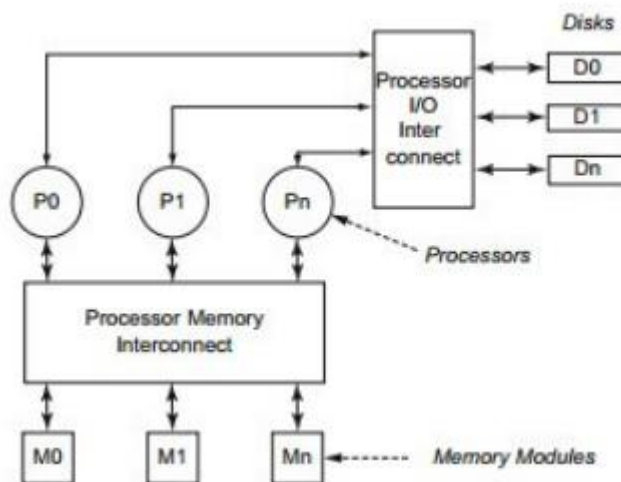


MUTIPROCESSOR SYSTEMS

- A set of processors connected by a communications network
- A multiprocessor system is an interconnection of two or more CPU's with memory and input-output equipment.
- Multiprocessors system are classified as multiple instruction stream, multiple data stream systems(MIMD).\
- There exists a distinction between multiprocessor and multicomputers that though both support concurrent operations.
- In multicomputers several autonomous computers are connected through a network and they may or may not communicate but in a multiprocessor system there is a single OS Control that provides interaction between processors and all the components of the system to cooperate in the solution of the problem.
- VLSI circuit technology has reduced the cost of the computers to such a low Level that the concept of applying multiple processors to meet system performance requirements has become an attractive design possibility.



Characteristics of Multiprocessors:

Benefits of Multiprocessing:

1. Multiprocessing increases the reliability of the system so that a failure or error in one part has limited effect on the rest of the system. If a fault causes one processor to fail, a second processor can be assigned to perform the functions of the disabled one.
2. Improved System performance. System derives high performance from the fact that computations can proceed in parallel in one of the two ways:
 - a) Multiple independent jobs can be made to operate in parallel.
 - b) A single job can be partitioned into multiple parallel tasks.

This can be achieved in two ways:

- The user explicitly declares that the tasks of the program be executed in parallel.
- The compiler provided with multiprocessor s/w that can automatically detect parallelism in program. Actually it checks for Data dependency.

COUPLING OF PROCESSORS

Tightly Coupled System/Shared Memory:

- Tasks and/or processors communicate in a highly synchronized fashion
- Communicates through a common global shared memory
- Shared memory system. This doesn't preclude each processor from having its own local memory (cache memory)

Loosely Coupled System/Distributed Memory

- Tasks or processors do not communicate in a synchronized fashion.
- Communicates by message passing packets consisting of an address, the data content, and some error detection code.
- Overhead for data exchange is high
- Distributed memory system

Loosely coupled systems are more efficient when the interaction between tasks is minimal, whereas tightly coupled system can tolerate a higher degree of interaction between tasks.

Interconnection Structures:

The interconnection between the components of a multiprocessor System can have different physical configurations depending on the number of transfer paths that are available between the processors and memory in a shared memory system and among the processing elements in a loosely coupled system.

Some of the schemes are as:

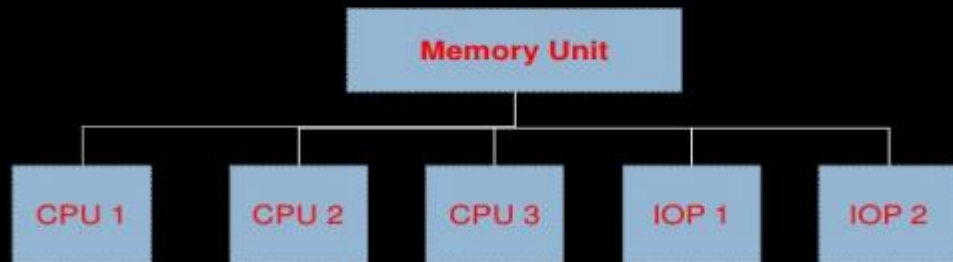
- Time-Shared Common Bus
- Multiport Memory
- Crossbar Switch
- Multistage Switching Network
- Hypercube System

a. Time shared common Bus

- All processors (and memory) are connected to a common bus or busses
- Memory access is fairly uniform, but not very scalable
- A collection of signal lines that carry module-to-module communication
- Data highways connecting several digital system elements
- Operations of Bus

1. Time –shared common bus.

- A system common bus multiprocessor system consists of a number of processors connected through path to a memory unit.



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b. Multiport Memory:

Multiport Memory Module

- Each port serves a CPU

Memory Module Control Logic

- Each memory module has control logic
- Resolve memory module conflicts Fixed priority among CPUs

Advantages

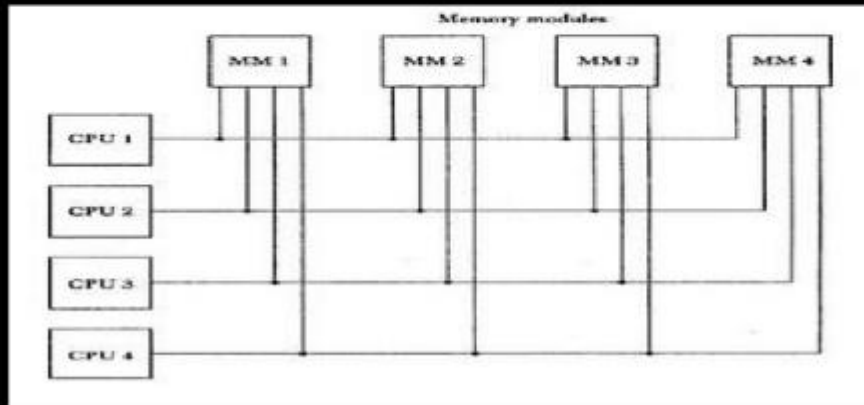
- The high transfer rate can be achieved because of the multiple paths.

Disadvantages:

- It requires expensive memory control logic and a large number of cables and connections

2. Multiport Memory

- A multiport memory system employs separate buses between each memory module and each CPU.

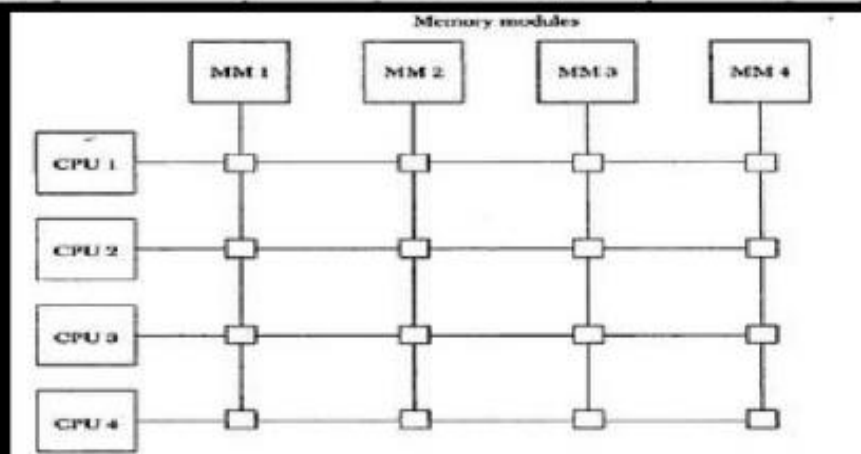


c. Crossbar switch:

- Each switch point has control logic to set up the transfer path between a processor and a memory.
- It also resolves the multiple requests for access to the same memory on the predetermined priority basis.
- Though this organization supports simultaneous transfers from all memory modules because there is a separate path associated with each Module.
- The H/w required to implement the switch can become quite large and complex.

3. Cross bar switch

The crossbar switch organization consists of a number of crosspoints that are placed at intersections between processor buses and memory module paths.



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Advantage:

- Supports simultaneous transfers from all memory modules

Disadvantage:

- The hardware required to implement the switch can become quite large and complex.

d. Multistage Switching Network:

- The basic component of a multi stage switching network is a two-input, two output interchange switch.

4. Multistage switching Network

- The basic component of a multistage network is a two- input , two- output interchange switch.

