PARALLEL PROCESSING

Course Name

ICT 411: Computer Architecture and Organization

Course Teacher

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Referred Book

“Computer Architecture and Organization” by John P. Hayes

“Microprocessor Hardware Interfacing and Application” by Barry B. Brey

Parallel Processing

- A parallel processing system is able to perform concurrent data processing to achieve faster execution time
- The system may have two or more ALUs and be able to execute two or more instructions at the same time
- The goal of parallel processing is to speed up the computer processing capability and increase its throughput, that is, the amount of processing that can be accomplished during a given interval of time

Parallel Processing (Contd.)

- Normal operation of a computer is to fetch instructions from memory and execute them in the processor.
- Instruction Stream
  - The sequence of instructions read from memory constitutes an instruction stream
- Data Stream
  - The operations performed on the data in the processor constitutes a data stream
- Parallel processing may occur in the instruction stream, the data stream, or both

Parallel Processing (Contd.)

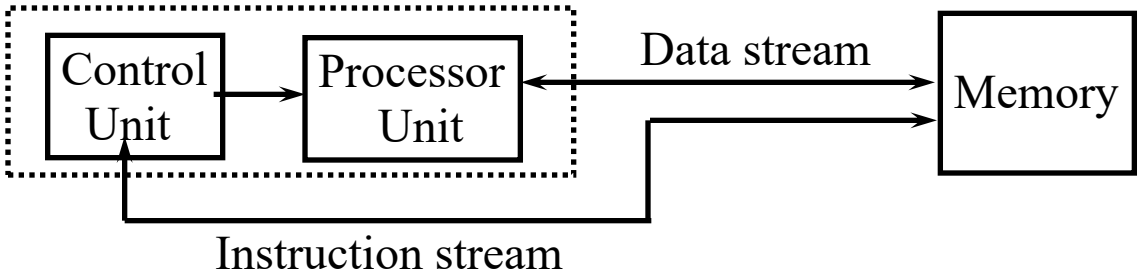
- Parallel processing can be classified from:
  - The internal organization of the processors
  - The interconnection structure between processors
  - The flow of information through the system
  - The number of instructions and data items that are manipulated simultaneously

Parallel Processing (Contd.)

- Flynn's classification divides computer into four major groups
  - Single instruction stream, single data stream – SISD
  - Single instruction stream, multiple data stream – SIMD
  - Multiple instruction stream, single data stream – MISD
  - Multiple instruction stream, multiple data stream – MIMD

		Number of *Data Streams*	
		Single	Multiple
Number of *Instruction Streams*	Single	**SISD**	**SIMD**
	Multiple	**MISD**	**MIMD**

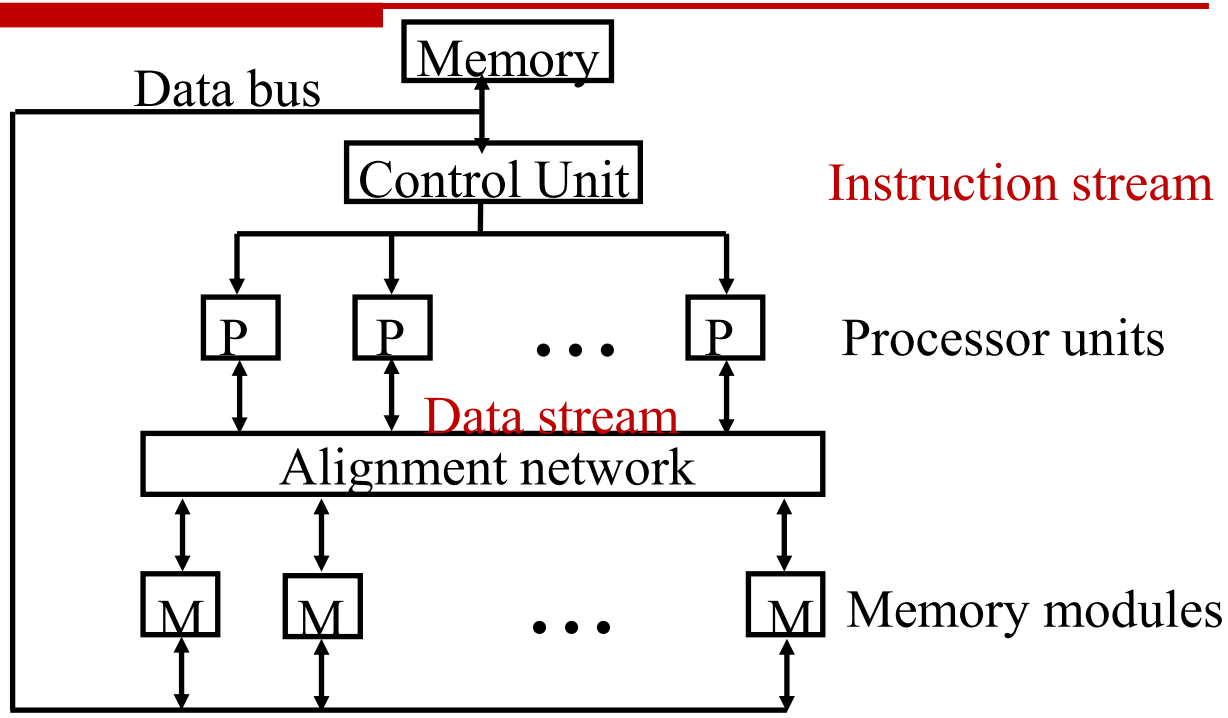
SISD



- SISD represents the organization of a single computer containing a control unit, a processor unit and a memory unit
- Instructions are executed sequentially
- These are uniprocessor computer

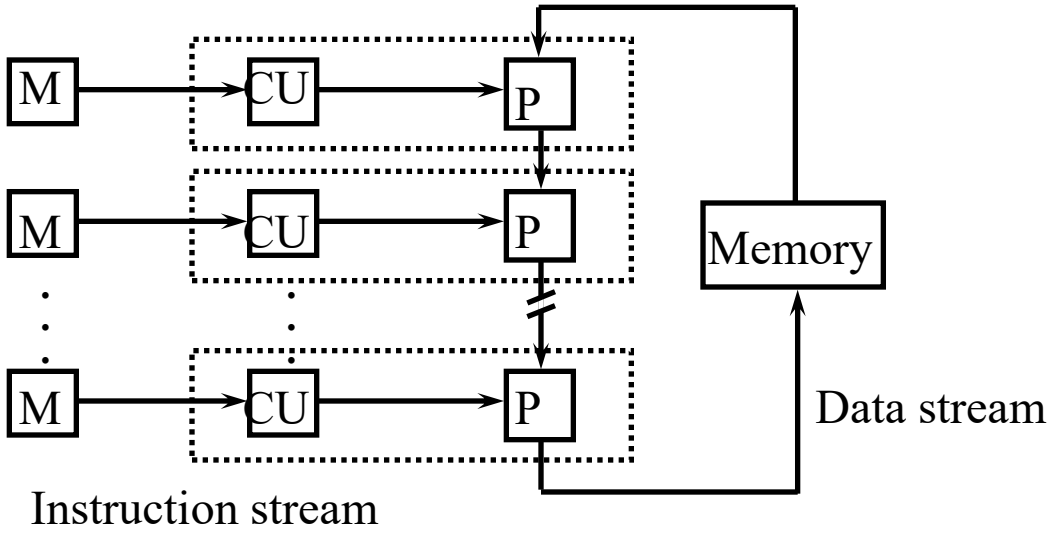
that process one instruction at a time.

SIMD



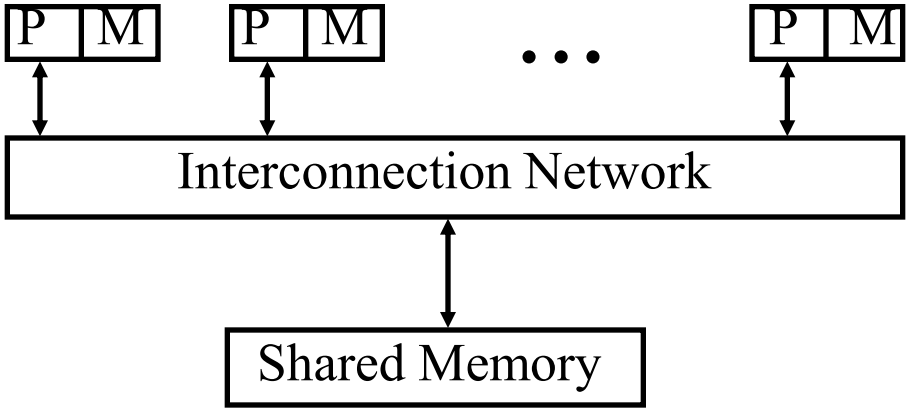
- Includes many processing units under the supervision of a common control unit
- All processors receive the same instruction, but operate on different data
- The shared memory unit must contain multiple modules so that it can communicate with all the processors simultaneously
- Application: **Vector and array processing**

MISD



- There is no computer at present that can be classified as MISD
- Theoretical only
- Not clear if it has ever been implemented

MIMD



- It has a number of processors that function asynchronously and independently
- MIMD organization refers to a computer system capable of processing several programs at the same time
- Application: Simulation

Processor Organizations