

ELEMENTS OF PARALLEL COMPUTING

a. Limits of Single Processors:

Modern processors are reaching the limit of how fast they can go because of physical constraints, like how fast signals can travel (speed of light) and how hot processors get (thermodynamics).

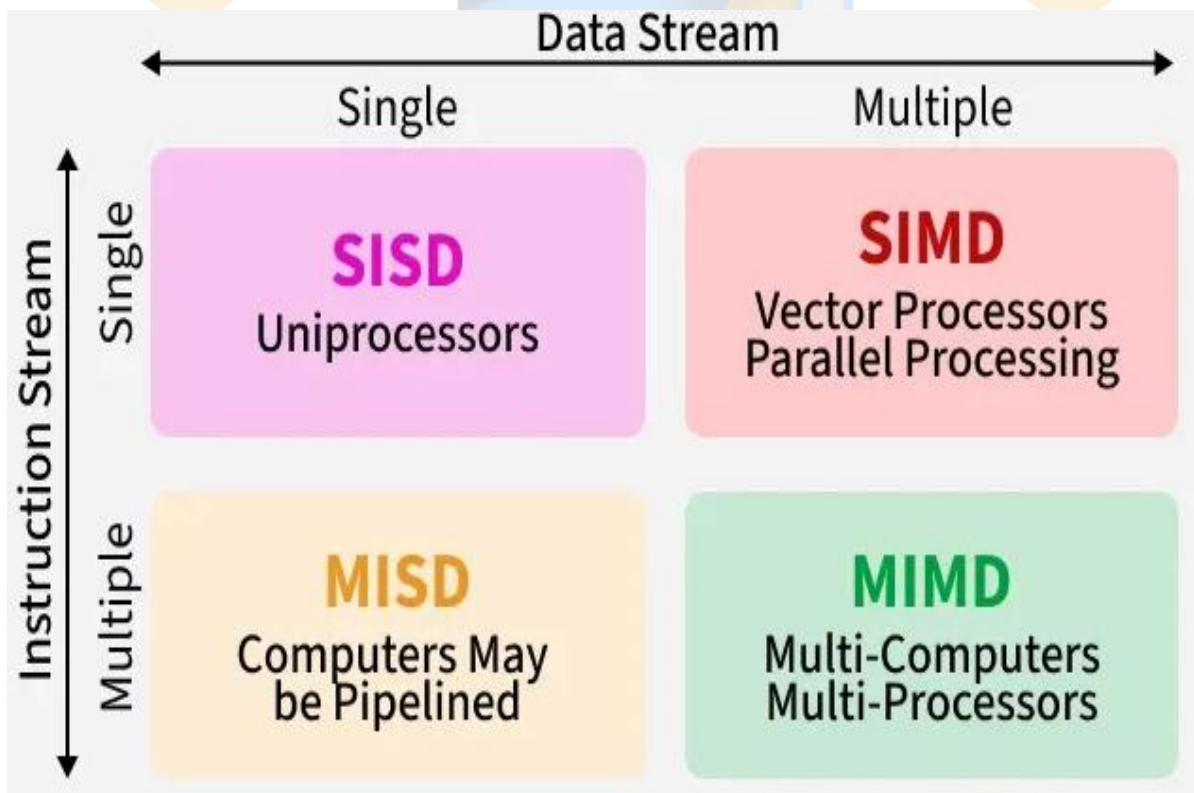
Since we can't keep making individual processors faster, the solution is to use many processors working together.

b. Parallel Processing:

This involves dividing a large task into smaller ones, then giving each smaller task to a different processor. All the processors work at the same time, solving their own part of the problem, and then their results are combined.

- **Divide-and-Conquer:** The task is split into smaller subtasks. For example, if you were multiplying two large matrices, different sections of the matrices would be given to different processors to multiply simultaneously.

c. Types of Parallel Architectures:



- **SISD (Single Instruction, Single Data):** A single processor handles one task at a time. This is what we're used to with regular desktop computers.
- **SIMD (Single Instruction, Multiple Data):** Here, one instruction is carried out on multiple data sets at the same time. This is great for tasks like image processing or scientific simulations where you apply the same operation to lots of data.
- **MISD (Multiple Instruction, Single Data):** Multiple processors perform different operations on the same data set. This is rare and not widely used.
- **MIMD (Multiple Instruction, Multiple Data):** Different processors perform different tasks on different data sets. This is the most common type of parallel computing used today, especially in multi-core processors.