

Section 15.1 - Processors, Parallel Processing and Virtual Machines

Layer 3: ISA Machine

Syllabus Content Section 15: Hardware and Virtual Machines

15.1.1 Show understanding of Reduced Instruction Set Computers (RISC) and Complex Instruction Set Computers (CISC) processors

- Differences between RISC and CISC
- Understand interrupt handling on CISC and RISC processors

Complex Instruction Set Computer (CISC): a single instruction can be more complex and involve more loading of data from memory

Reduced Instruction Set Computer (RISC): a single instruction is simpler, requiring minimal loading of data from memory

RISC (Reduced Instruction Set Computers)	CISC (Complex Instruction Set Computers)
Simple instructions	Complex instructions
One instruction = one cycle	Many instructions = One cycle
Register to Register (LOAD and STORE are separate commands)	Memory to Memory (LOAD and STORE are built into the instructions)
Speeds up individual instructions	Tries to do a task in few lines as possible
Instructions are fixed length	Variable length instructions
Fewer addressing modes	More addressing modes
Multiple register sets	Fewer registers
Hard wired control unit	Microprogrammed control unit
Easier pipelining	Harder pipeline

S15.1.2 Show understanding of the importance / use of pipelining and

Because in RISC each instruction has a fixed length. And each instruction is one cycle
It is easier to pipeline tasks

Pipeline: Instruction level parallelism

Instruction level parallelism: breaking one task down into different stages

S15.1.3 Show understanding of the four basic computer architectures

- 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)

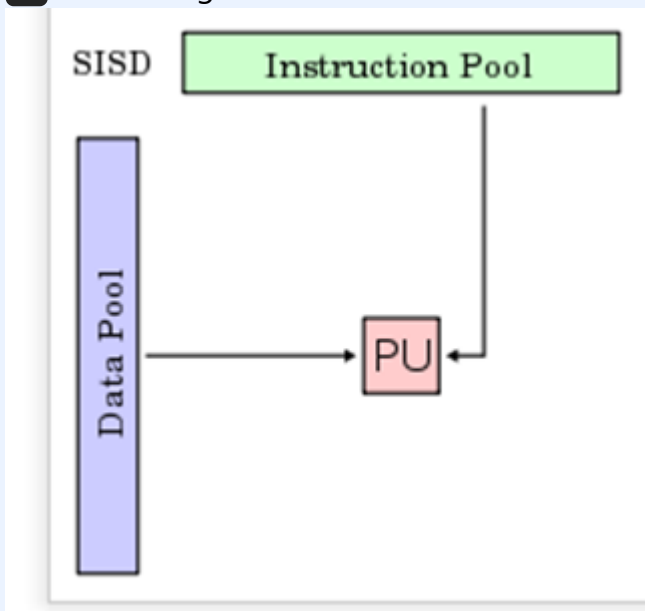
SISD: Single Instruction Stream Single Data stream; a single processor accessing one memory

- One Processing Unit
- One Control Unit
- One Memory Unit
- One instruction pool
- One data pool

Instruction pool: the list of instructions that can be used

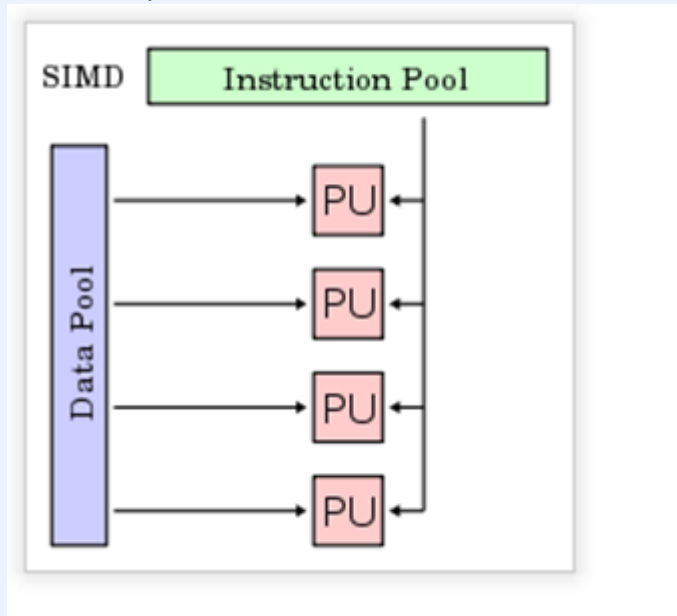
Data pool: Your data source

PU: Processing Unit / CPU



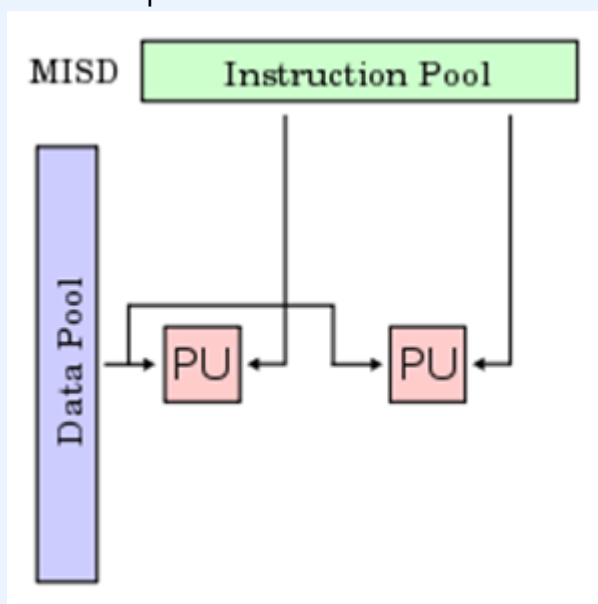
SIMD: Single Instruction Stream Multiple Data stream; processing of parallel data input requiring one control unit instructing multiple processing units

- One Control Unit
- One Memory Unit
- One instruction pool
- One data pool



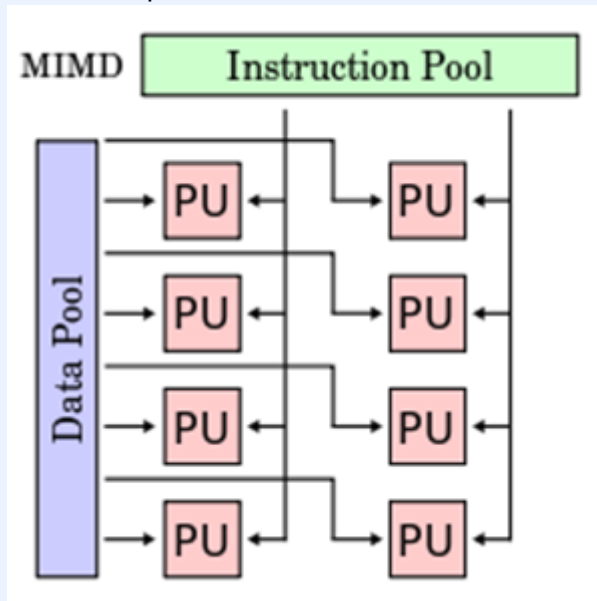
MISD: Multiple Instruction Stream Single Data stream; does not exist in a single architecture

- One Control Unit
- One Memory Unit
- One instruction pool
- One data pool



MIMD: Multiple Instruction Stream Multiple Data stream; multiple processors asynchronously processing parallel data input

- One Control Unit
- One Memory Unit
- One instruction pool
- One data pool



S15.1.4 Show understanding of the characteristics of massively parallel computers

MIMD known as massively parallel computers

Multiple processing units working with multiple pieces of data doing different things with the data at the same time.

S15.1.5 Show understanding of the concept of a virtual machine

- Give examples of the role of virtual machines
- Understand the benefits and limitations of virtual machines

System virtual machine: the emulation of computer system hardware using software

Benefits:

- Run different OS / programs without needing another computer

- Secure area to test new software, if something messes up then only your VM gets messed up

| drawback

- Takes up your machines hard drive, processor, memory and resources
- Slower than using a dedicated machine