

Computer Programming

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Session: Computer Architecture

Quick Recap of Relevant Topics



- Dumbo model of computing
- Named drawers for storing/retrieving values
- Workbench registers for computing
- Input and output using carts

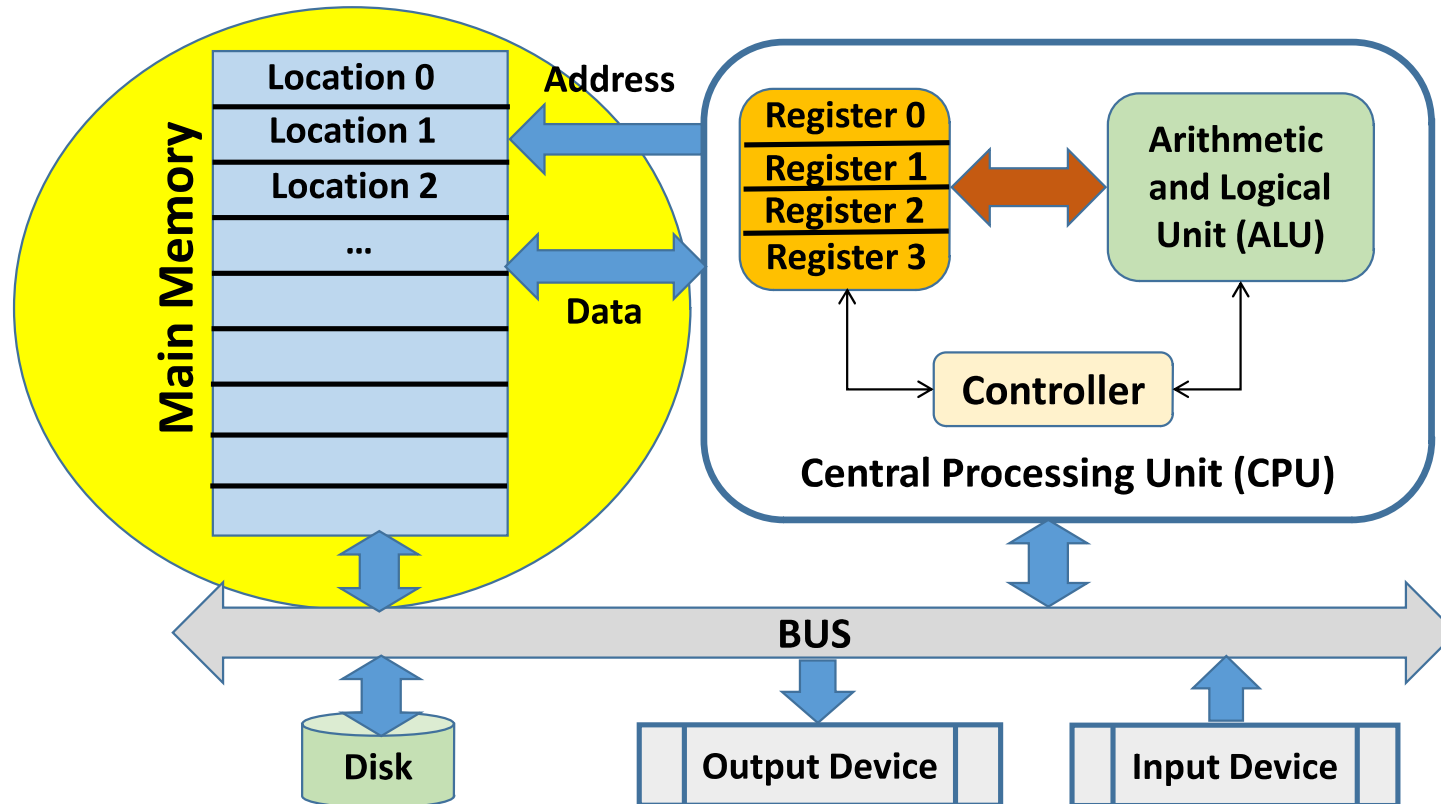
Overview of This Lecture



- What is it that we will actually be programming
 - From Dumbo to a real computer (almost a Dumbo!)
- Simplified architecture of a computer
- Functionalities of different parts
- Bits and bytes of information



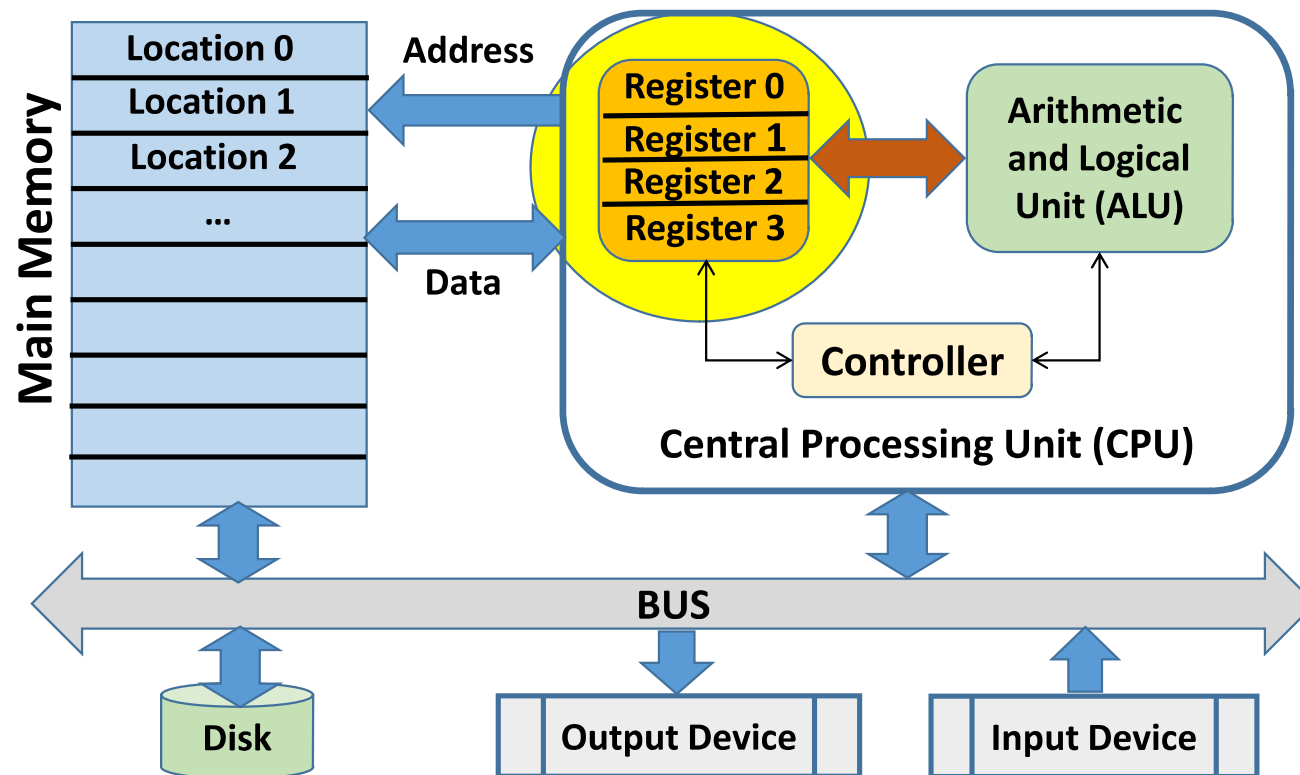
Parts of a Computer



Main Memory

- Usually called “Random Access Memory” (RAM) or simply “Memory”
- Large number of addressable locations
- Each location stores exactly one value at a time
 - **Even if you don’t store a value at a location, “garbage” value exists**
- Writing to a location destroys value originally there
- Reading a location makes a copy, does not destroy value

Parts of a Computer

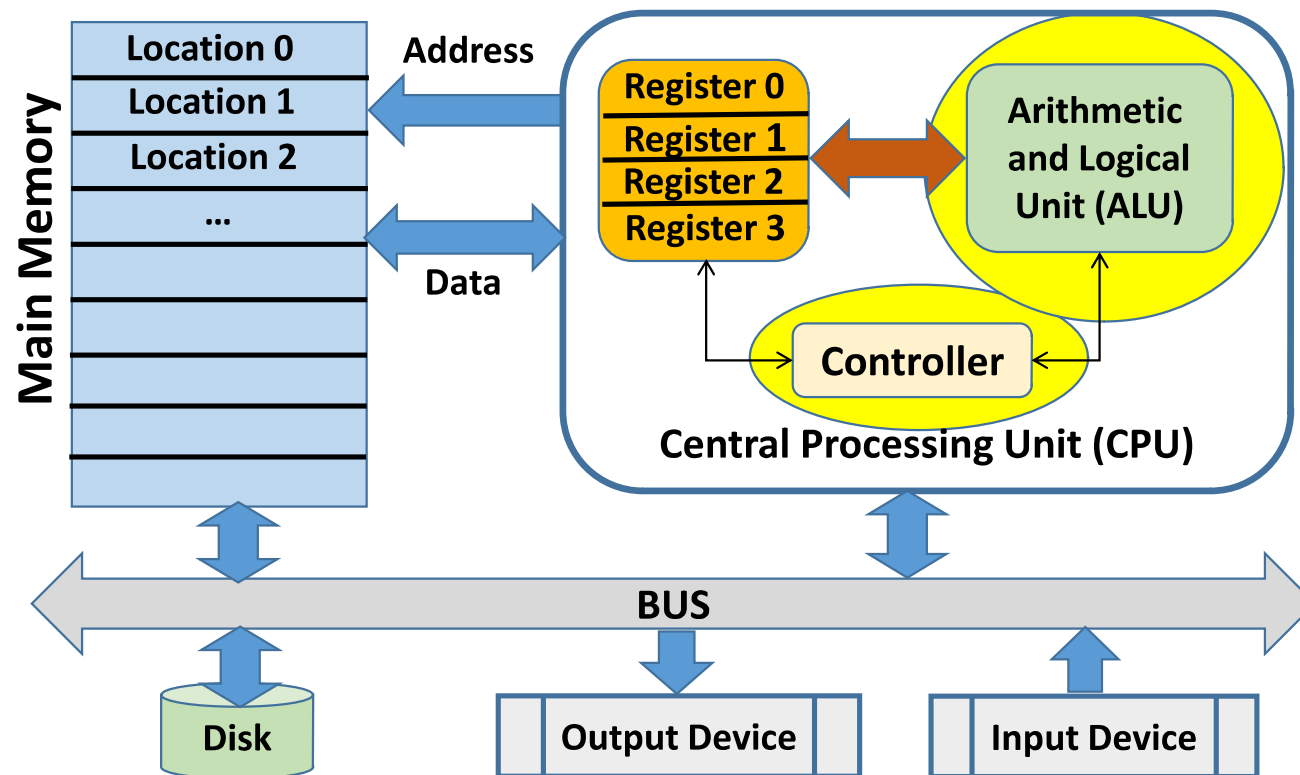


Registers



- Much faster, costlier and smaller than main memory
- Won't see much of these in our programs
 - Works behind the scenes
- Advanced programming can refer to registers directly
 - We won't get to cover this in this course

Parts of a Computer

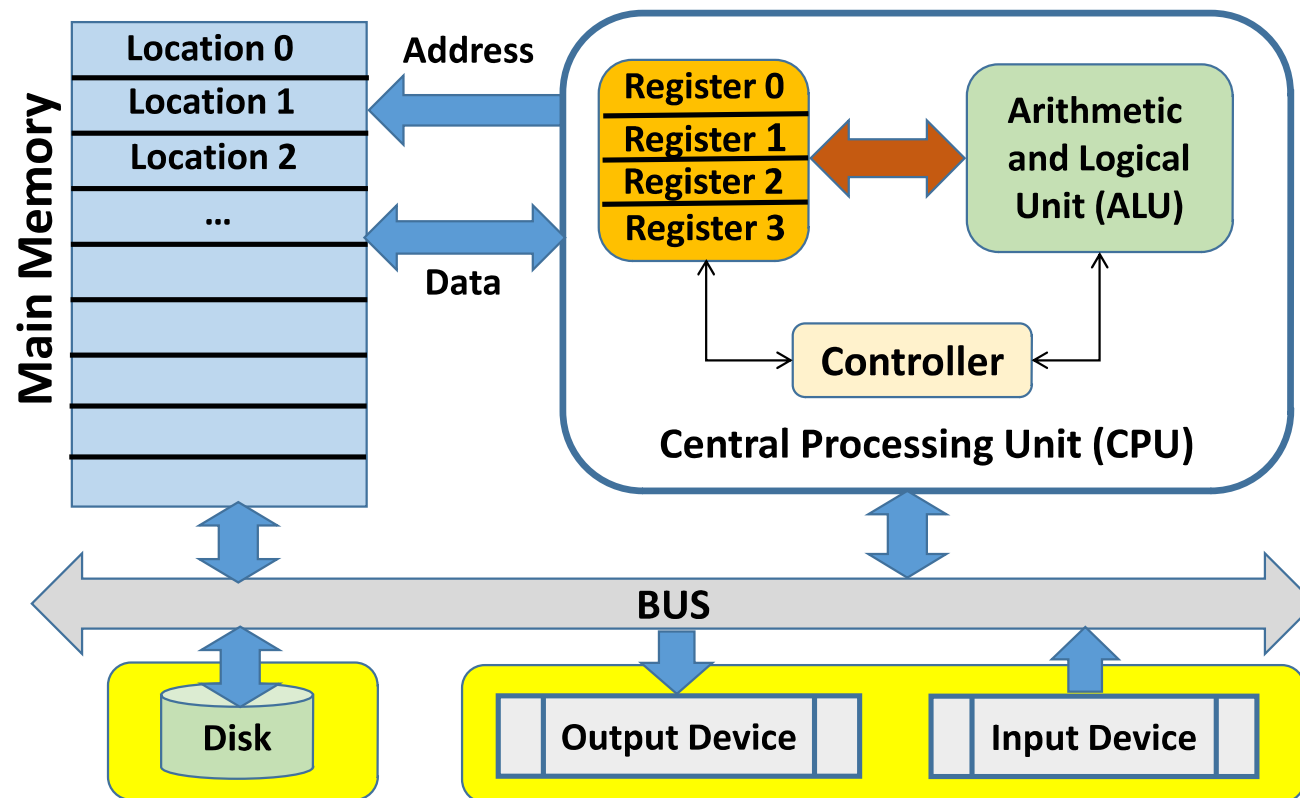


ALU and Controller



- Arithmetic Logic Unit (ALU)
 - Workhorse of computer
 - All arithmetic (add, multiply ...) and logical (and, or ...) operations happen here
 - Takes operands from registers, stores result in registers
- Controller
 - Sequences various actions involved in executing instructions

Parts of a Computer

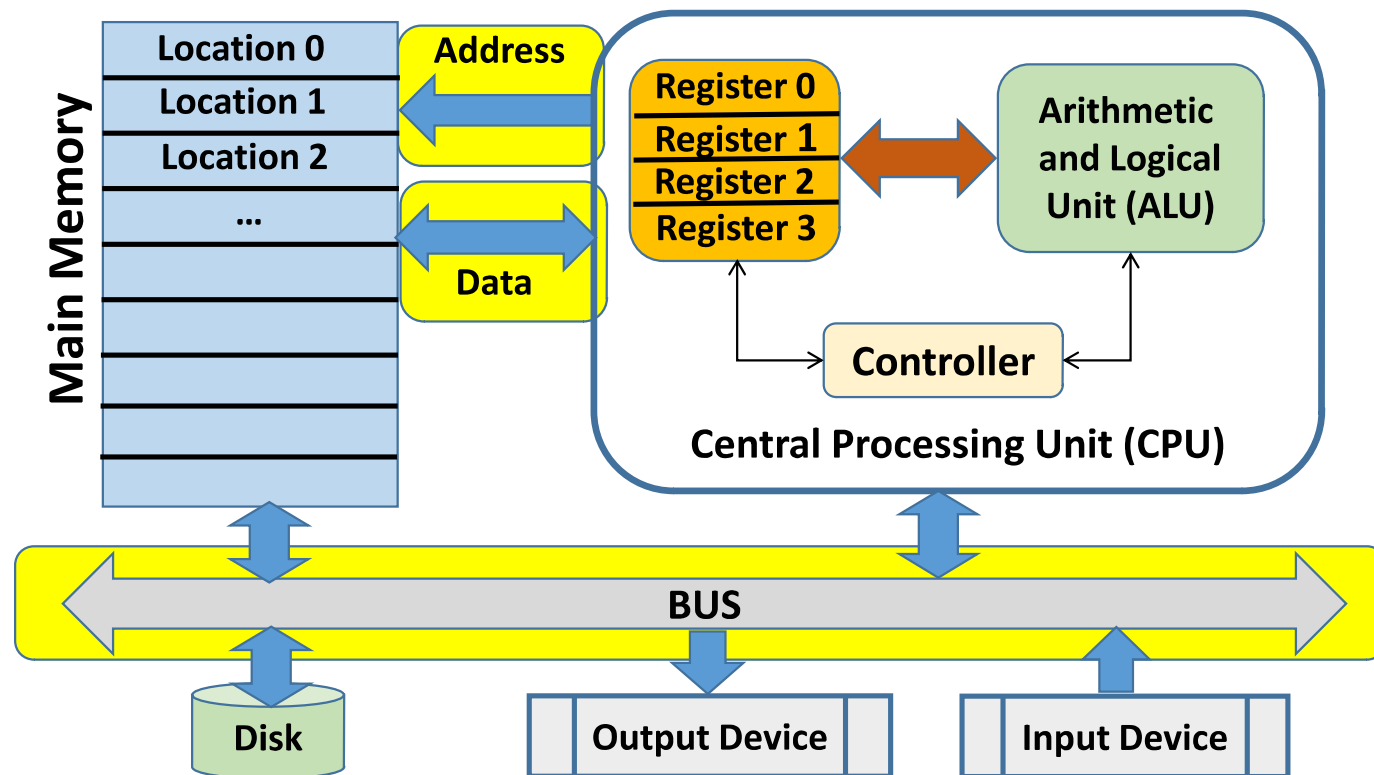


Disks and Input/Output Devices



- Disks
 - Longer term storage for files (programs, data, logs, outputs ...)
 - Like main memory, but much slower, larger, cheaper
 - More later when we study about files
- Input/Output (aka I/O) Devices
 - Allows computer to interact with world outside
 - Input device: Keyboard for us
 - Output device: Console (screen) for us
 - Computers can interact with other kinds of I/O devices too!

Parts of a Computer



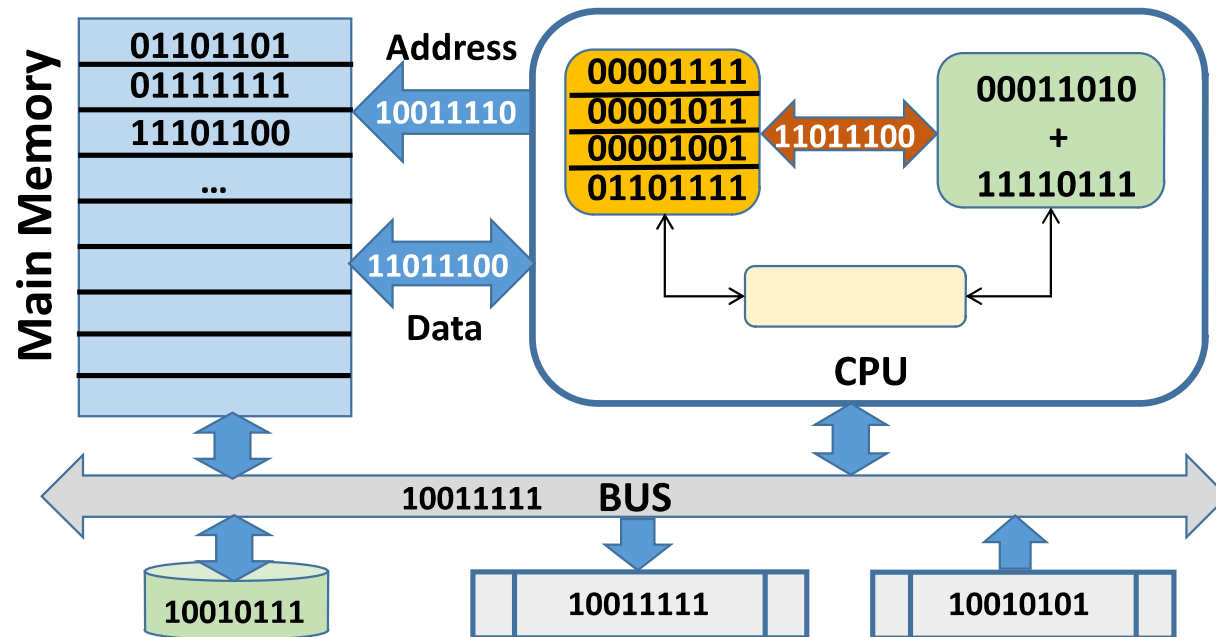
Buses



- Highways for transferring information between different parts
- Address bus, data bus, I/O bus, external device bus (Universal Serial Bus)
- We won't see these in our study
 - Works behind the scenes

How is Information Represented?

- All information represented as sequences of 0's and 1's
- Snapshot:



Internal Representation of Information

- Electronic circuits in a computer can efficiently store and process two states of electrical signals
 - Call them '0' and '1'
- Information represented using '0' and '1'
 - Binary representation
 - '0' and '1' called **bits (binary digits)**
- Information accessed in chunks of 8 bits: a **byte**
 - Memory access, I/O access, register access, addresses, ...
- Important to understand how numbers, characters, strings ... are represented using bits and bytes
 - Topic of another lecture ...

Summary



- Architecture of a simple real computer
 - Main memory
 - Registers
 - ALU
 - Input/Output devices
 - Disk
 - Bus
- Representing information: Bits and bytes