Introduction

- Class is an introduction to parallel computing
  - topics include: hardware, applications, compilers, system software, and tools
- Will count for Masters/PhD Comp Credit
- Work required
  - small programming assignments (two)
  - midterm
  - classroom participation
  - project

What is Parallel Computing?

- Does it include:
  - super-scalar processing (more than one instruction at once)?
  - client/server computing?
    - what if RPC calls are non-blocking?
  - vector processing (same instruction to several values)?
  - collection of PC's **not** connected to a network?

- For this class, parallel computing requires:
  - more than one processing element
  - nodes connected to a communication network
  - nodes working together to solve a single problem

Why Parallelism

- Speed
  - need to get results faster than possible with sequential
    - a weather forecast that is late is useless
  - could come from
    - more processing elements (P.E.)
    - more memory (or cache)
    - more disks
- Cost: cheaper to buy many smaller machines
  - this is only recently true due to
    - VLSI
    - commodity parts

What Does a Parallel Computer Look Like?

- Hardware
  - processors
  - communication
  - memory
  - coordination

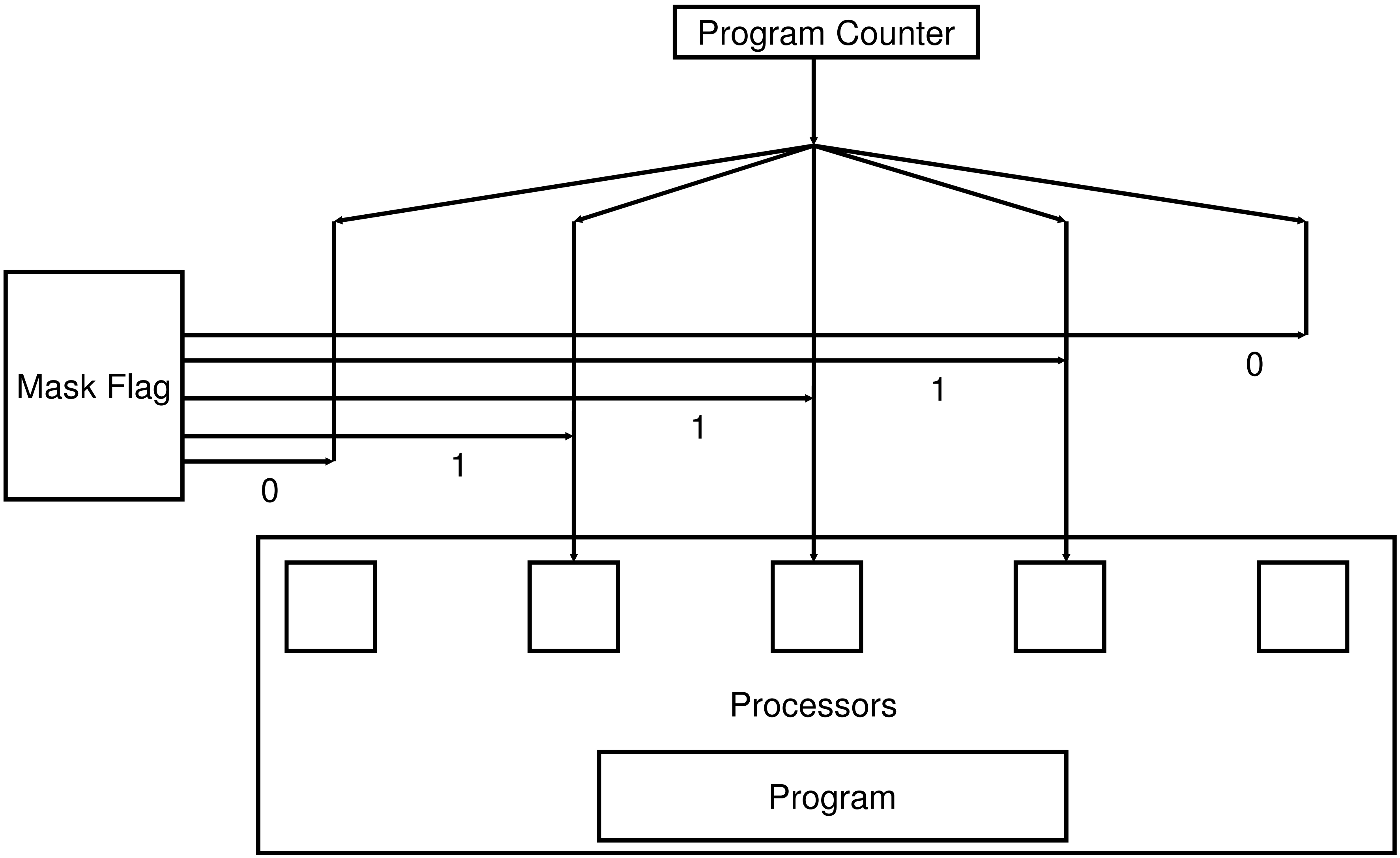
- Software
  - programming model
  - communication libraries
  - operating system

Processing Elements (PE)

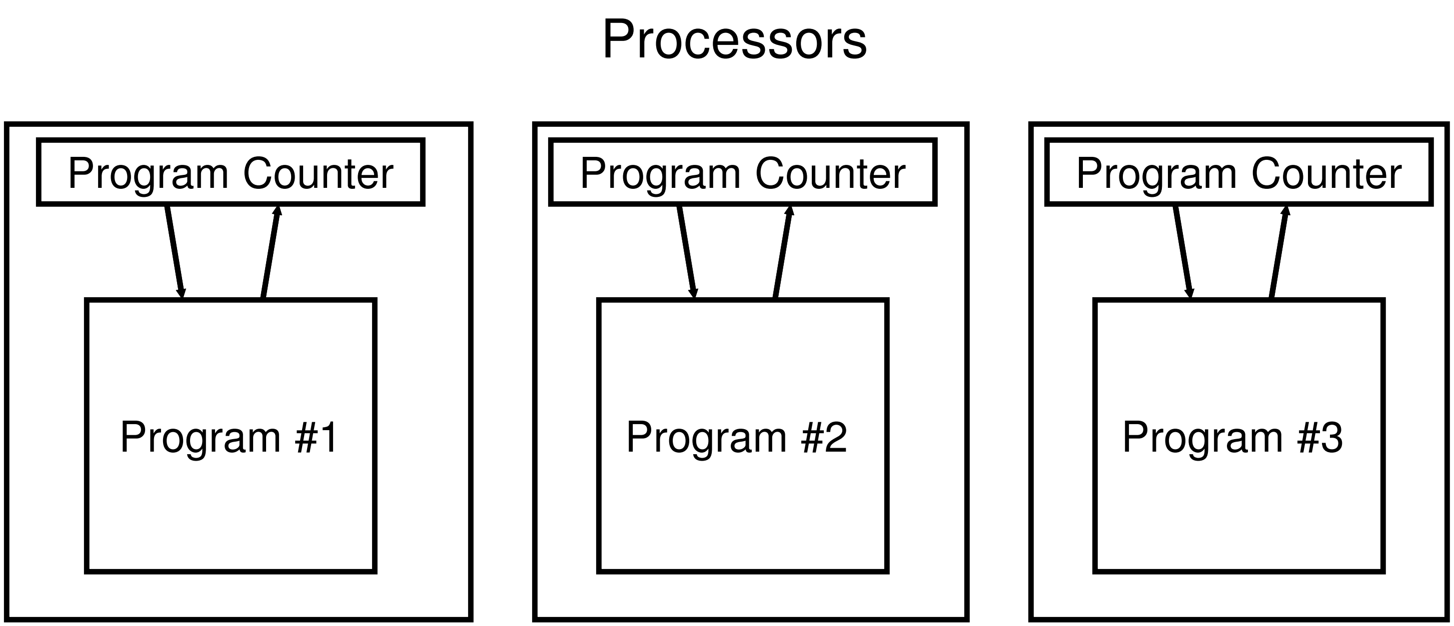
- Key Processor Choices
  - How many?
  - How powerful?
  - Custom or off-the-shelf?

- Major Styles of Parallel Computing
  - SIMD - Single Instruction Multiple Data
    - one master program counter (PC)
  - MIMD - Multiple Instruction Multiple Data
    - separate code for each processor
  - SPMD - Single Program Multiple Data
    - same code on each processor, separate PC's on each
  - Dataflow - instruction waits for operands
    - "automatically" finds parallelism

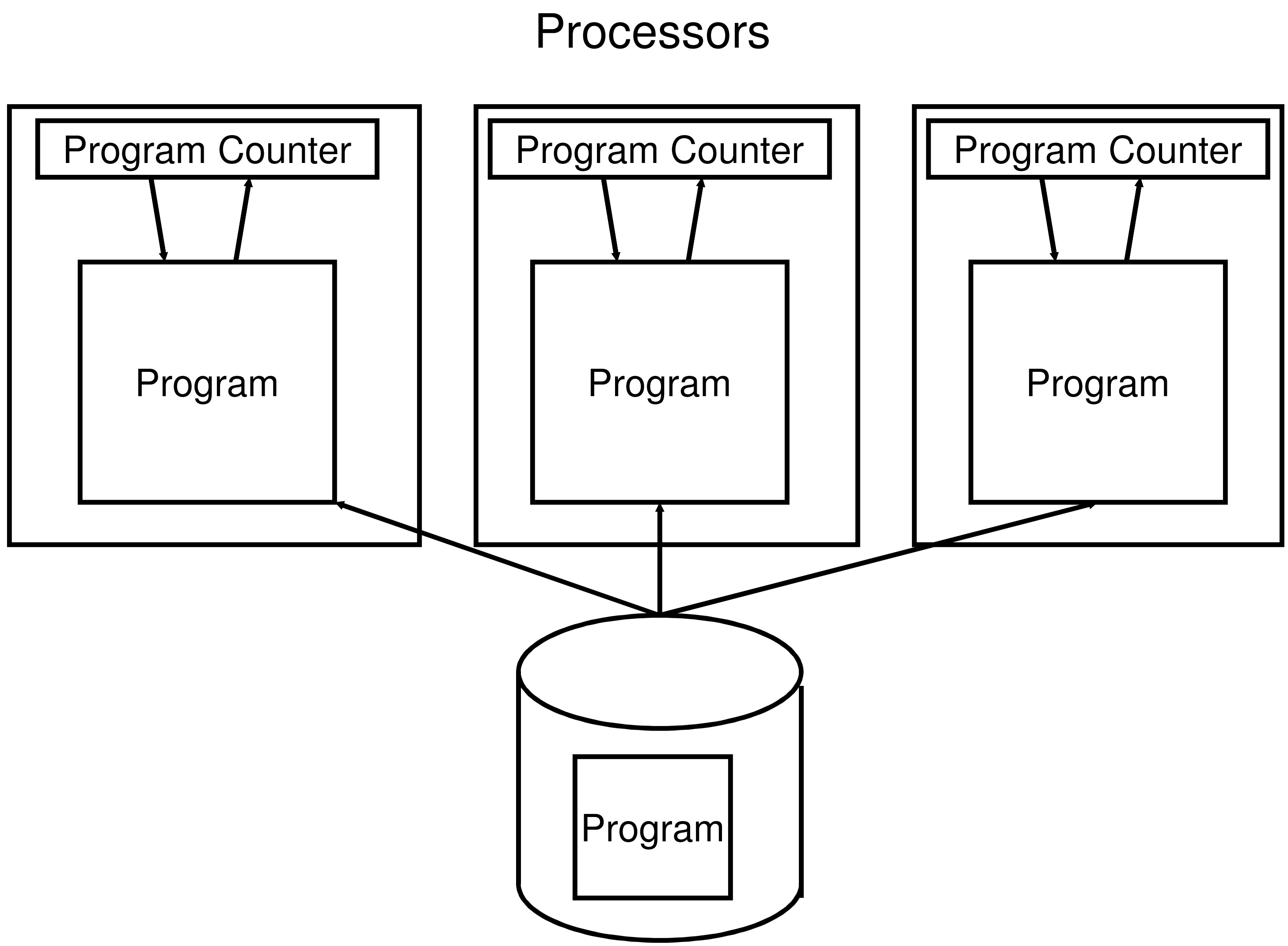
SIMD



MIMD


Processors
Program Counter
Program Counter
Program Counter
Program #1
Program #2
Program #3

SPMD


Processors
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