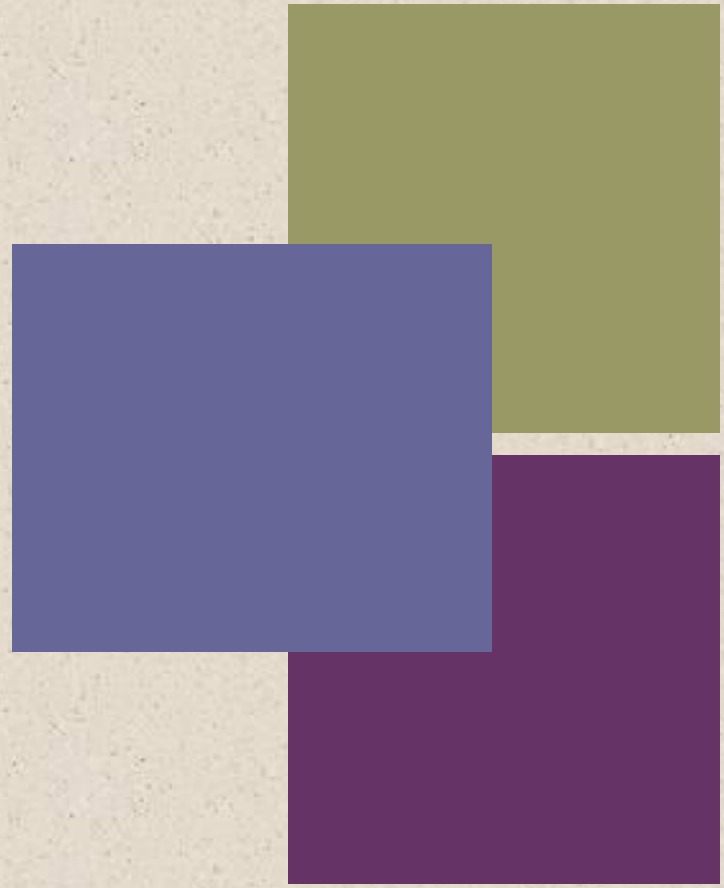

Chapter 1

+ Introduction of Computer Architecture and Organization

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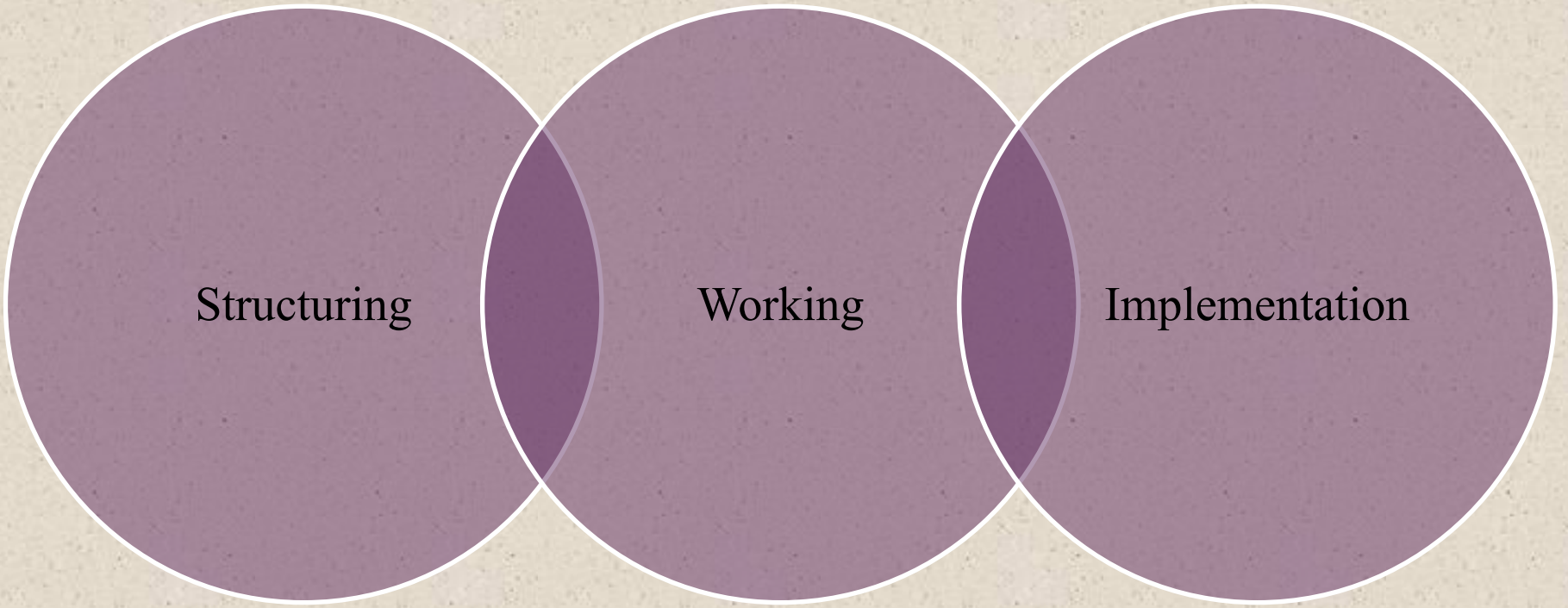
What is Computer Architecture and Organization?



Why Study Computer Architecture?

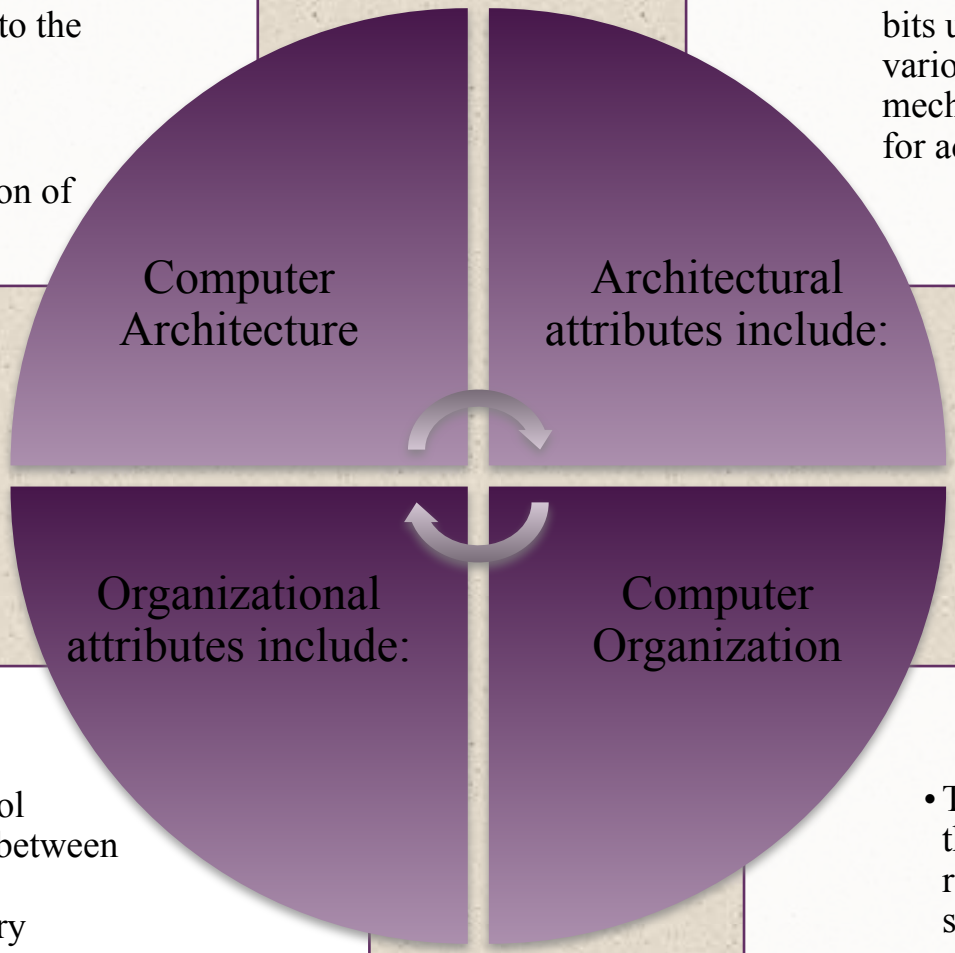
- Enable better systems: make computers faster, cheaper, smaller, more reliable, …
  - By exploiting advances and changes in underlying technology/circuits
- Improve computer performance with design modifications
- Improve software performance
- Enable new applications
  - 3D visualization
  - Virtual reality
  - Personal genomics
- Enable better solutions to problems

Computer Architecture

Computer Organization

- Attributes of a system visible to the programmer
- Have a direct impact on the logical execution of a program

- Instruction set, number of bits used to represent various data types, I/O mechanisms, techniques for addressing memory



- Hardware details transparent to the programmer, control signals, interfaces between the computer and peripherals, memory technology used

- The operational units and their interconnections that realize the architectural specifications

IBM System 370 Architecture

- IBM System/370 architecture
  - Was introduced in 1970
  - Included a number of models
  - Could upgrade to a more expensive, faster model without having to abandon original software
  - New models are introduced with improved technology, but retain the same architecture so that the customer's software investment is protected
  - Architecture has survived to this day as the architecture of IBM's mainframe product line

Structure and Function

Structure

- The way in which the components are interrelated

Function

- The operation of individual components as part of the structure

Structure

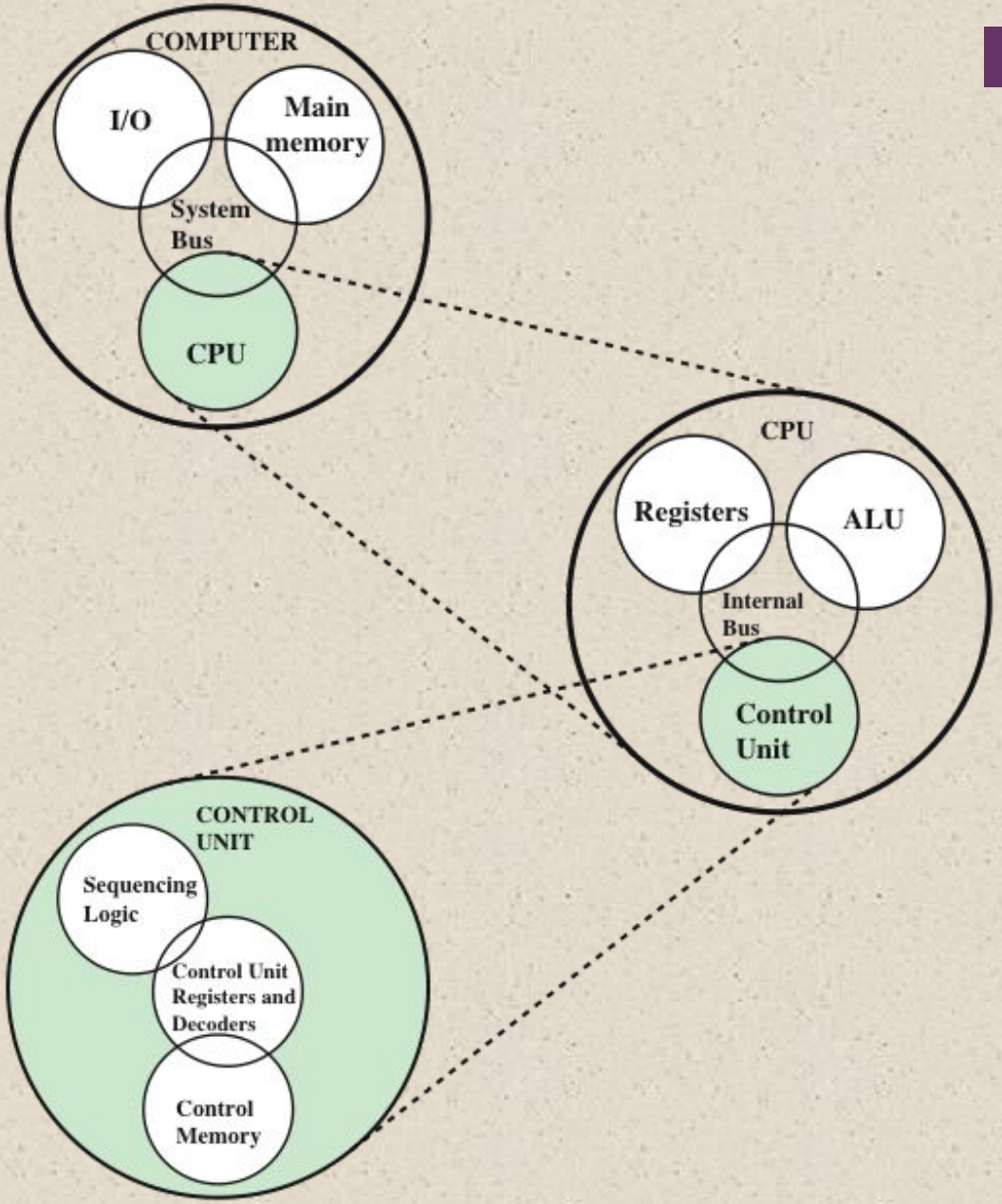
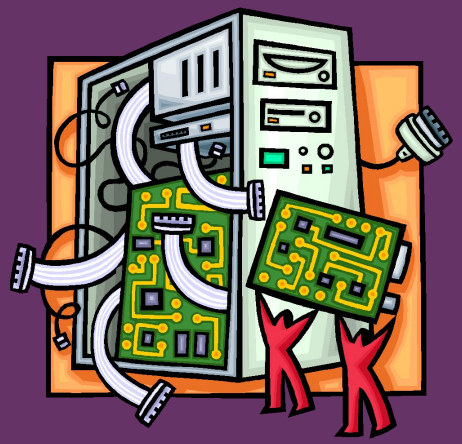


Figure 1.4 A Top-Down View of a Computer

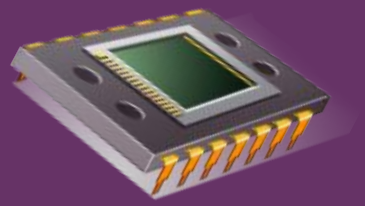
There are four main structural components of the computer:

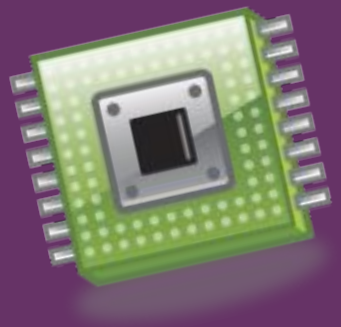


- CPU – controls the operation of the computer and performs its data processing functions
- Main Memory – stores data
- I/O – moves data between the computer and its external environment
- System Interconnection – some mechanism that provides for communication among CPU, main memory, and I/O

CPU

Major structural components:





- Control Unit
  - Controls the operation of the CPU and hence the computer
- Arithmetic and Logic Unit (ALU)
  - Performs the computer's data processing function
- Registers
  - Provide storage internal to the CPU
- CPU Interconnection
  - Some mechanism that provides for communication among the control unit, ALU, and registers

Function

A computer can perform four basic functions:

- Data processing
- Data storage
- Data movement
- Control

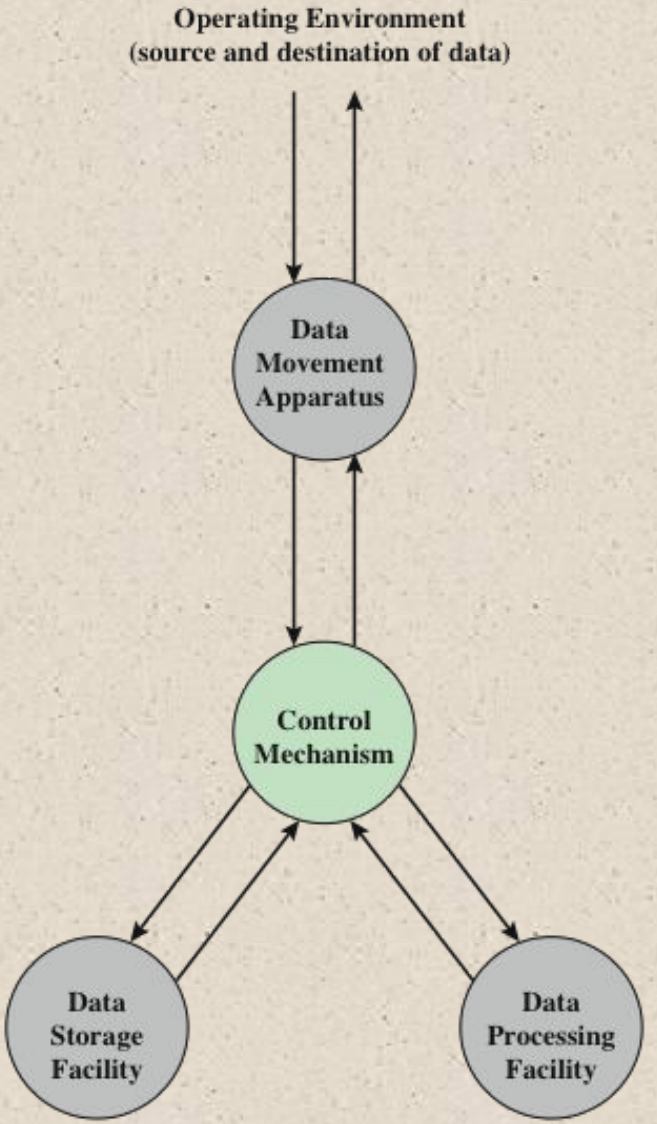
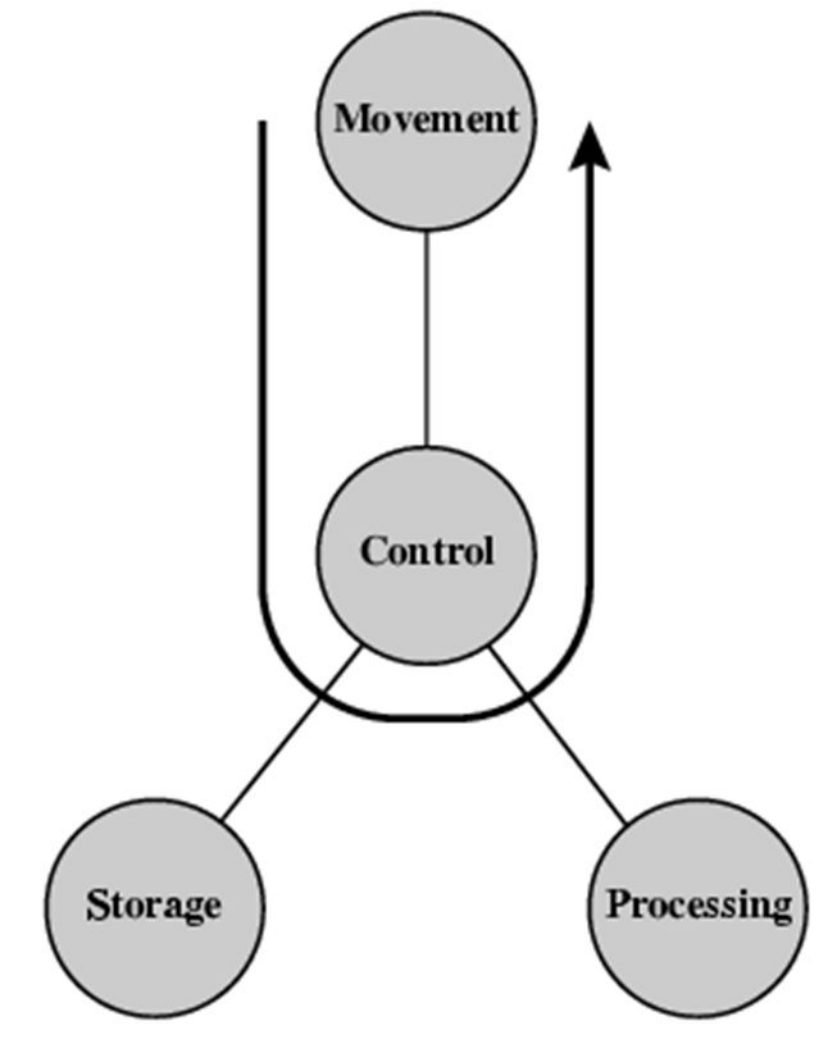


Figure 1.1 A Functional View of the Computer

Operation

Operations (a)

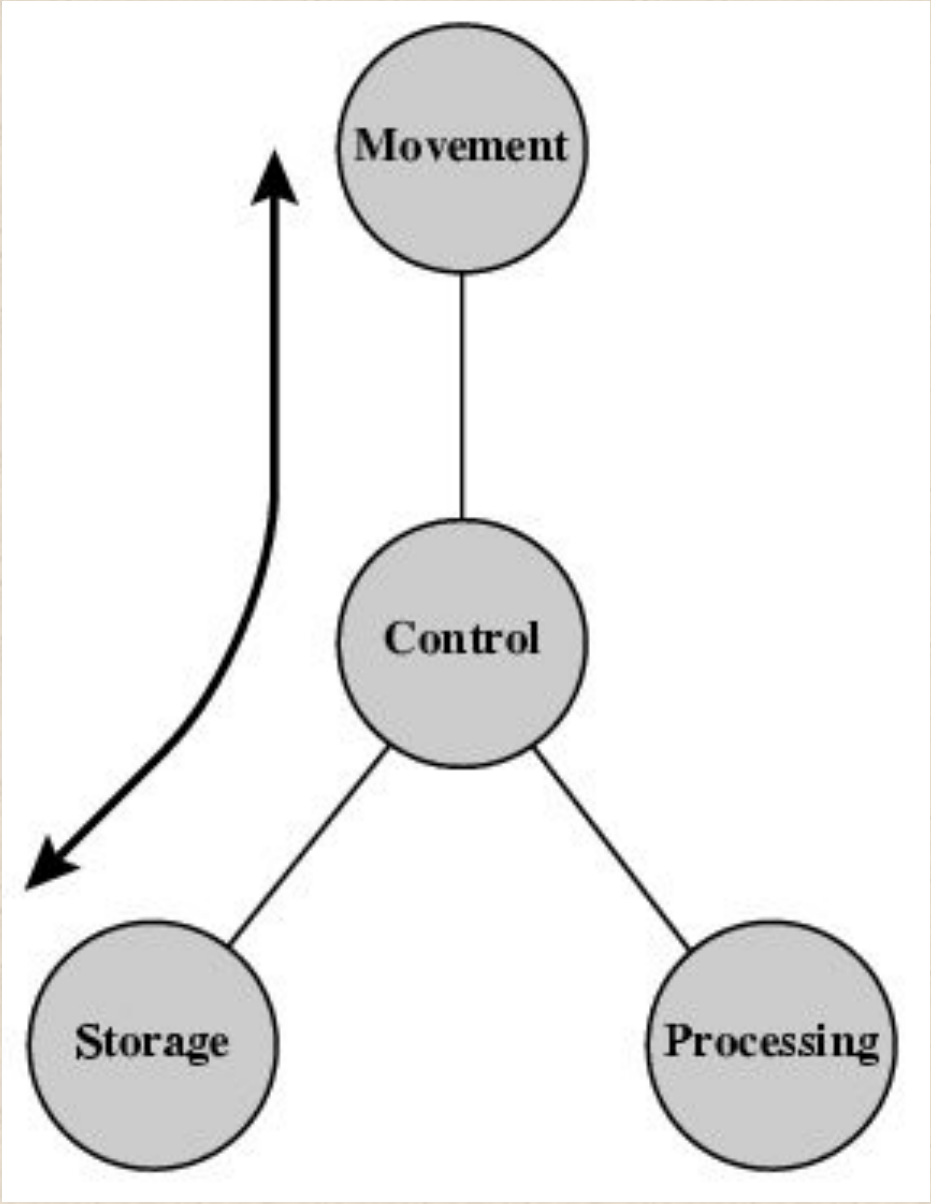
Data movement



Operation

Operations (b)

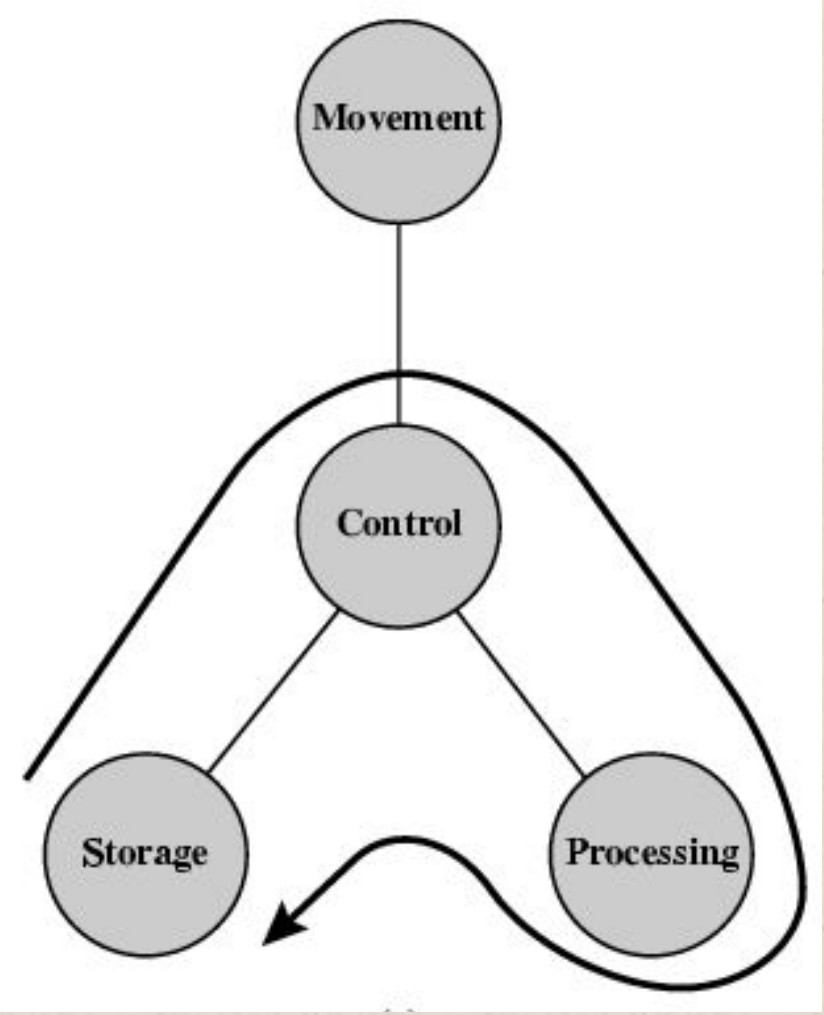
Data Storage



Operation

Operations (c)

Data Movement



Operation

Operations (d)

Control