

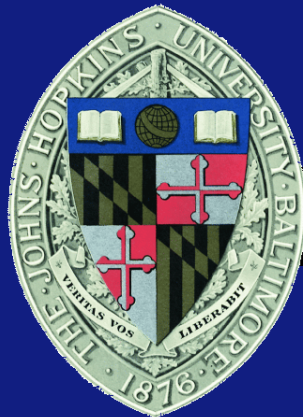
Lecture 7.1

Flynn's Taxonomy

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Why do I care about architecture?

- What's my machine?
 - What do I need to know about the processors and memory architecture?
- How can I program it?
 - Different classes of machines mandate different tools
- The interaction of architecture and programming environment places many constraints on how best to solve a parallel computing problem



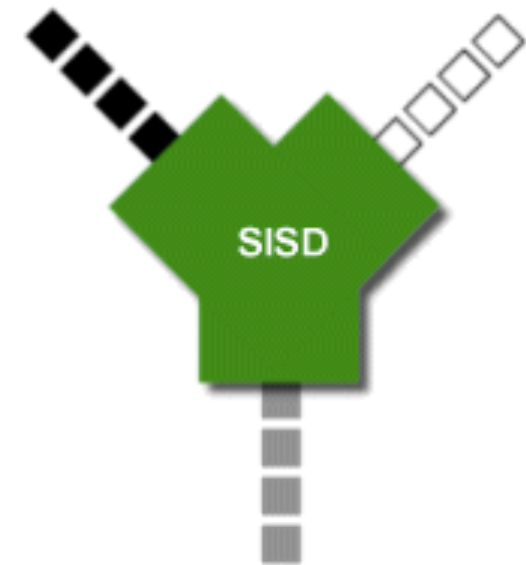
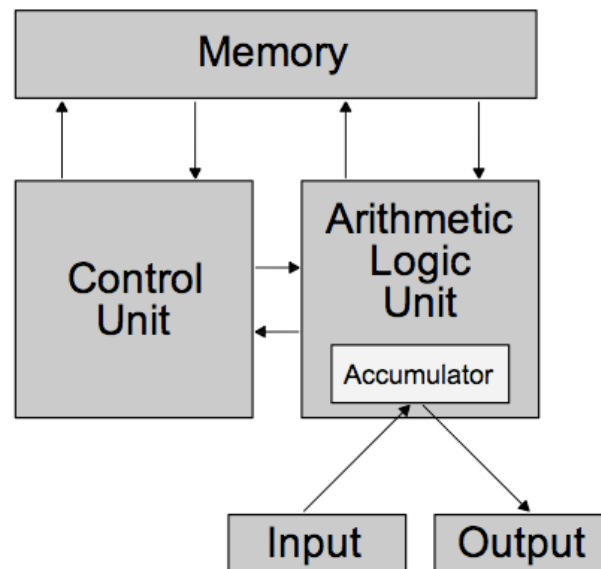
Flynn's Taxonomy

- Characterize machines by number of instruction streams and data streams
 - Defined in 1972. Still common practice.
 - A little too restrictive, but a starting place
- SISD: single instruction, single data
- SIMD: single instruction, multiple data
- MISD: multiple instruction, single data
 - Irrelevant. No such machines.
- MIMD: multiple instruction, multiple data



SISD

- Single instruction, single data
- The von Neumann architecture
 - Implements a universal Turing machine
 - Conforms to serial algorithmic analysis



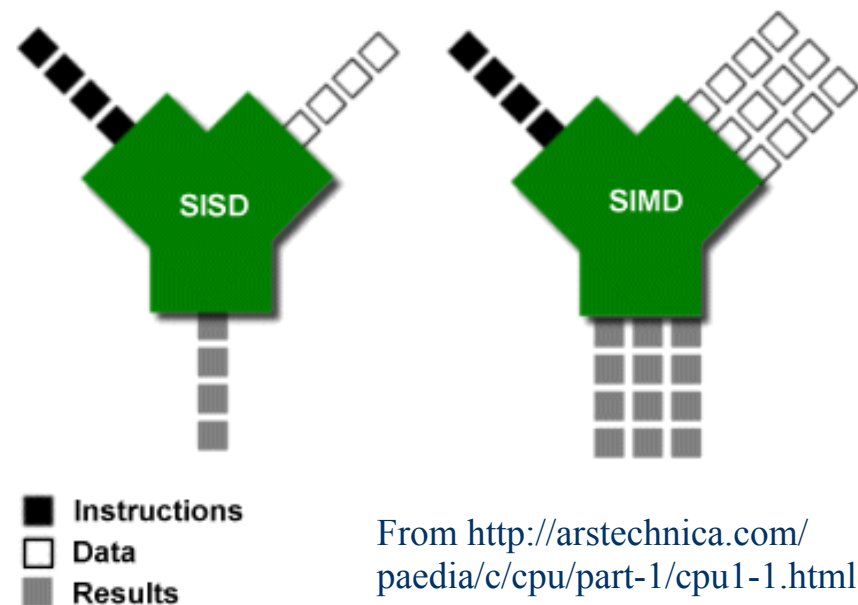
- Instructions
- Data
- Results

From <http://arstechnica.com/pedia/c/cpu/part-1/cpu1-1.html>



SIMD: Single Instruction, Multiple Data

- Single control stream
 - All processors operating in lock step
 - Fine-grained parallelism without inter-process communication
- Examples
 - Intel vector processors
 - nVidia G80
 - CUDA? (sorta)



From <http://arstechnica.com/paedia/c/cpu/part-1/cpu1-1.html>



MIMD: Multiple Instructions, Multiple Data

- Most the machines we are interested in
 - Multi-core, SMP, Clusters, ccNUMA, etc.
- Flynn's taxonomy not so useful
 - Must further divide the world
 - By architectural features and programming model

