



William Stallings Computer Organization and Architecture 10th Edition



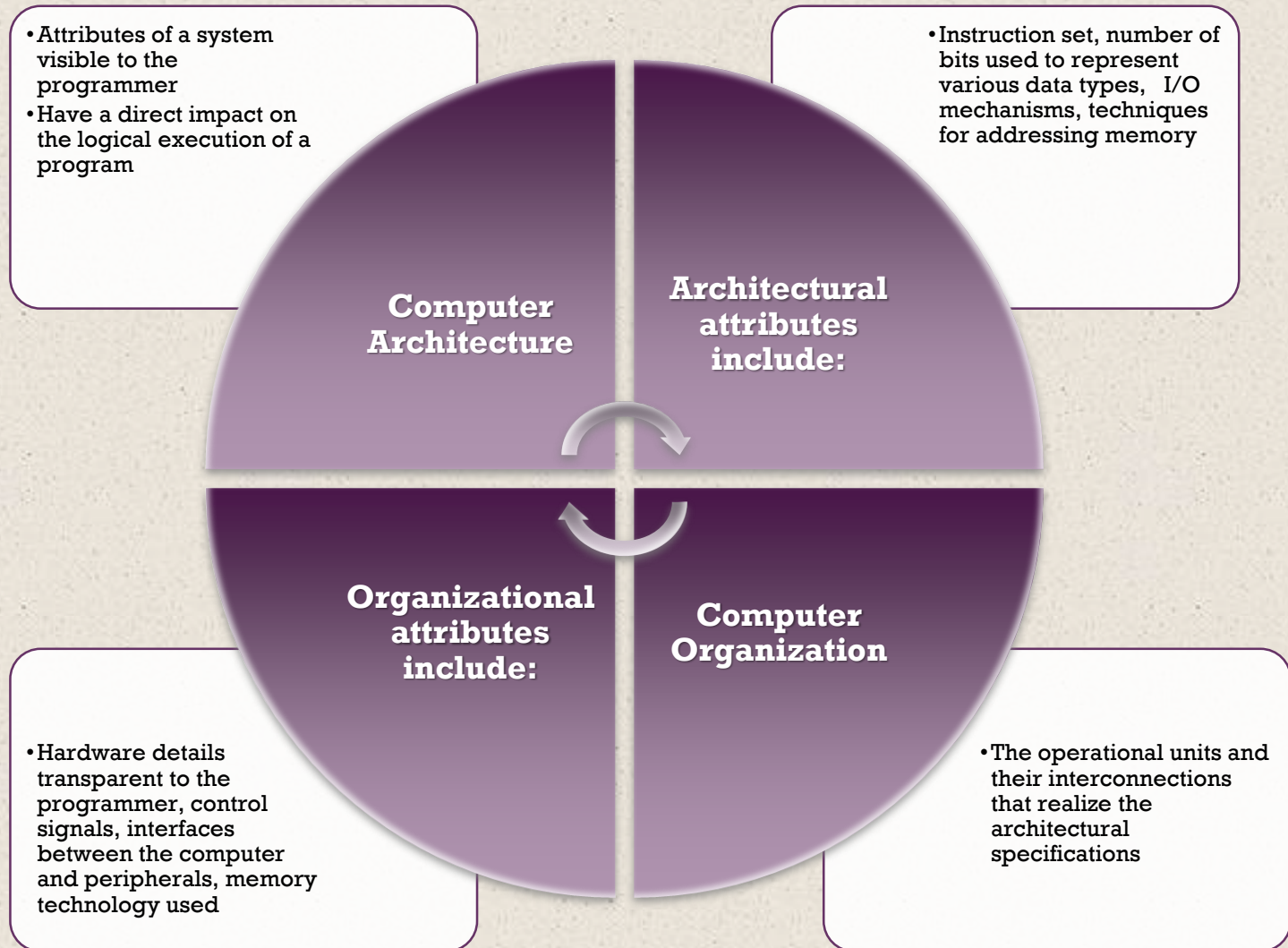
Chapter 1

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Basic Concepts and Computer Evolution

Computer Architecture

Computer Organization





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



- Hierarchical system
 - Set of interrelated subsystems
- Hierarchical nature of complex systems is essential to both their design and their description
- Designer need only deal with a particular level of the system at a time
 - Concerned with structure and function at each level

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



+ Function

- There are four basic functions that a computer can perform:
 - Data processing
 - Data may take a wide variety of forms and the range of processing requirements is broad
 - Data storage
 - Short-term
 - Long-term
 - Data movement
 - Input-output (I/O) - when data are received from or delivered to a device (peripheral) that is directly connected to the computer
 - Data communications – when data are moved over longer distances, to or from a remote device
 - Control
 - A control unit manages the computer's resources and orchestrates the performance of its functional parts in response to instructions

Structure

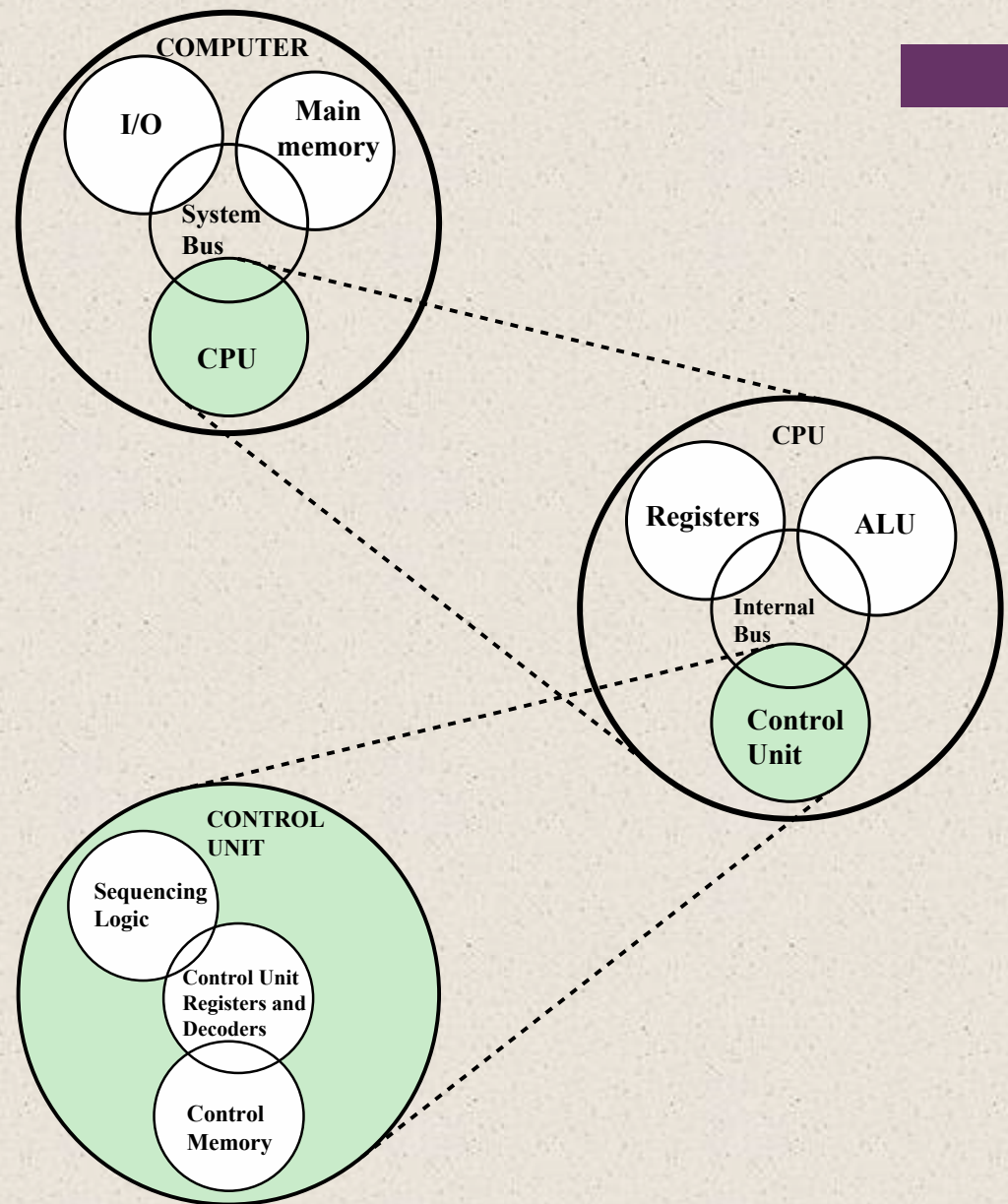
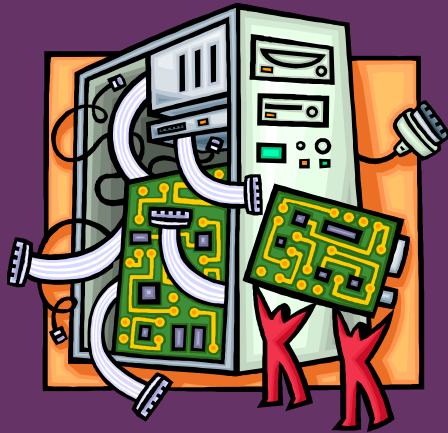


Figure 1.1 A Top-Down View of a Computer



There are four
main structural
components
of the computer:

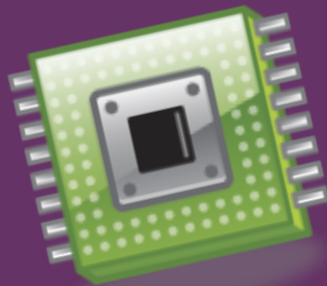
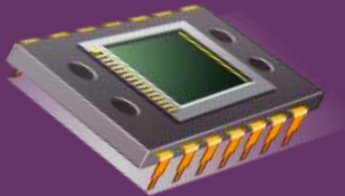


- ★ CPU – controls the operation of the computer and performs its data processing functions
- ★ Main Memory – stores data
- ★ I/O – moves data between the computer and its external environment
- ★ System Interconnection – some mechanism that provides for communication among CPU, main memory, and I/O



CPU

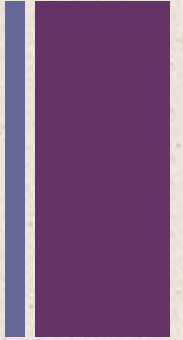
Major structural components:



- **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



Cache Memory



- Multiple layers of memory between the processor and main memory
- Is smaller and faster than main memory
- Used to speed up memory access by placing in the cache data from main memory that is likely to be used in the near future
- A greater performance improvement may be obtained by using multiple levels of cache, with level 1 (L1) closest to the core and additional levels (L2, L3, etc.) progressively farther from the core

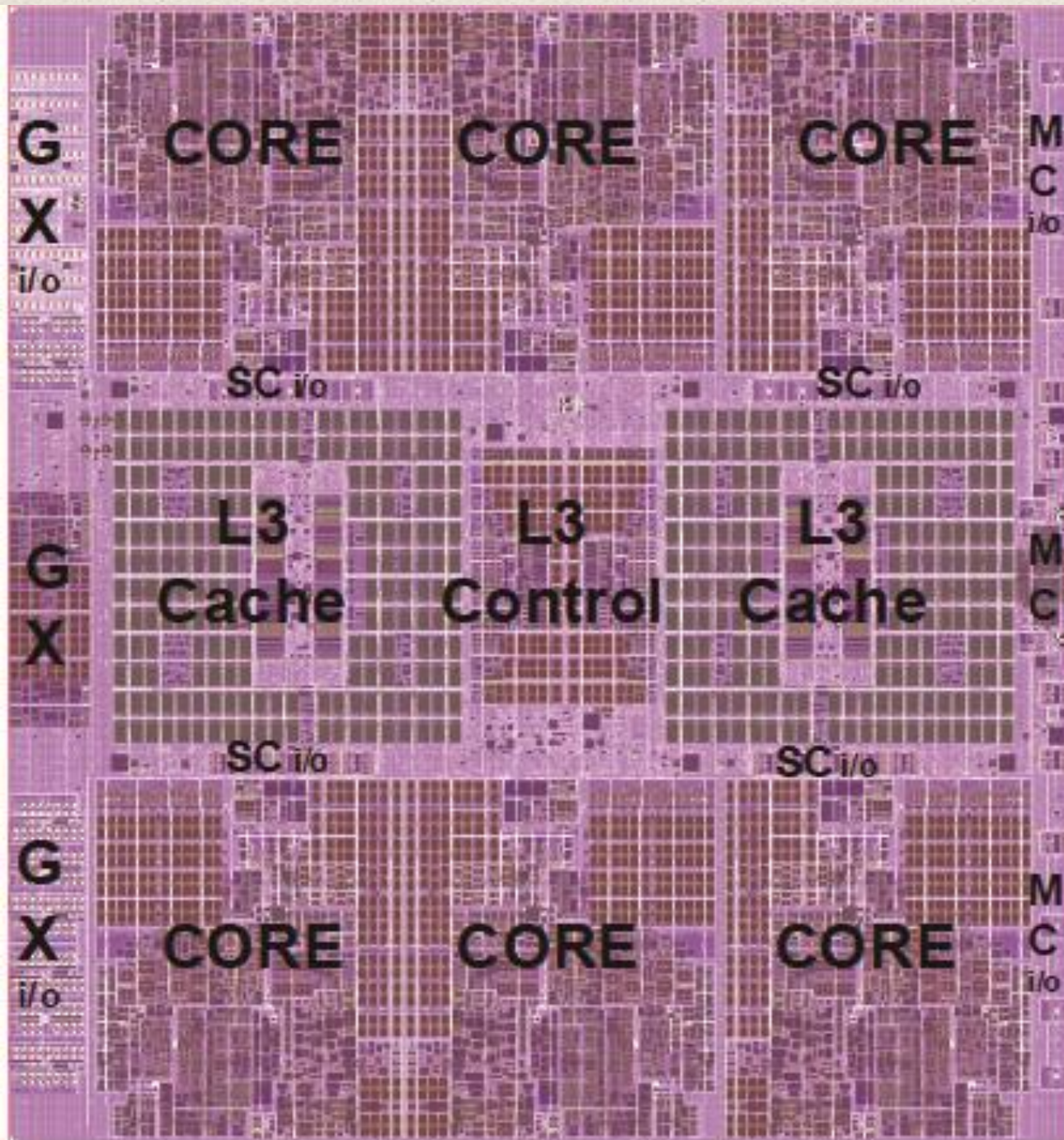


Figure 1.4

zEnterprise
EC12 Processor
Unit (PU)
Chip Diagram

+ History of Computers

First Generation: Vacuum Tubes

- Vacuum tubes were used for digital logic elements and memory
- IAS computer
 - Fundamental design approach was the stored program concept
 - Attributed to the mathematician John von Neumann
 - First publication of the idea was in 1945 for the EDVAC
 - Design began at the Princeton Institute for Advanced Studies
 - Completed in 1952
 - Prototype of all subsequent general-purpose computers

