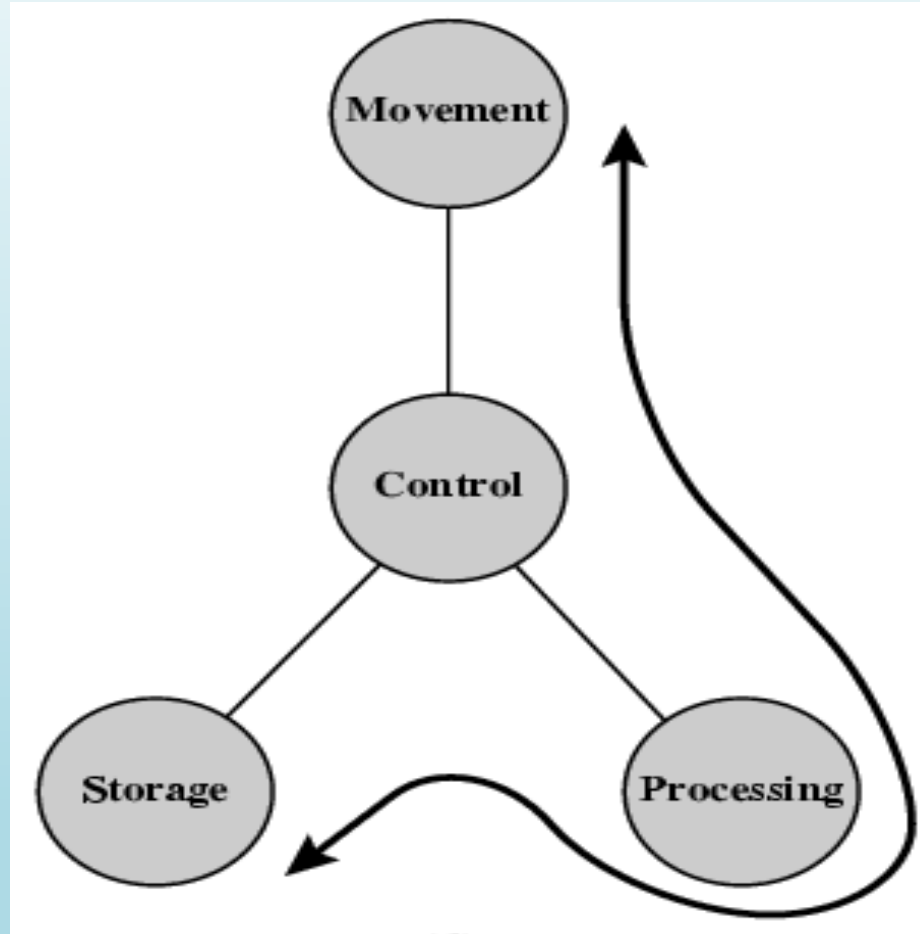


Fig.1.5: Processing from storage to I/O



Structure - Top Level

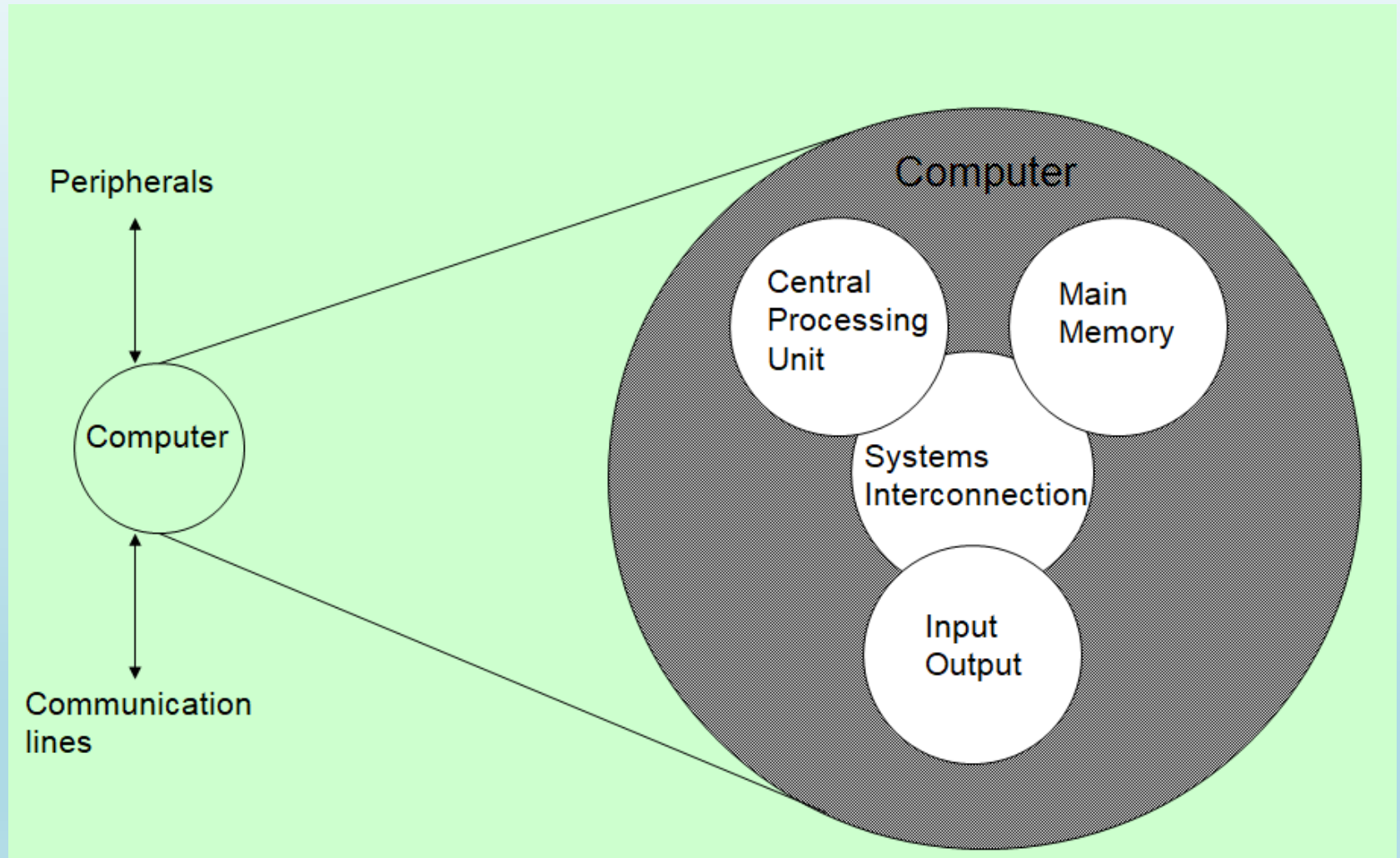


Fig.1.6: Structure-Top Level

Top Level Structure



There are four main structural components:

- **Central processing unit (CPU):** Controls the operation of the computer and performs its data processing functions; often simply referred to as **processor**.
- **Main memory:** Stores data.
- **I/O:** Moves data between the computer and its external environment.
- **System interconnection:** Some mechanism that provides for communication among CPU, main memory, and I/O. A common example of system interconnection is by means of a **system bus**, consisting of a number of conducting wires to which all the other components attach.

Structure - The CPU

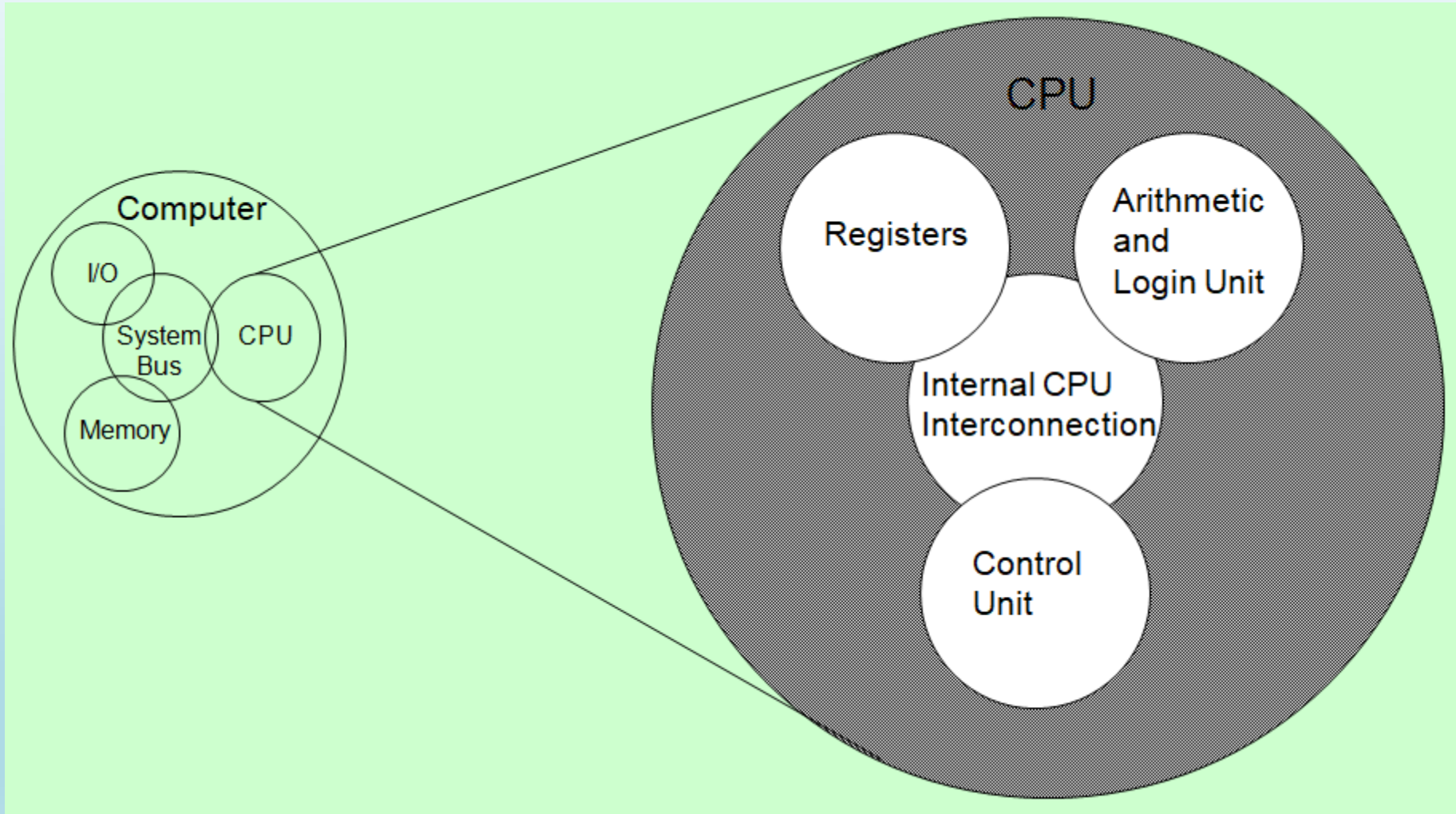


Fig.1.7: Structure-The CPU

The CPU



CPU's major structural components are as follows:

- **Control unit:** Controls the operation of the CPU and hence the computer
- **Arithmetic and logic unit (ALU):** Performs the computer's data processing functions
- **Registers:** Provides storage internal to the CPU
- **CPU interconnection:** Some mechanism that provides for communication among the control unit, ALU, and registers.

Structure - The Control Unit

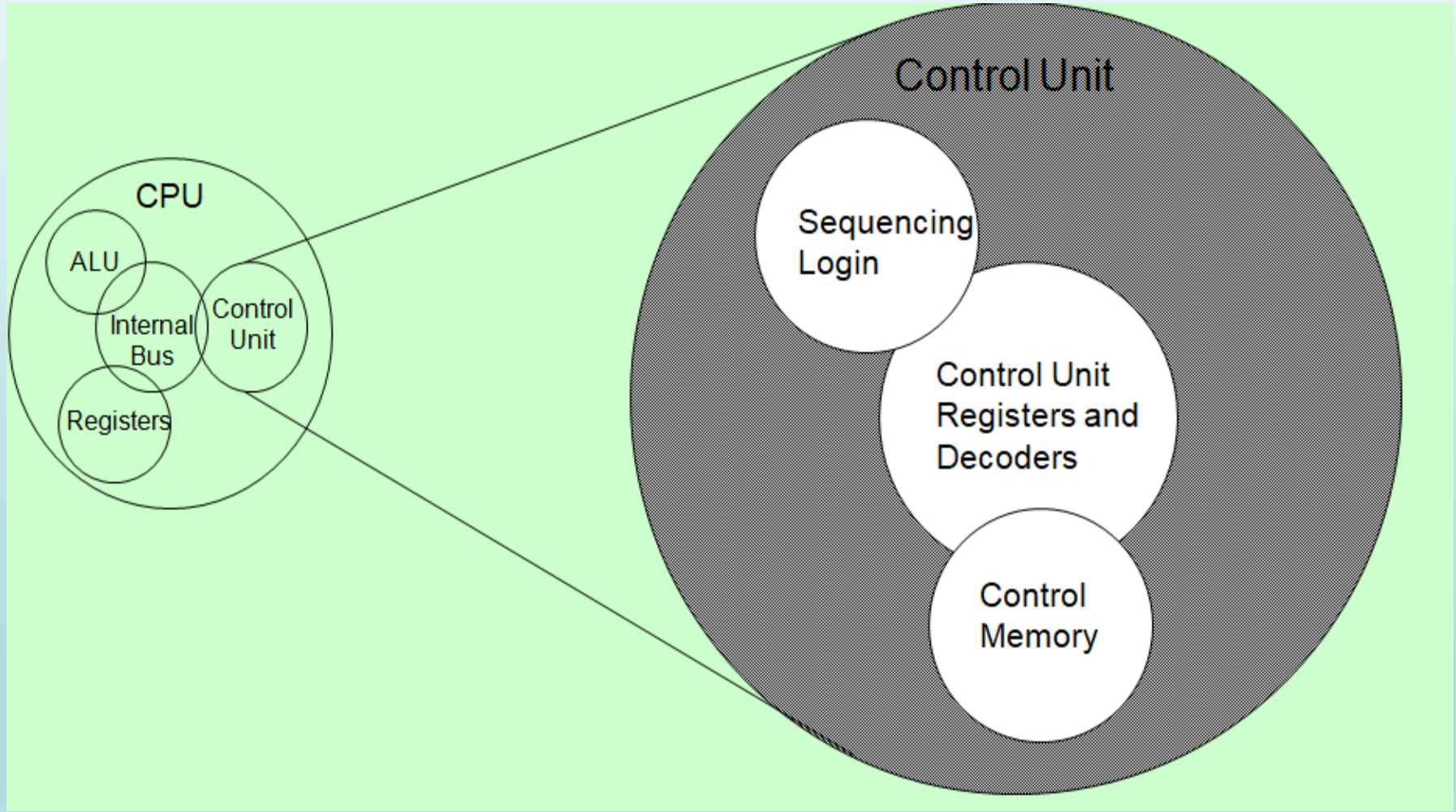


Fig.1.8: Structure-The Control Unit

Review Questions



- **1.1.** What, in general terms, is the distinction between computer organization and computer architecture?
- **1.2.** What, in general terms, is the distinction between computer structure and computer function?
- **1.3.** What are the four main functions of a computer?
- **1.4.** List and briefly define the main structural components of a computer.
- **1.5.** List and briefly define the main structural components of a processor.



**Thank You.
Any question(s)?**