CSE 112: Computer Organization

Instructor: Sujay Deb

Lecture 5

Architecture vs. Organization

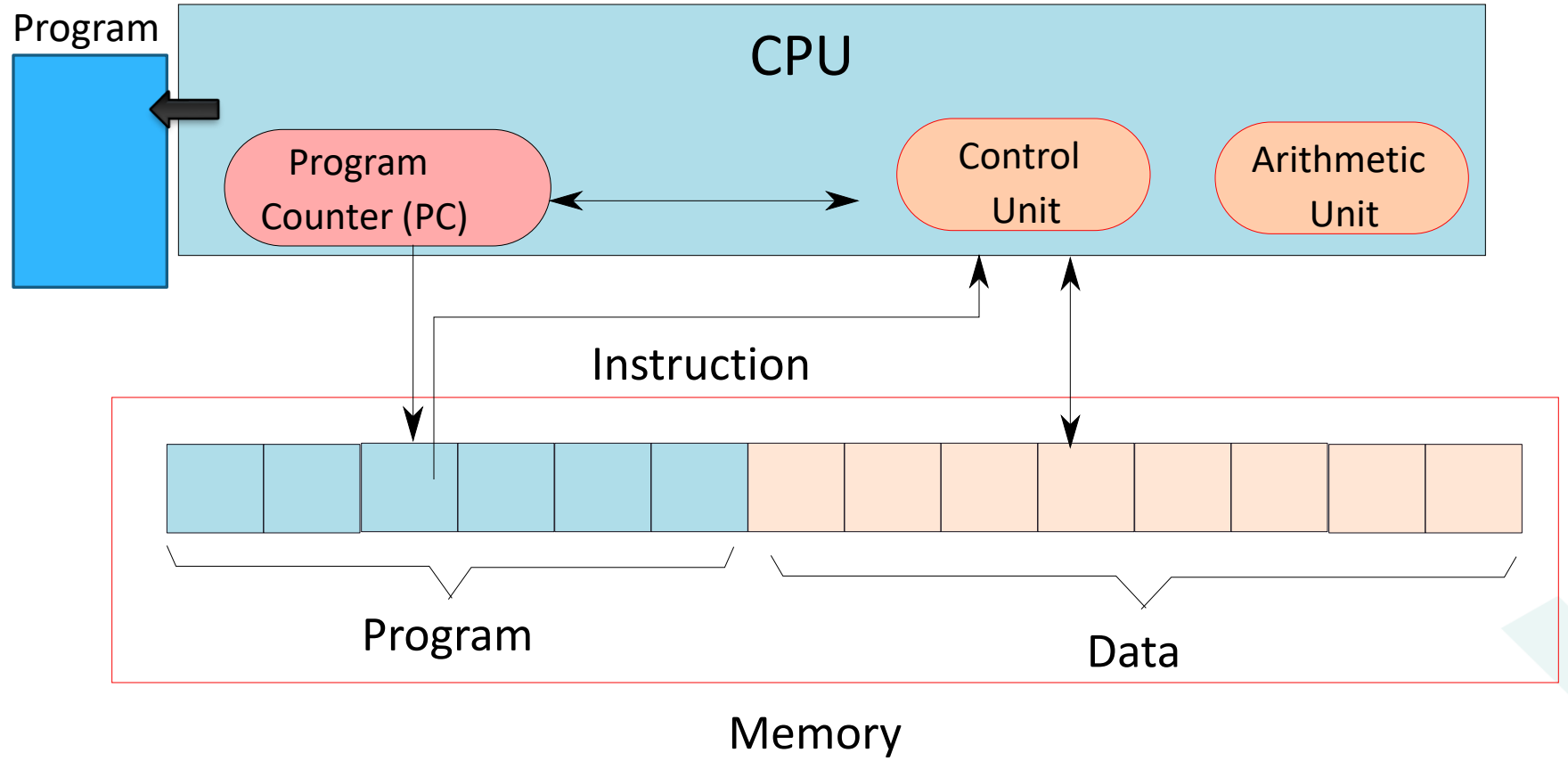
"Architecture"/ Instruction Set Architecture:

- Programmer visible state (Memory & Register)
- Operations (Instructions and how they work)
- Execution Semantics (interrupts)
- Input/Output
- Data Types/Sizes

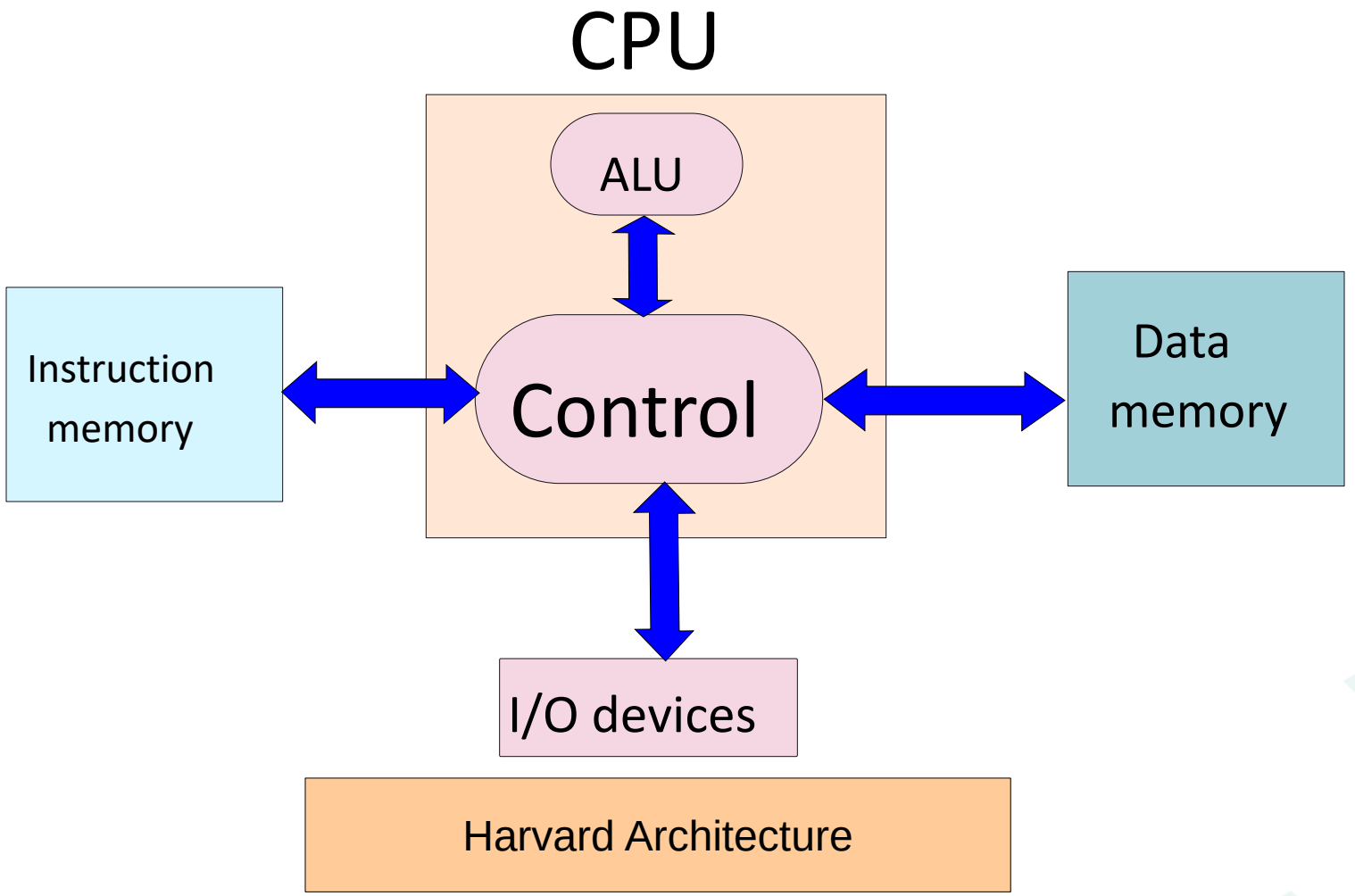
Microarchitecture/ Organization:

- Tradeoffs on how to implement ISA for some metric (Speed, Energy, Cost)
- Examples: Pipeline depth, number of pipelines, cache size, silicon area, peak power, execution ordering, bus widths, ALU widths

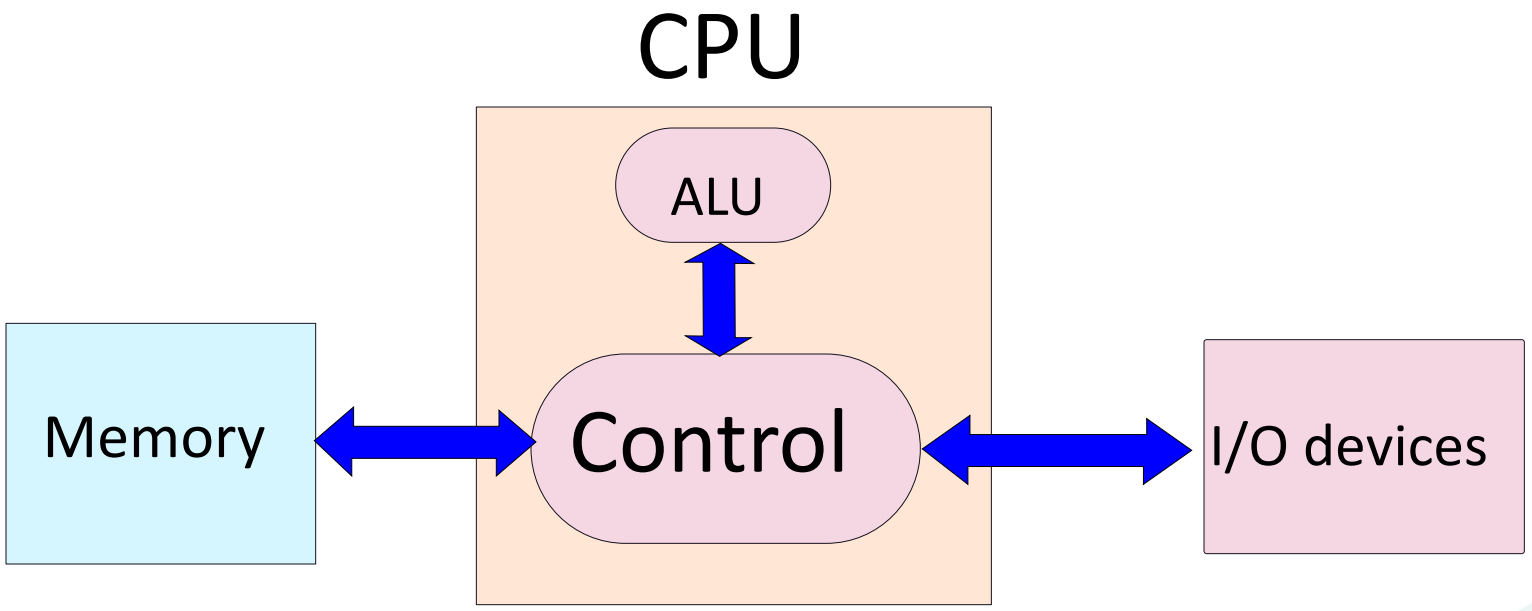
Elements of a Computer



Designing Practical Machines



Von-Neumann Architecture



Problems with Harvard/ Von-Neumann Architectures

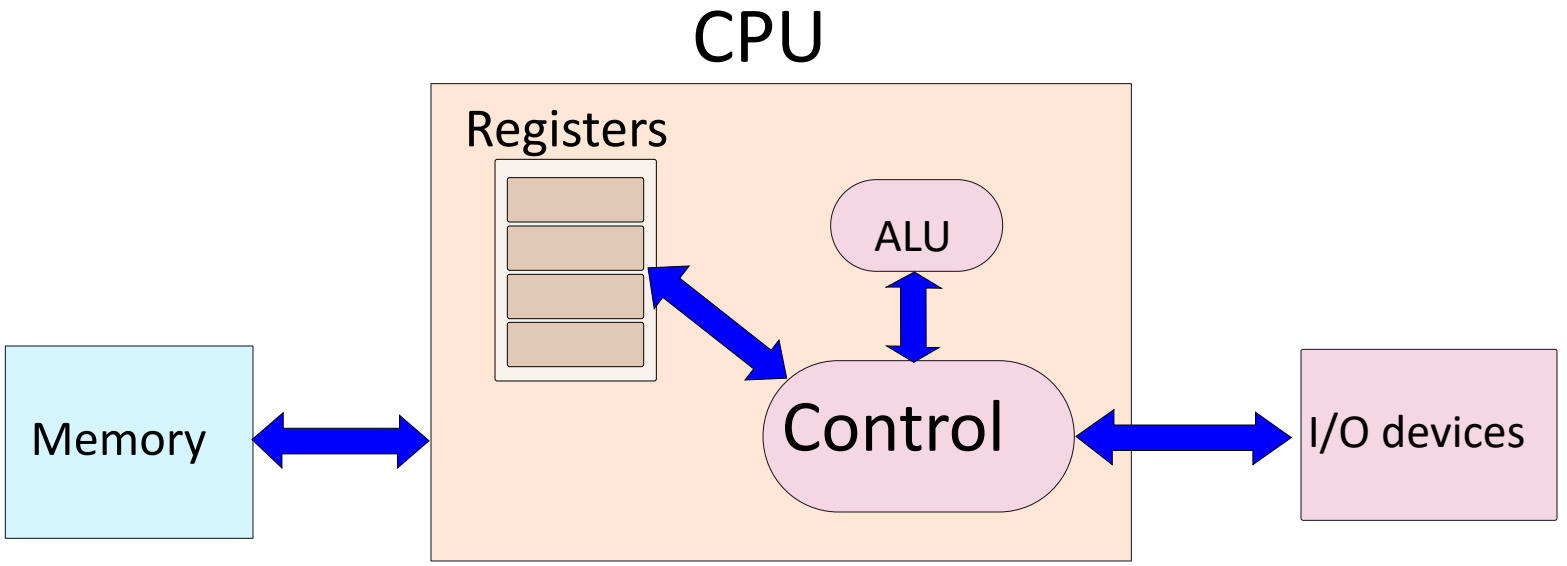
- The memory is assumed to be one large array of bytes
  - It is very very slow

General Rule: Larger is a structure, slower it is

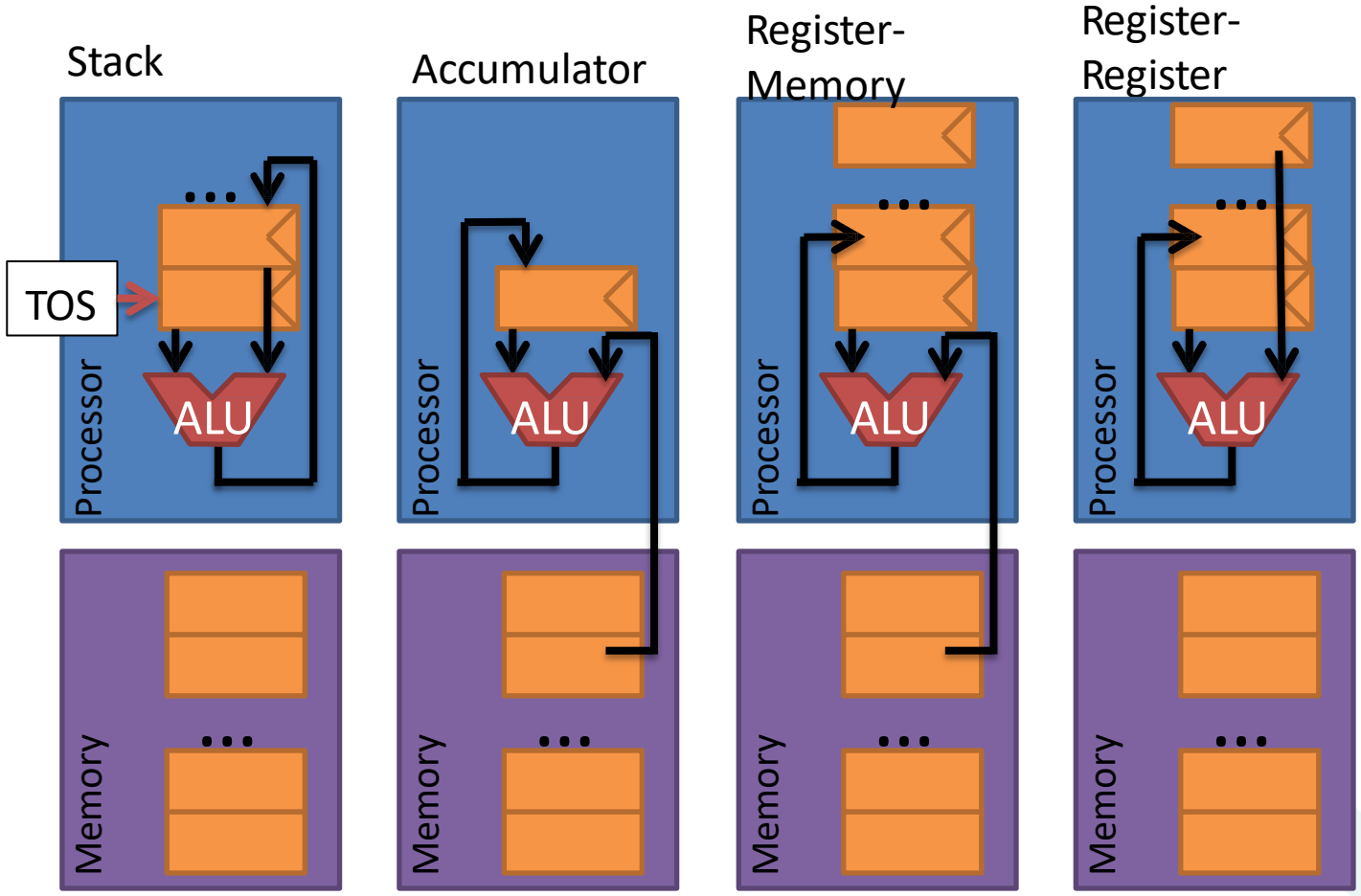
- Solution:
  - Have a small array of named locations **(registers)** that can be used by instructions
  - This small array is very fast

Insight: Accesses exhibit locality (tend to use the same variables frequently in the same window of time)

Machine with Registers

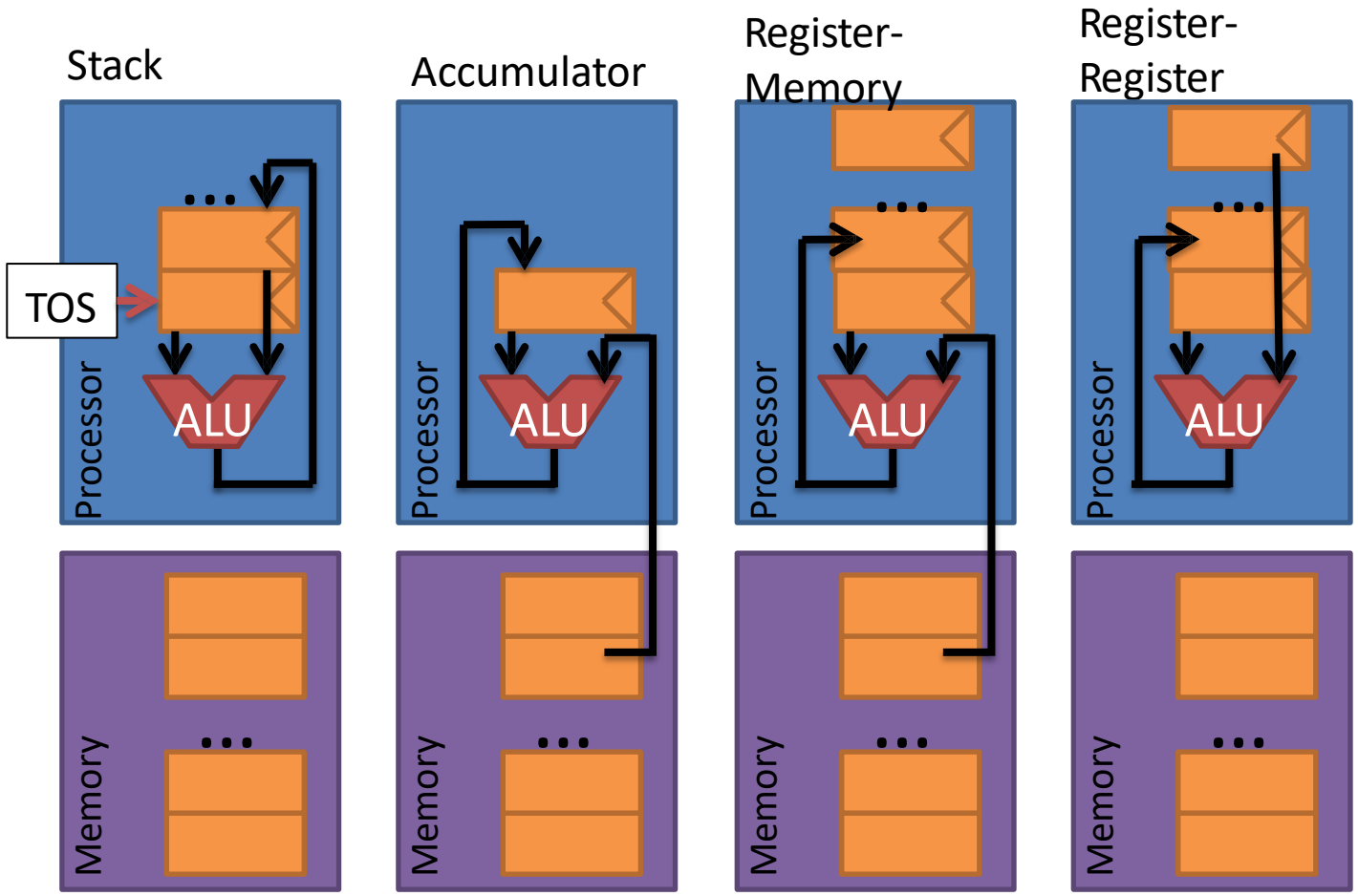


Where Do Operands Come from And Where Do Results Go?



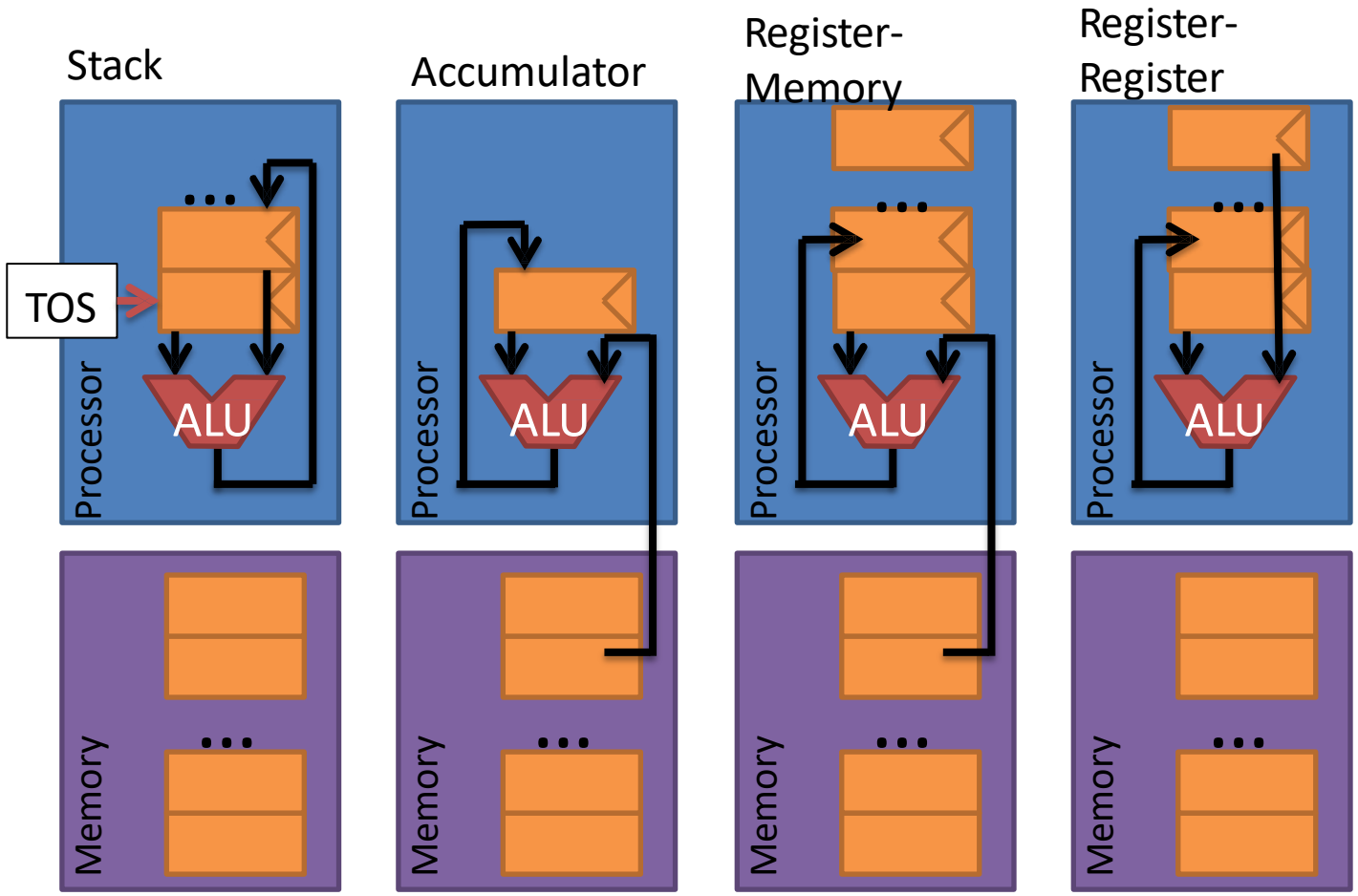
Number Explicitly Named Operands:	0	1	2 or 3	2 or 3

Machine Model Summary



Machine Model Summary

C = A + B



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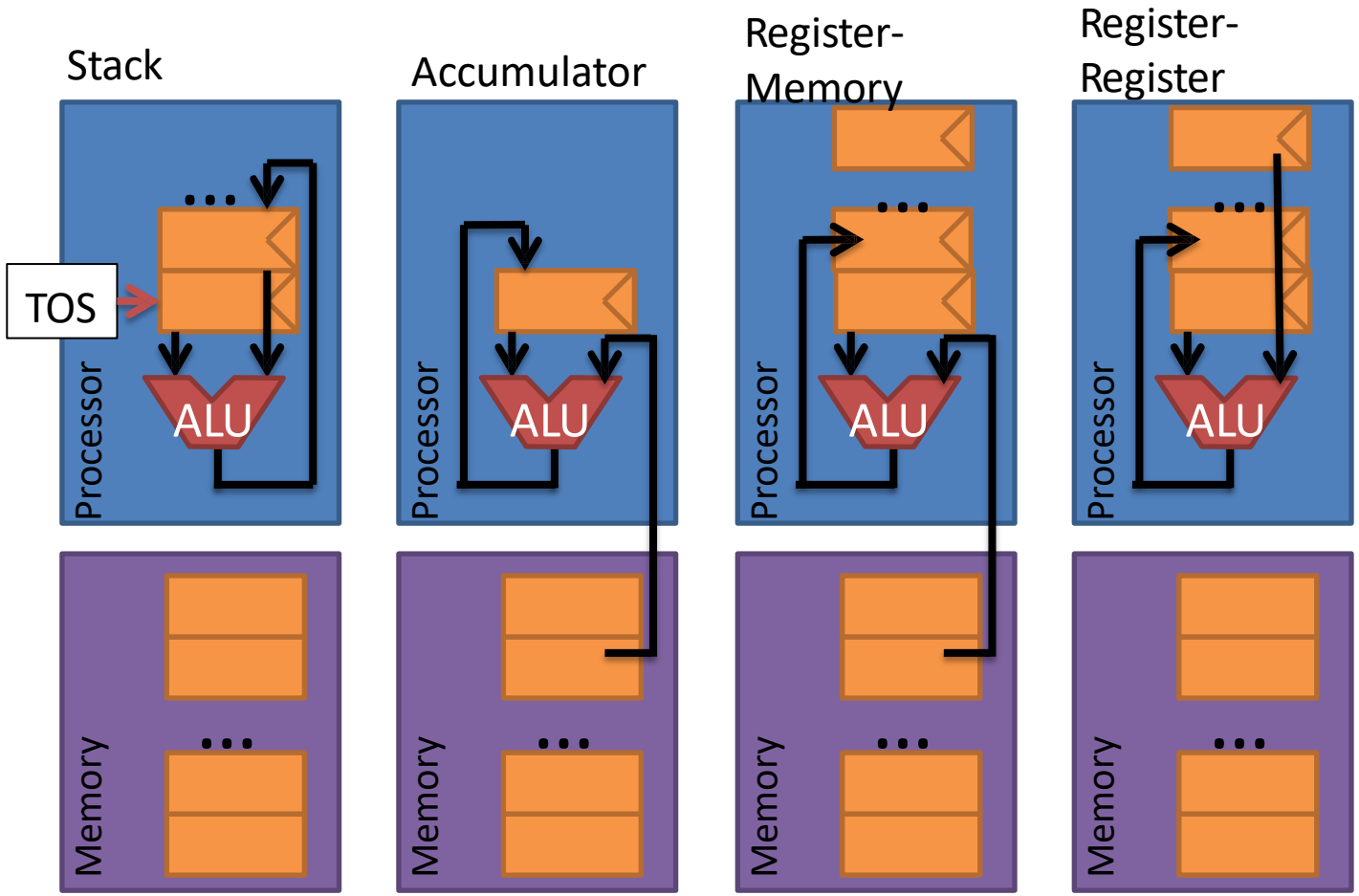

Class Interaction #6