


Computer Organization and Application

Introduction to Computer system Organization

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Computer Organization & Architecture

- **Architecture** is those attributes visible to the programmer
  - **Instruction set**: Defines the operations the computer can perform.
  - **Number of bits**: Determines how data types like numbers and characters are represented.
  - **I/O mechanisms**: Handles communication between the computer and external devices.
  - **Memory addressing techniques**: Dictates how the system accesses and locates data in memory.
  - e.g. Is there a multiply instruction?
- **Organization** is how features are implemented
  - **Control signals**: Manage the flow of data within the system.
  - **Interfaces**: Connect the computer to peripherals (e.g., printers, storage devices).
  - **Memory technology**: The hardware used for storing and retrieving data.
  - e.g. Is there a hardware multiply unit or is it done by repeated addition

Computer Organization & Architecture

- Many computer manufacturers offer a family of models with the same ***architecture*** but different ***organization***.

- As a result, these models vary in ***price*** and ***performance***. A particular architecture may last for many years, while its organization changes with changing technology.

- 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

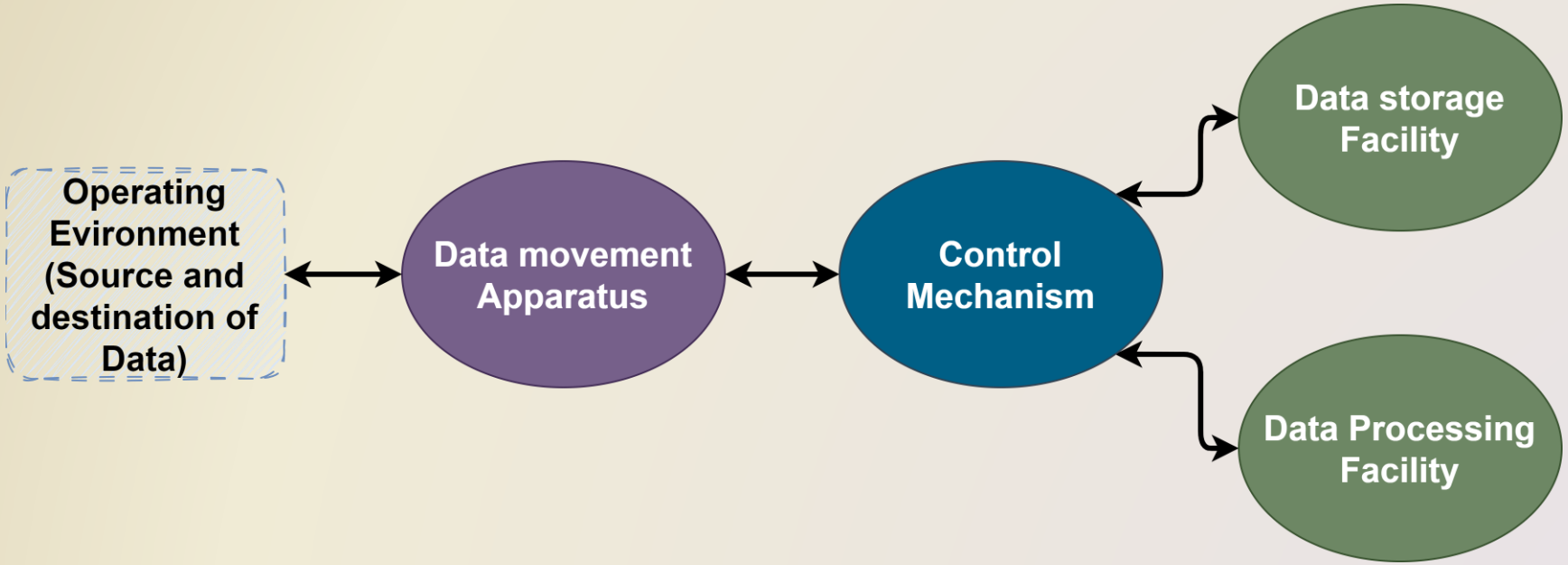
Structure & Function

- **Computers** are complex systems with millions of electronic components. How, then, can one clearly describe them? The key is to recognize the hierarchical nature of most complex systems.
  - a **hierarchical approach**, where each system is made up of smaller subsystems, and those subsystems can be broken down further until we reach the basic components.
- The hierarchical design allows a **designer** to focus on one level at a time, understanding how components interact. At each level, ***two*** *main aspects are important*:
  - **Structure** the way in which the components are interrelated.
  - **Function** is the operation of each individual component as part of the structure.

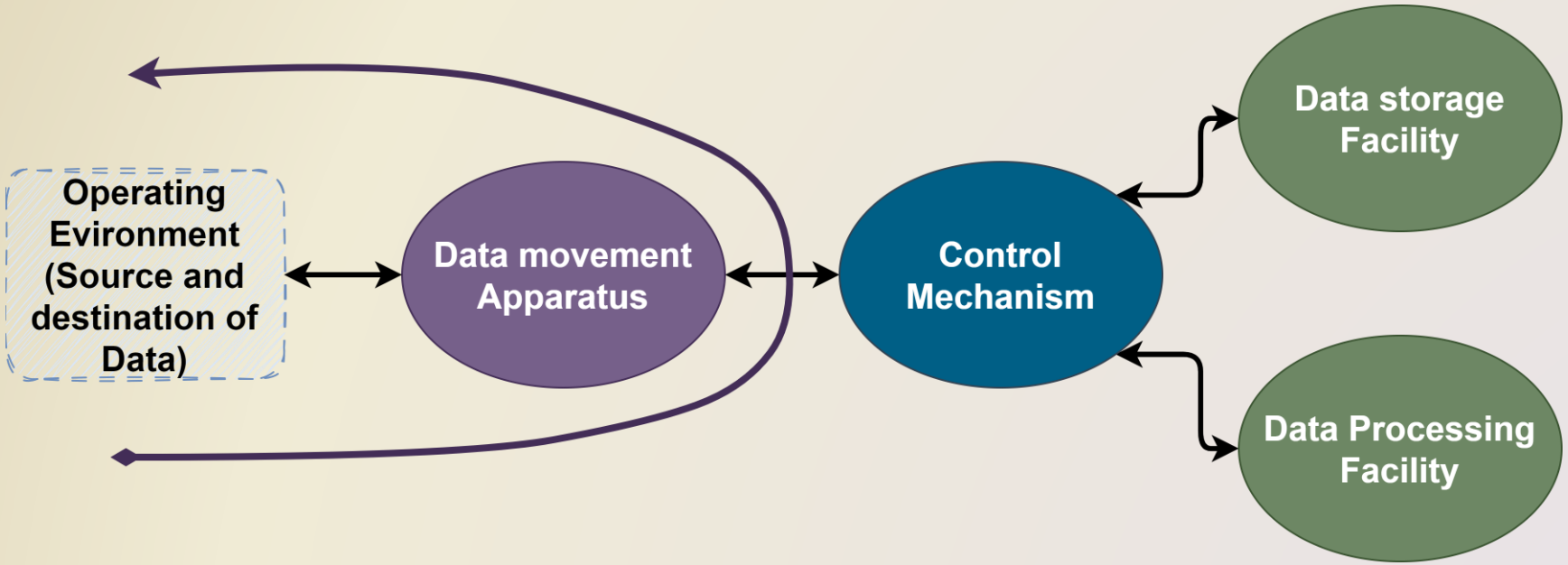
Function

- In general terms, there are only four basic functions that a computer can perform:
  - **Data processing:** can involve various forms of data and a wide range of processing needs. However, there are only a few fundamental methods or types of data processing.
  - **Data storage:** computers must temporarily store data being processed in real time for short-term use. They also provide long-term storage for saving files for future retrieval and updates.
  - **Data movement:** the computer's operating environment includes devices that act as sources or destinations for data. The computer must be able to move data between itself and the outside world.
    - **Input–Output (I/O)**: This refers to the process of receiving data from or delivering data to directly connected devices, known as peripherals.
    - **Data Communications**: This involves moving data over longer distances to or from remote devices
  - **Control:** the control unit within a computer manages resources and coordinates the performance of functional parts based on instructions.

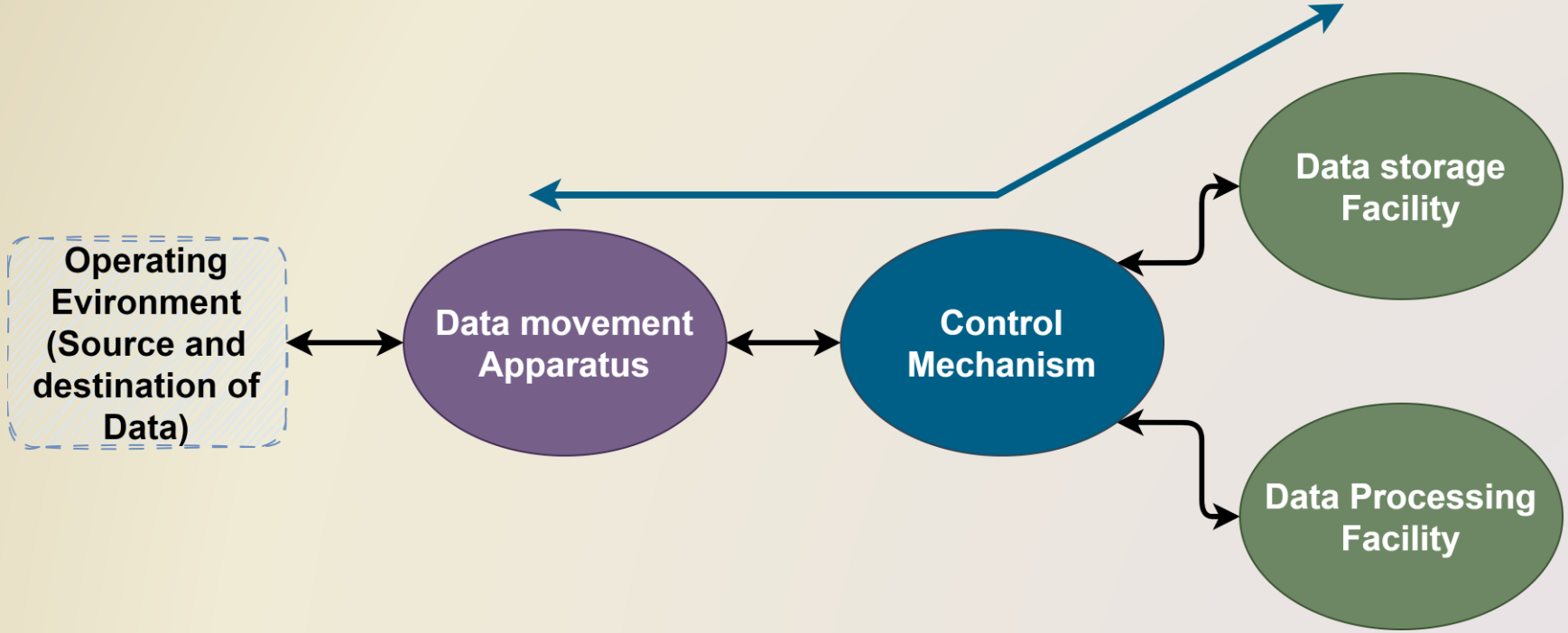
Functional view



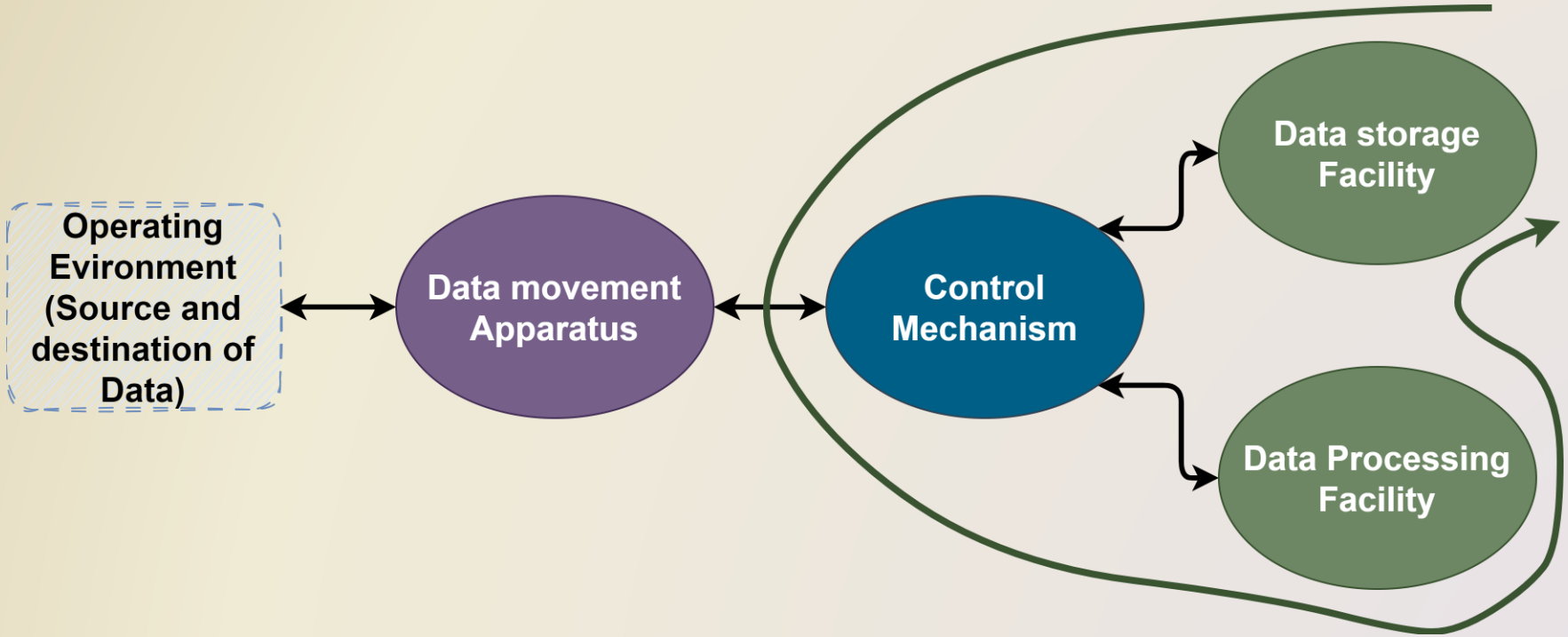
Operations (1) Data Movement



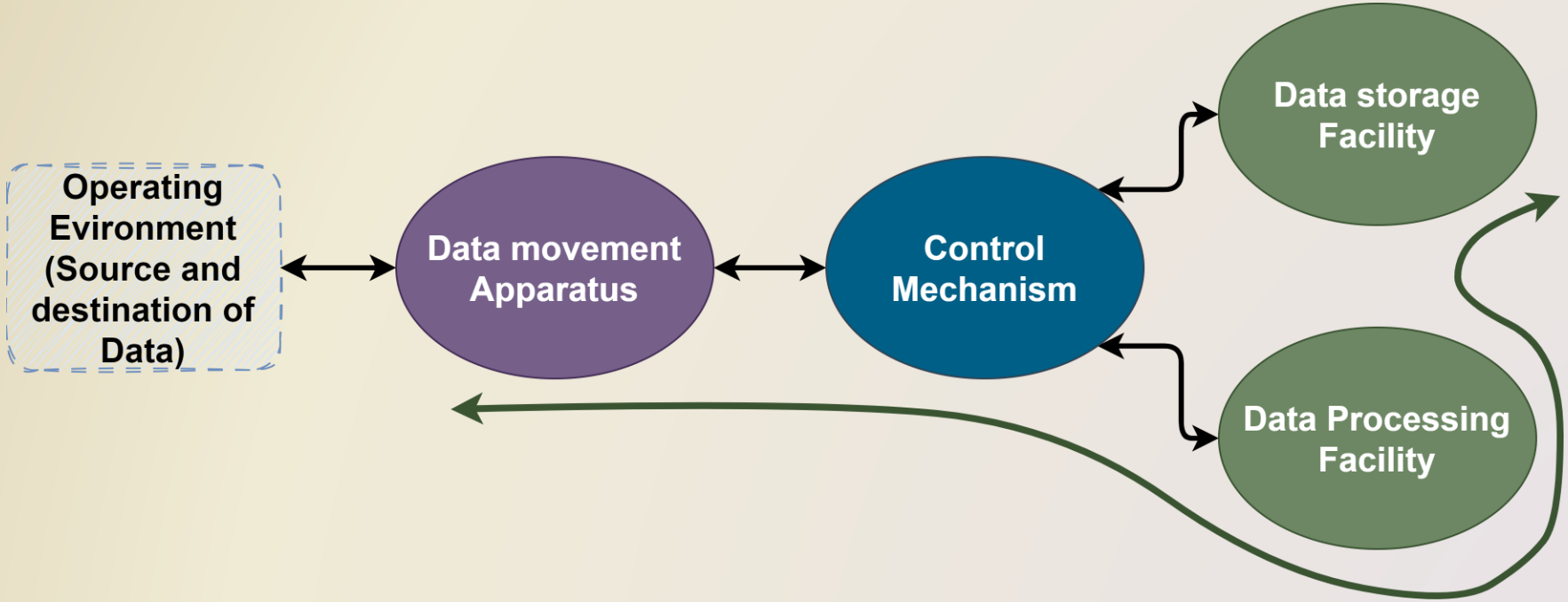
Operations (2) Storage



Operations (3) Processing from/to storage



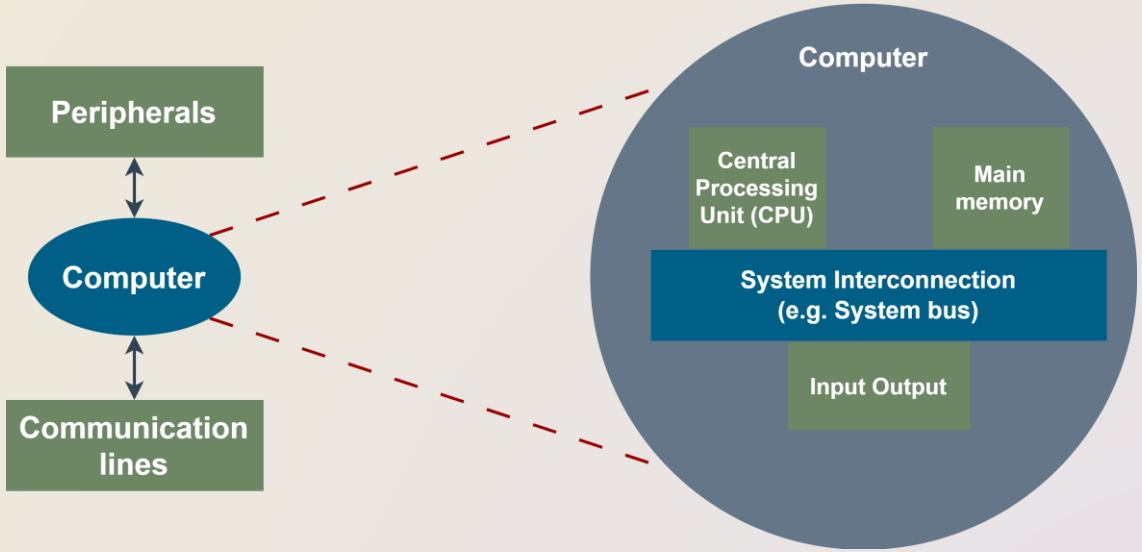
Operations (4) Processing from storage I/O



Structure – Top level

- 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**.

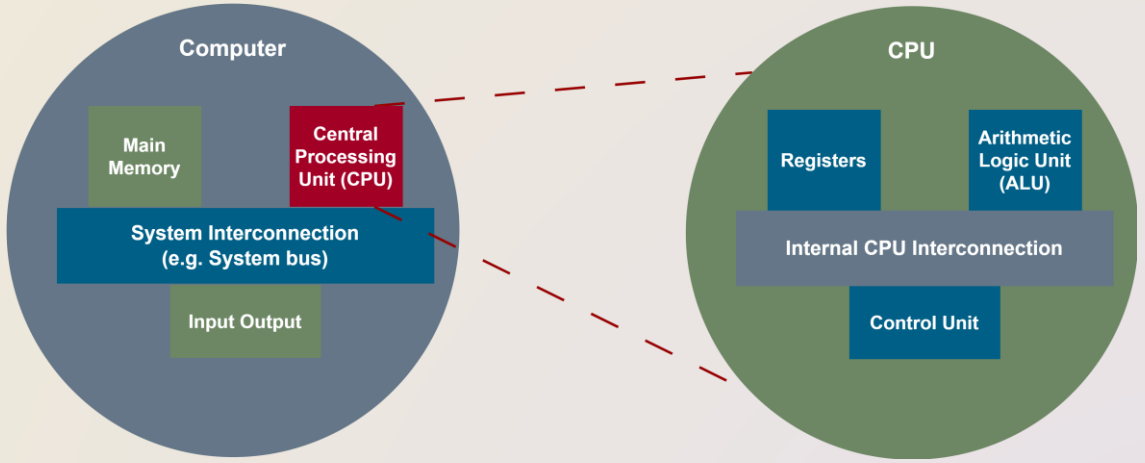
The following figures provide a hierarchical view of the internal structure of a traditional single-processor computer.



I. The computer

Structure – The CPU

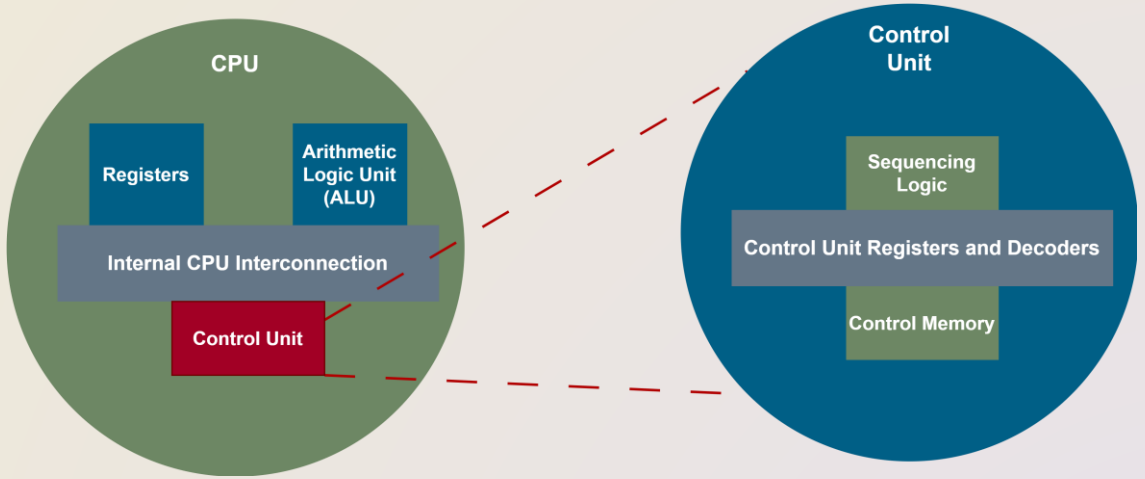
- **CPU** major structural components are as follows:
  - **Control unit**: Controls the operation of the CPU and hence the computer.
  - **Arithmetic and logic unit (ALU)**: Performs the computer's data processing functions.
  - **Registers**: Provides storage internal to the CPU.
  - **CPU interconnection**: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



II. The CPU

Structure – The Control Unit

- The **Control Unit** component:
  - **Sequencing logic** : dictates the order in which instructions are executed by the processor.
  - **CU decoders and registers**: **decoders** in the CU translate instructions into control signals, while **registers** temporarily hold data and instructions during processing.
  - **Control memory**: a specialized memory in the CU that stores microinstructions which define how the processor's control signals are generated and executed.



III. The Control Unit

Thank You ☺