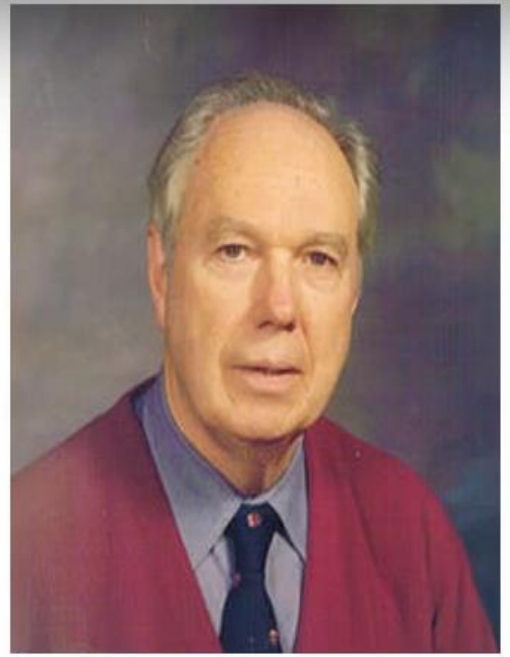
# The Agenda

1. **What is Taxonomy?**
2. **Architecture**
3. **Flynn's Taxonomy**

# Taxonomy

- **Taxonomy**- from Greek ***taxis***, meaning **arrangement** or **division**, and ***nomos***, meaning **law**
- The **science** of **categorization**, or **classification**, of **things** based on a **predetermined system**.



# Flynn & Flynn's Taxonomy

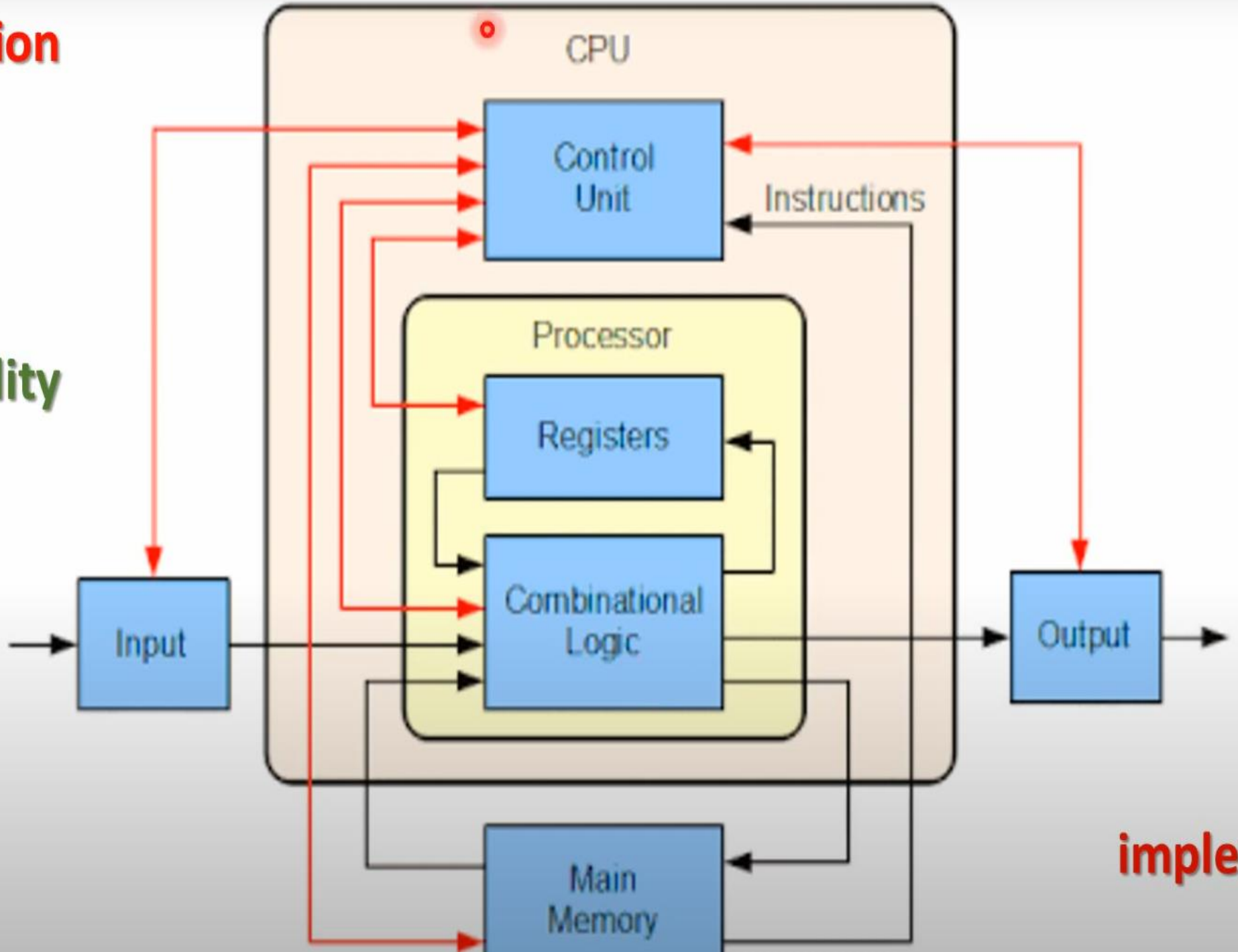
- **Michael J. Flynn** (born May 20, 1934) is an American professor at Stanford University.
- Flynn proposed the **Flynn's taxonomy**, a **method of classifying digital computer architecutes**, in 1966

# Architecture

- **Computer architecture** is a set of **rules and methods** that describe the **functionality**, **organization**, and **implementation** of computer.
- Computer architecture is concerned with **balancing the performance**, **efficiency**, **cost**, and **reliability** of a computer system.

organization

functionality




implementation

# Flynn's Taxonomy

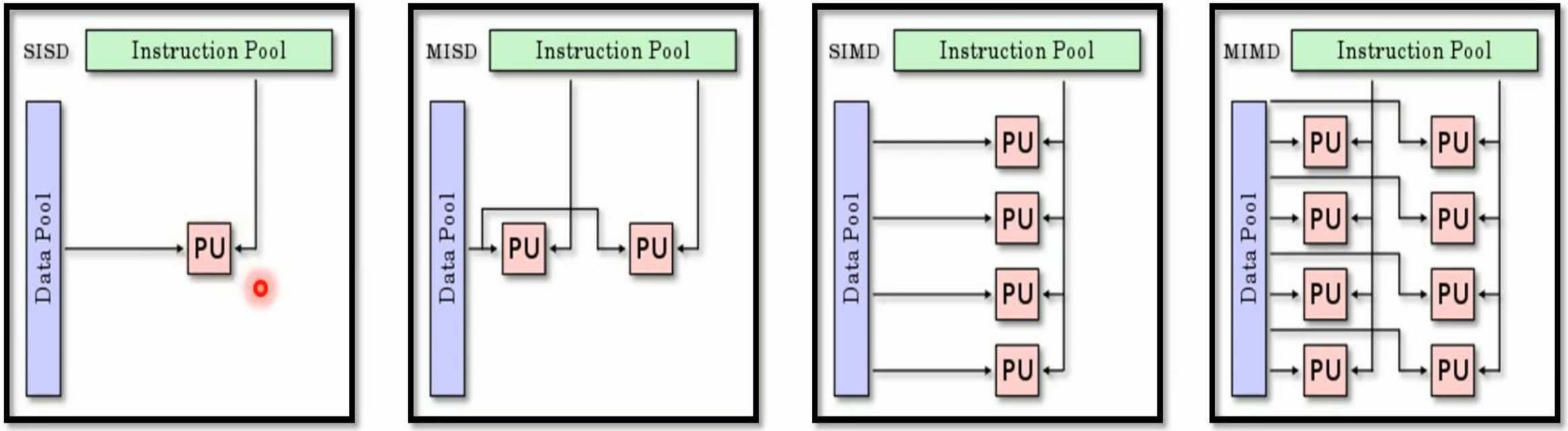
- The four classifications based upon the number of **concurrent instruction (or control) streams** and **data streams** available in the architecture:

1. **Single instruction stream, single data stream (SISD)**
2. **Single instruction stream, multiple data streams (SIMD)**
3. **Multiple instruction streams, single data stream (MISD)**
4. **Multiple instruction streams, multiple data streams (MIMD)**

# Flynn's Taxonomy cont...

- **Instruction stream:** The sequence of **instructions** from **memory to the control unit**.
- **Data stream:** The sequence of **data** from **memory to the control unit**.

# Flynn's Taxonomy cont...



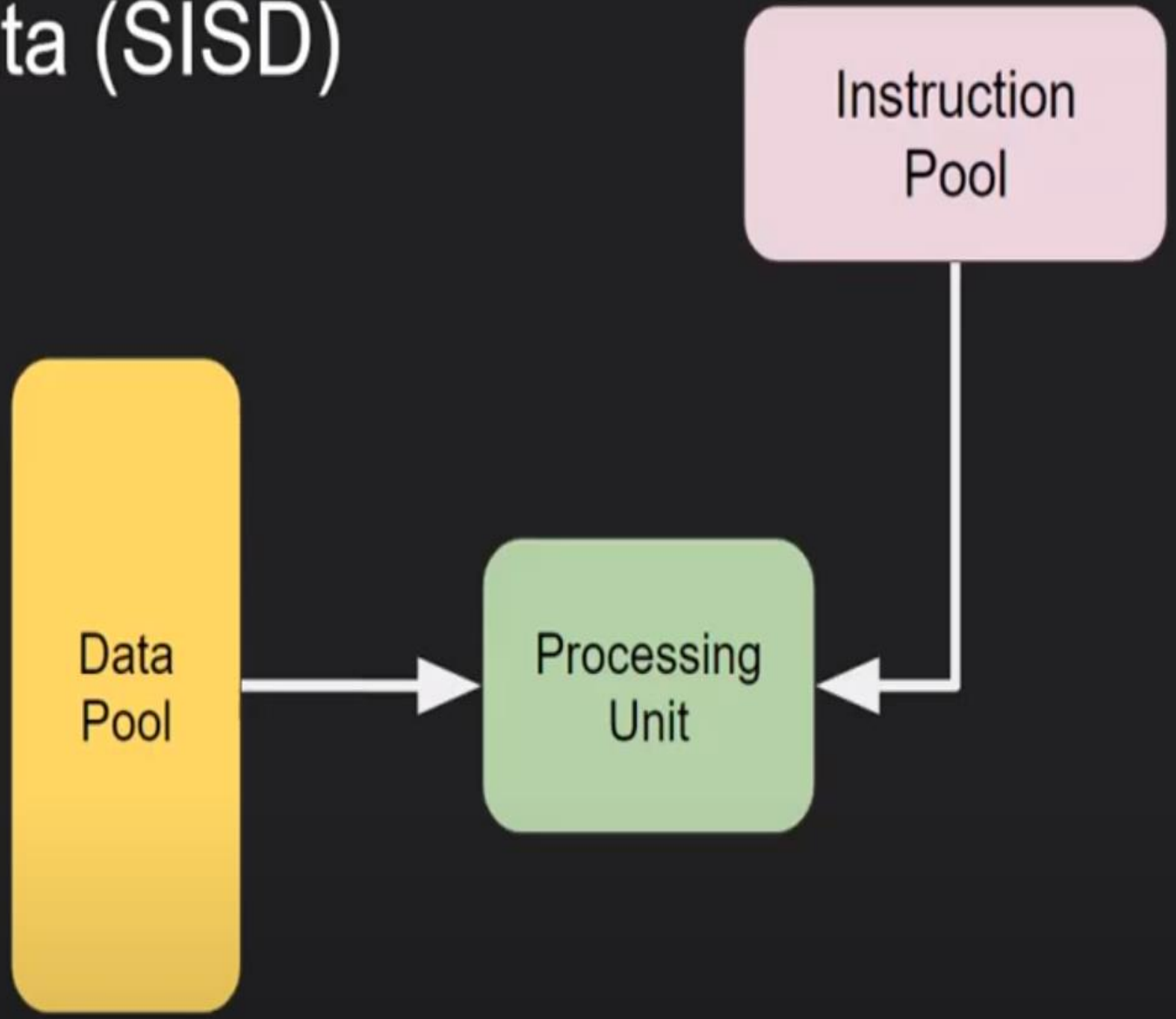
# Single Instruction Single Data (SISD)

A single processor takes data from a single address in memory and performs a single instruction on the data at a time

The original Von Neumann Architecture was SISD.

Pipelining can be implemented, but only one instruction will be executed at a time.

All single processor systems are SISD.



# Single Instruction Single Data (SISD)

## Advantages

- Cheap
- Low power consumption

## Disadvantages

- Limited speed due to being a single core

## Uses

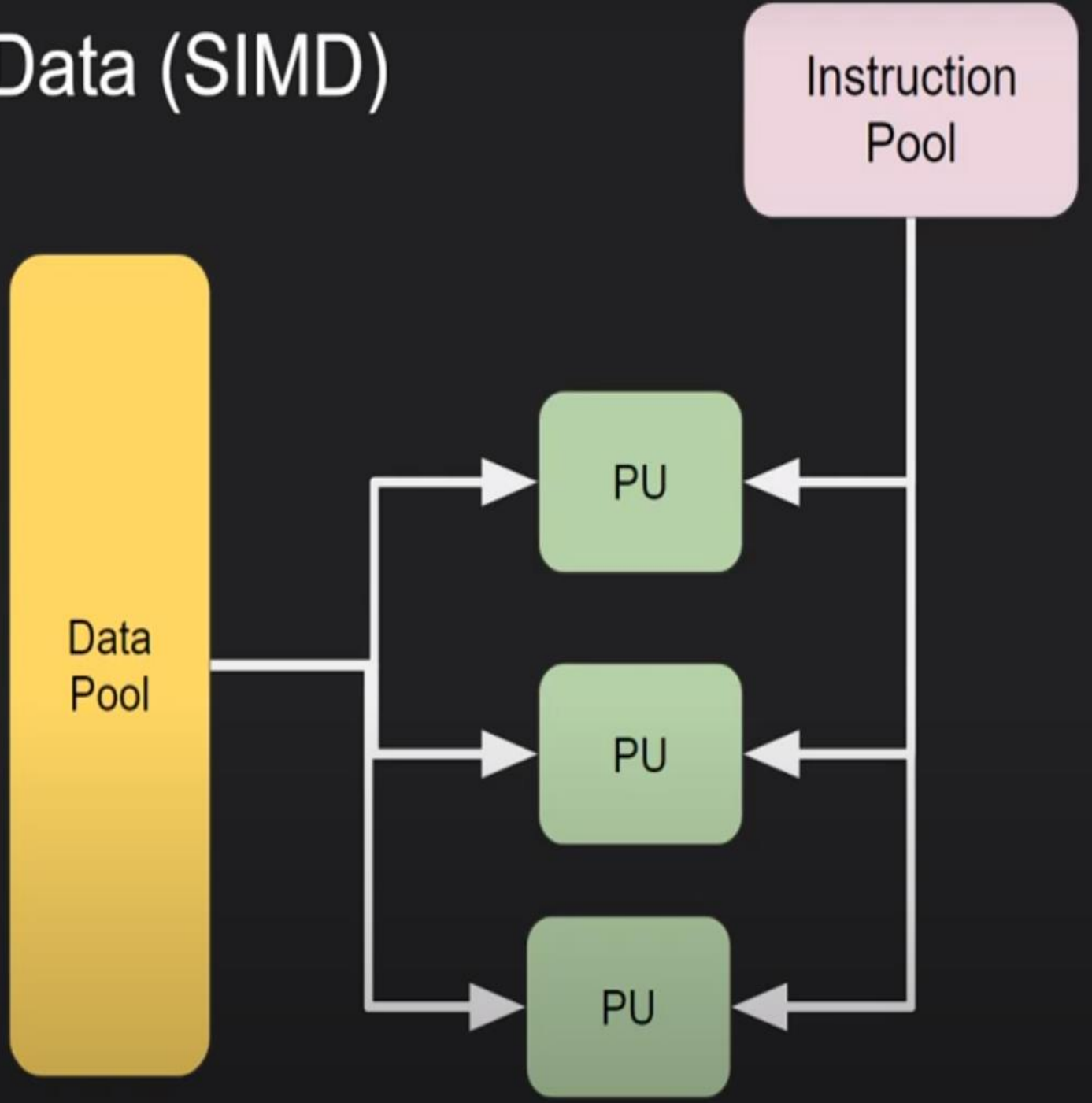
- Microcontrollers
- Older mainframes

# Single Instruction Multiple Data (SIMD)

A single instruction is executed on multiple different pieces of data

These instructions can be performed sequentially, taking advantage of pipelining, or in parallel using multiple processors.

Modern GPUs, containing Vector processors and array processors, are commonly SIMD systems.



# Single Instruction Multiple Data (SIMD)

## Advantages

- Very efficient where you need to perform the same instruction on large amounts of data.

## Disadvantages

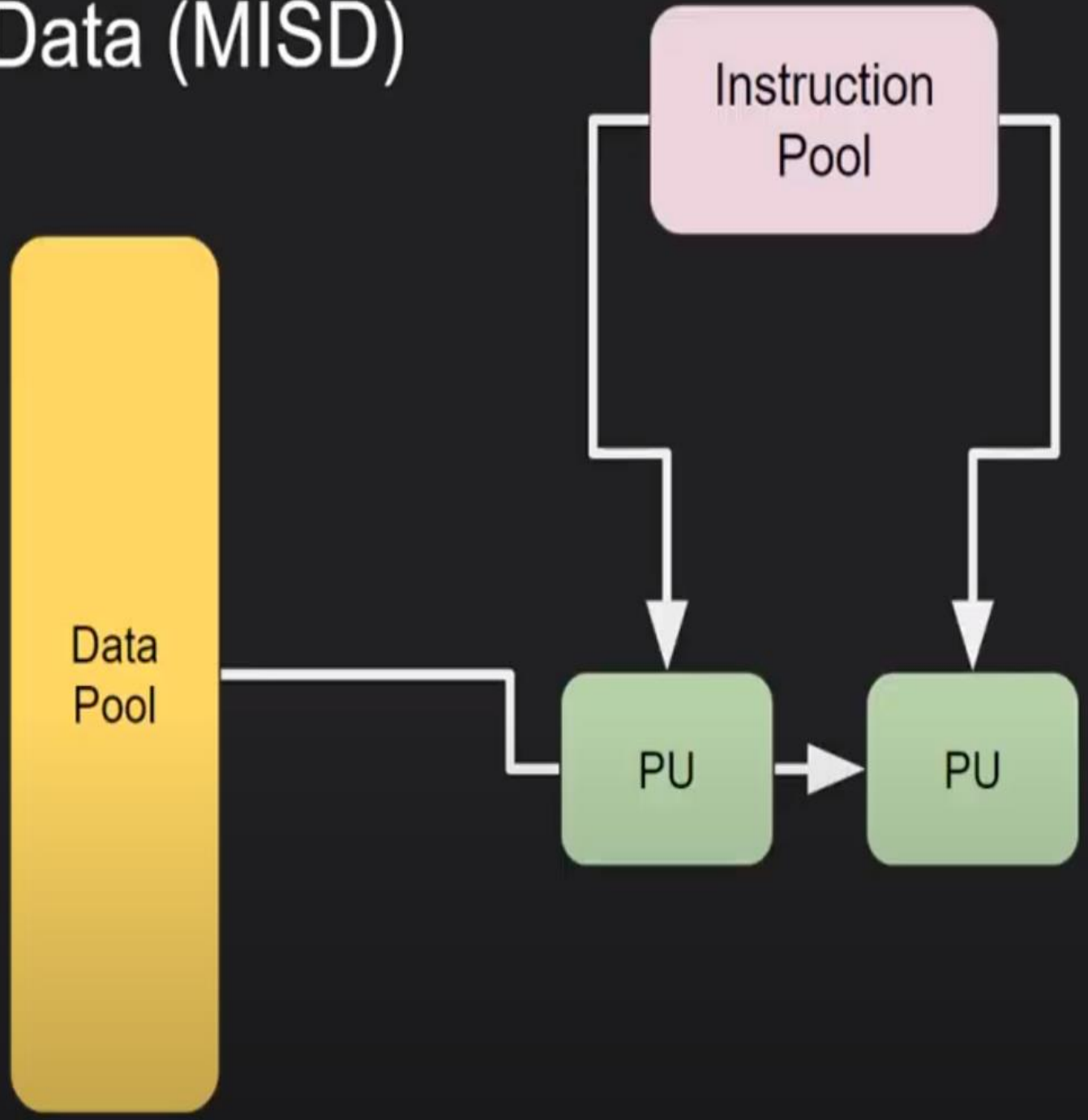
- Limited to specific applications

## Uses

- GPUs
- Scientific processing

# Multiple Instruction Single Data (MISD)

This is where multiple processors work on the same data set, performing different instructions at the same time.



# Multiple Instruction Single Data (MISD)

## Advantages

- Useful where real time fault detection is critical

## Disadvantages

- Very limited application so not available commercially

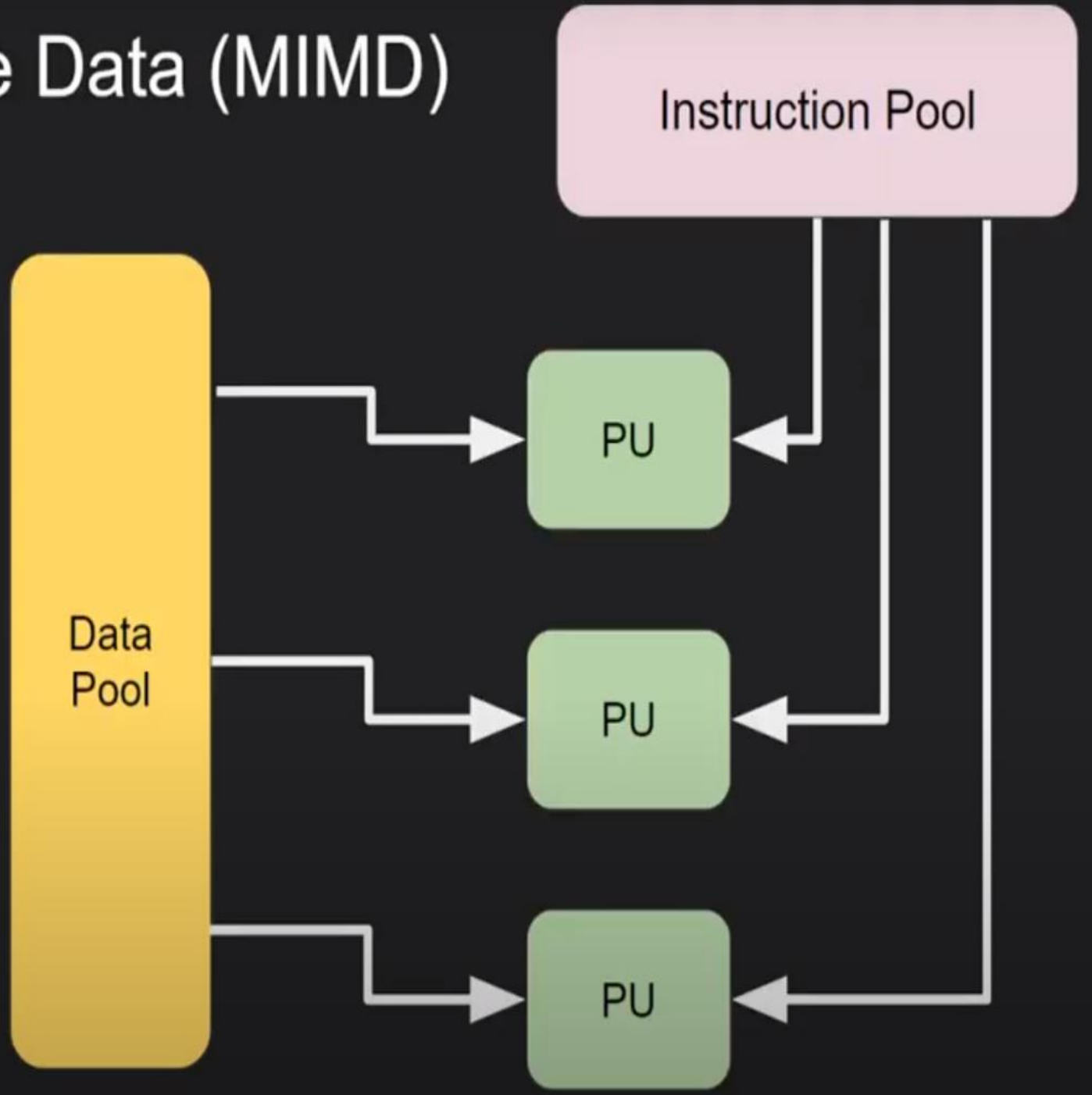
## Uses

- Space shuttle flight control systems.

# Multiple Instruction Multiple Data (MIMD)

Multiple autonomous processors perform operations on difference pieces of data, either independently or as part of shared memory space.

This means that several different instructions can be executed at the same time, using different data streams.



# Multiple Instruction Multiple Data (MIMD)

## Advantages

- Great for situations where multitasking is required

## Disadvantages

- Much more complicated architecture so more expensive

## Uses

- Most modern PCs, Laptops, Smart Phones