CSSE132
Introduction to Computer Systems

12 : Computational model

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Today: Computational Model

- **Basic structures**

- **Computational model**
    - Instructions
    - Execution
    - Save

Basic structures

- **Clock**
    - Regular signal, clock edges can trigger events
- **Register**
    - Stores value, can change each clock cycle
- **Register File**
    - Several addressable read/write registers
- **ALU**
    - Performs math/logic operations on inputs
- **Memory**
    - Stores data and instructions
    - Abstracted as large array of byte storage
    - Convenient to split into instruction and data

Computational model

- **Processor**
  - CPU : Central Processing Unit
    - Large, fast chip that drives most computer operations
  - GPU : Graphics Processing Unit
    - Large chip, made of many simple, slow CPUs
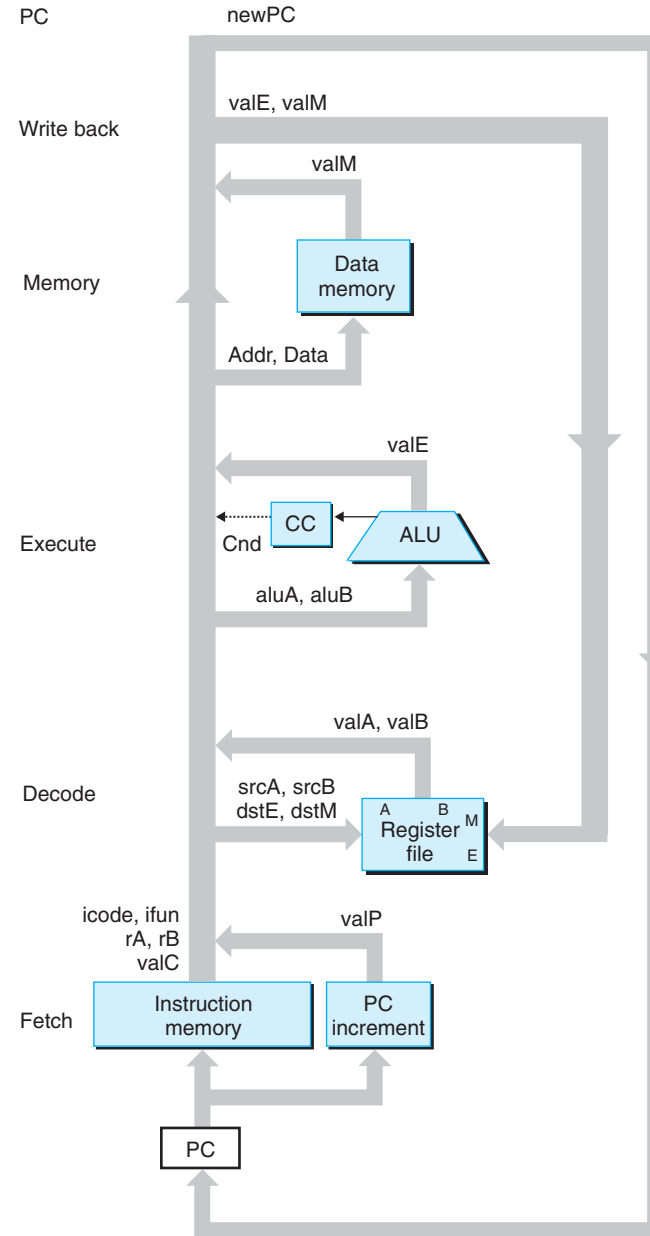   - Operates on vector data
- **For all processors**
  - Instruction directs processor operation
  - Instructions & data fetched from memory
  - Registers store intermediate results
  - ALU combines data into new results
  - New results can be written back to memory

Processor layout

- **Combine basic logic structures into datapath**
  - Input from memory
    - Instructions
    - Data
  - Track current instruction with Program Counter (PC) register
  - Temporary storage in register file
  - Instructions direct ALU to operate on data
  - Output result to memory

- **Most datapaths are clock driven**
  - All the exciting things happen on a clock edge

Y86 datapath

- **Simplified x86**

MIPS datapath