Parallel Computing

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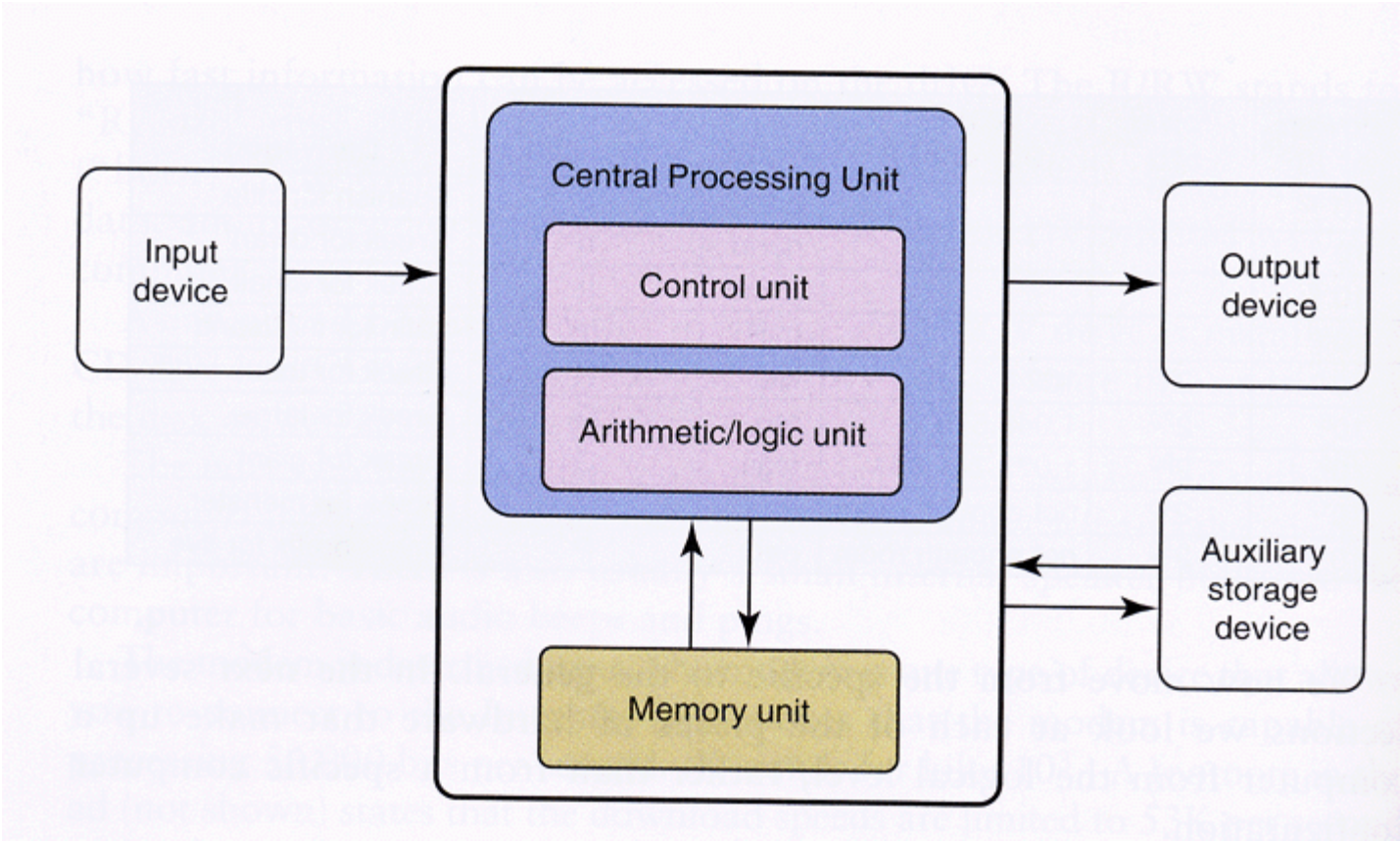
CS 210: Computing and Culture

Lecture 7, October 15, 2007

von Neumann Architecture

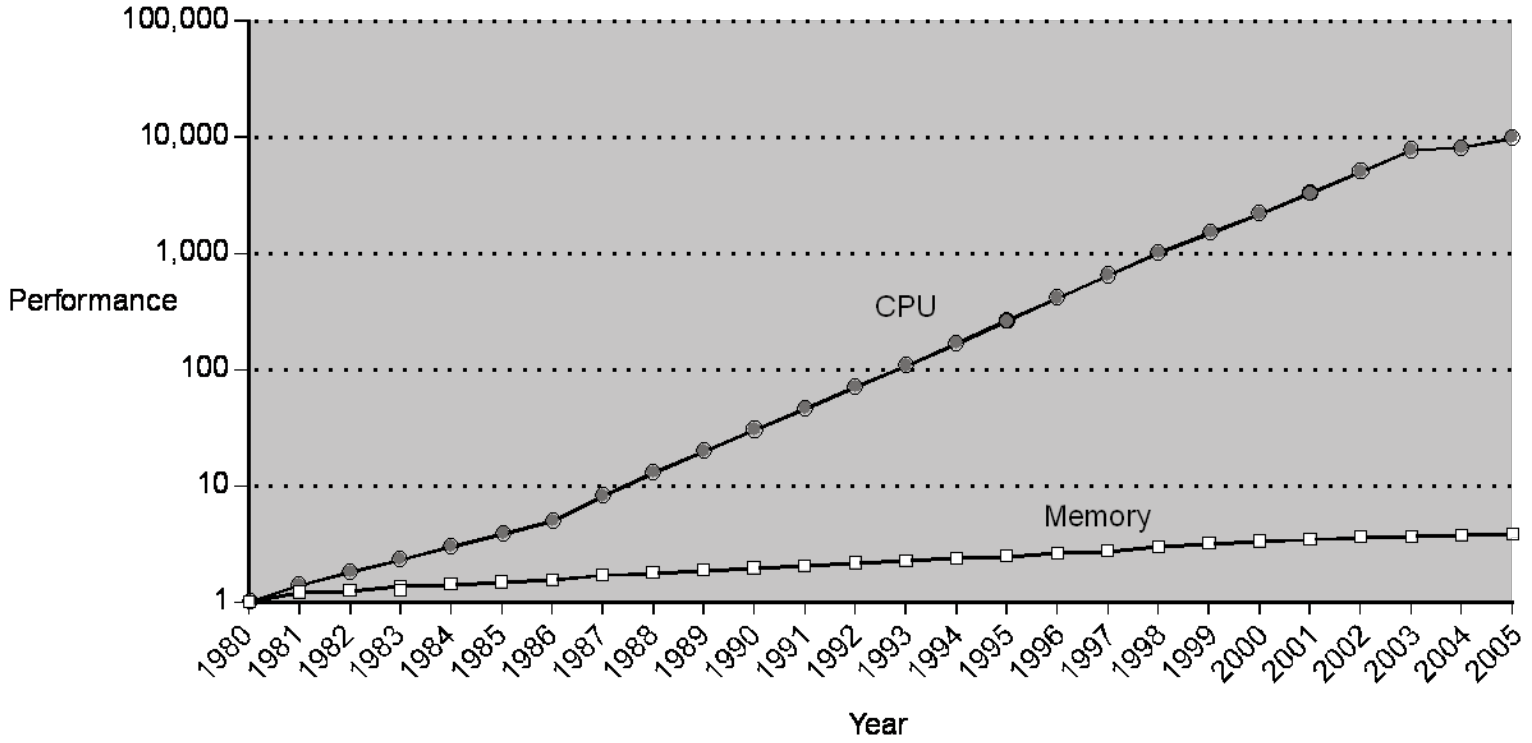


Problem 1

- The flow of data between processor and memory is the bottleneck of a sequential computer

Problem 2

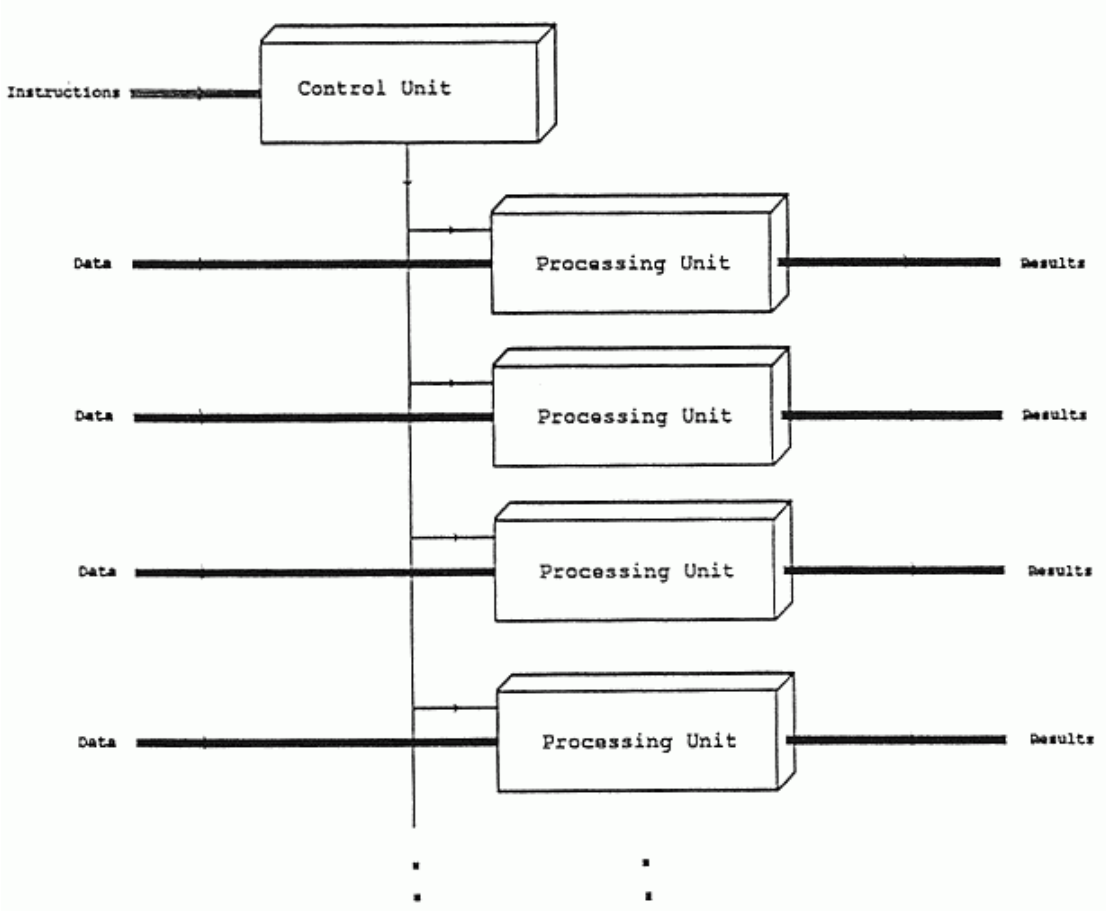
- Processor speeds continue to increase very fast
  — much faster than either DRAM or disk access times



- Design challenge: dealing with this growing disparity

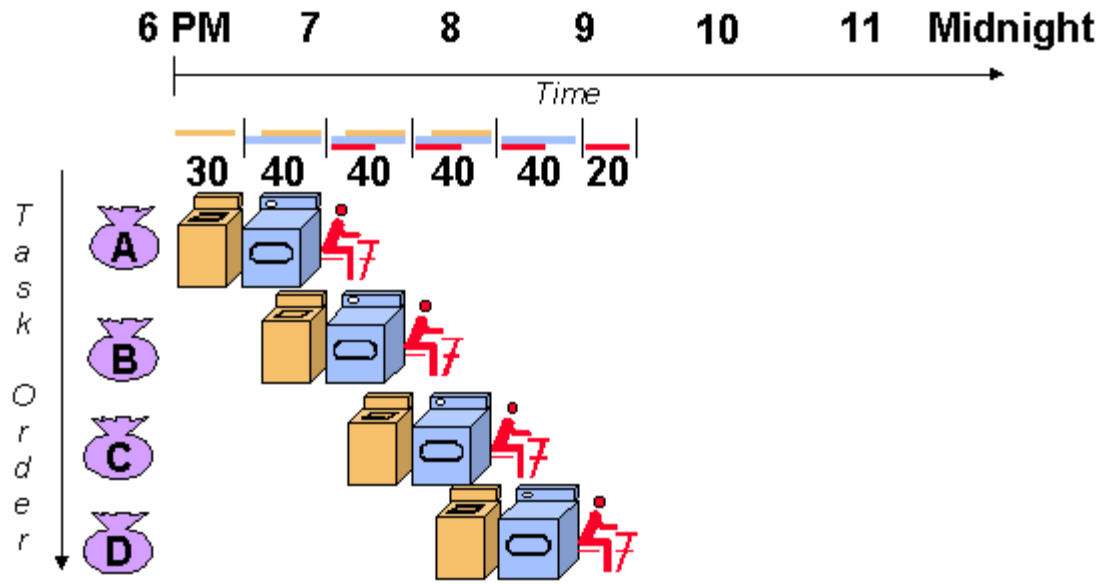
Non-von Neumann Architectures

- *Synchronous processing*: Multiple processors apply the same program in lock-step to multiple data sets



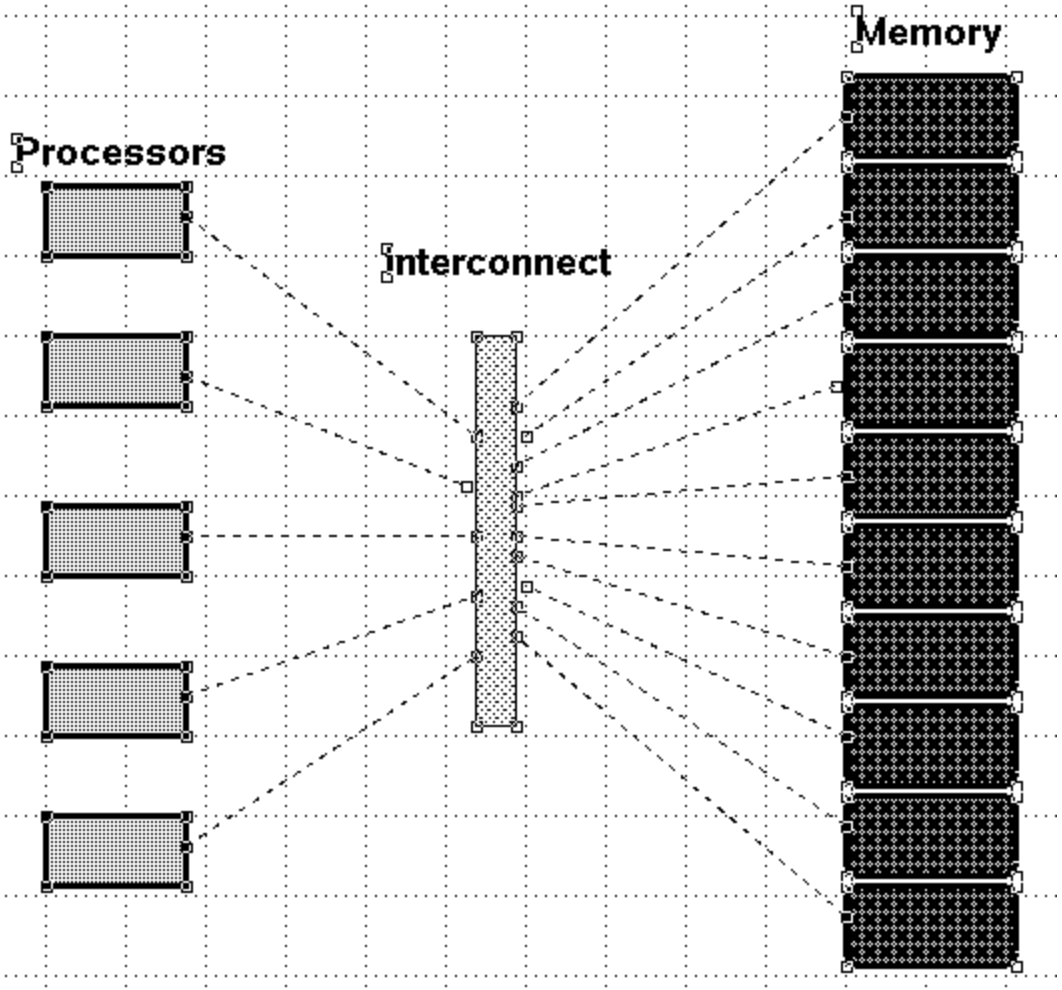
Non-von Neumann Architectures (cont'd)

- *Pipelining processing*: Multiple processors are arranged in tandem, where each contributes one part of an overall computation



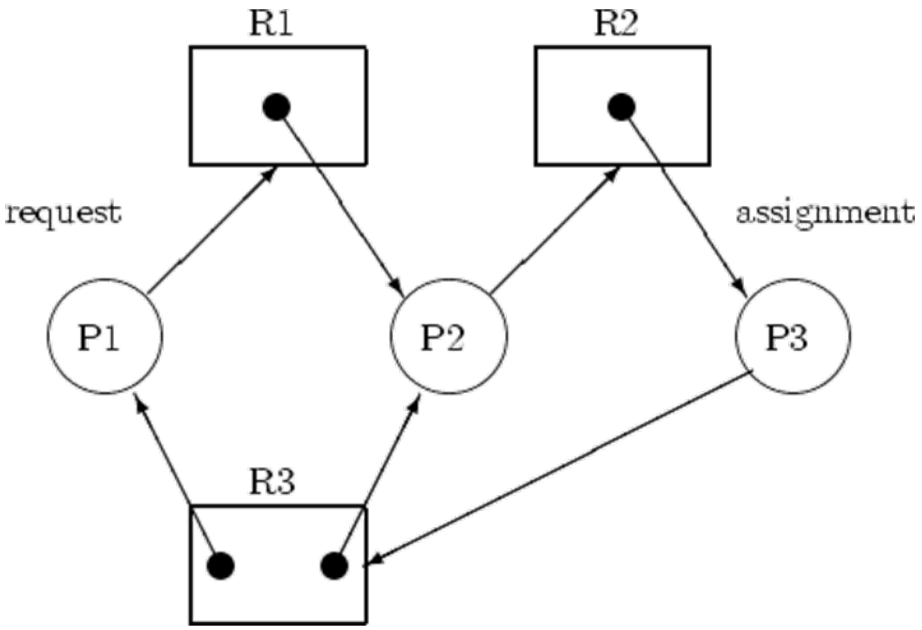
Non-von Neumann Architectures (cont'd)

- A *shared memory* configuration: Multiple processors share a global memory



Deadlock

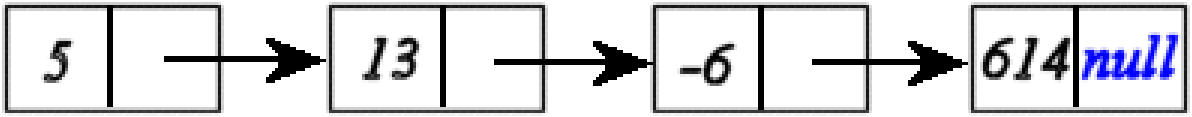
Deadlock is a condition when two or more processes are each waiting for another to release a resource, or more than two processes are waiting for resources in a circular chain:



Massively Parallel Computers

- *Massively parallel computers* use thousands or tens of thousands of processors

The Chain-Following Problem: Tracing Linked Lists



Midterm Review

- Open book, open notes, calculators allowed, no laptops, cell phones off
- 20 questions, each question worth 3 points
- Multiple-choice question: “All or nothing”
- Problem question: Can get partial credit by showing work. Examples: Write a sequence of states of a list sorted using bubble sort; Decode a Huffman-encoded message.
- Material covered: Lectures & Chapters 1-7, Discussions 1-6