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Multiprocessor Scheduling in Operating System

In this article, we will learn about the **multiprocessor scheduling** and also discuss about the **different types of multiprocessor operating system**.

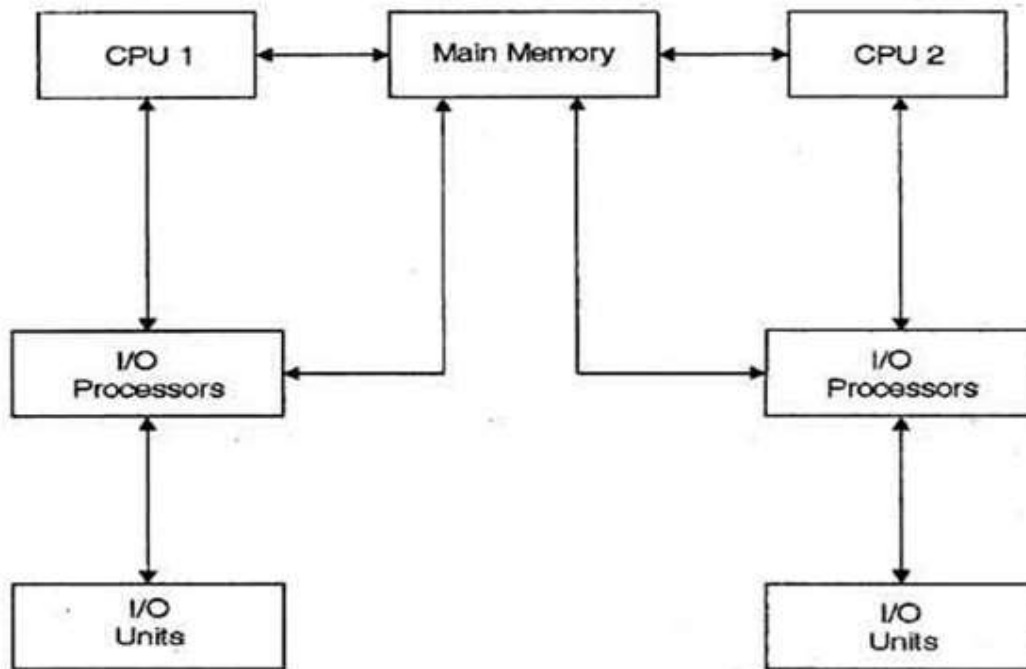
Submitted by [Prerana Jain](#), on December 11, 2018

Multiprocessor Operating system

A multiprocessor system consists of several processors which share memory. In the multiprocessor, there is more than one processor in the system. The reason we use multiprocessor is that sometimes load on the processor is very high but input output on other function is not required. This type of operating system is more reliable as even if one processor goes down the other can still continue to work. This system is relatively cheap because we are only having the copies of processor but other devices like input-output and Memory are shared. In the multiprocessor system all the processors operate under the single operating system. Multiplicity of the processor and how the processors work together are transparent to the other.

In this, the user does not know in which processor their process work. A process is divided into several small processes and they work independently on the different processor. A system can be both multi-programmed by having multiple programs running at the same time and multiprocessing by having more than one physical and the processor.

In this diagram, there are more than 1 CPU and they shared a common memory.



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Multiprocessing scheduling

In the multiprocessor scheduling, there are multiple CPU's which share the load so that various process run simultaneously. In general, the multiprocessor scheduling is complex as compared to single processor scheduling. In the multiprocessor scheduling, there are many processors and they are identical and we can run any process at any time.

The multiple CPU's in the system are in the close communication which shares a common bus, memory and other peripheral devices. So we can say that the system is a tightly coupled system. These systems are used when we want to process a bulk amount of data. These systems are mainly used in satellite, weather forecasting etc.

Multiprocessing system work on the concept of symmetric multiprocessing model. In this system, each processor work on the identical copy of the operating system and these copies communicate with each other. We the help of this system we can save money because of other devices like peripherals. Power supplies and other devices are shared. The most important thing is that we can do more work in a short period of time. If one system fails in the multiprocessor system the whole system will not halt only the speed of the processor will be slow down. The whole performance of the multiprocessing system is managed by the operating system . operating system assigns different task to the different processor in the system. In the multiprocessing system, the process is broken into the thread which they can be run independently. These type of system allow the threads to run on more

than one processor simultaneously. In these systems the various process in the parallel so this is called parallel processor. Parallel processing is the ability of the CPU to run various process simultaneously. In the multiprocessing system, there is dynamically sharing of resources among the various processors.

Multiprocessor operating system is a kind of regular OS which handles many systems calls at the same time, do memory management, provide file management also the input-output devices.

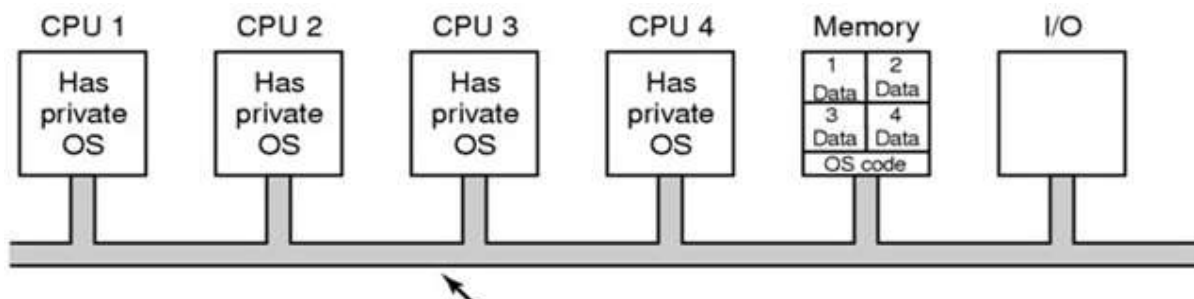
There are some extra features which multiprocessor perform:

- Process synchronization
- Resource management
- Scheduling

There are various organizations of multiprocessor operating system:

1. Each CPU has its own OS

In this types of the organization then there are much Central processing units in the system and each CPU has its own private operating system and memory is shared among all the processors and input-output system are also shared. All the system is connected by the single bus.

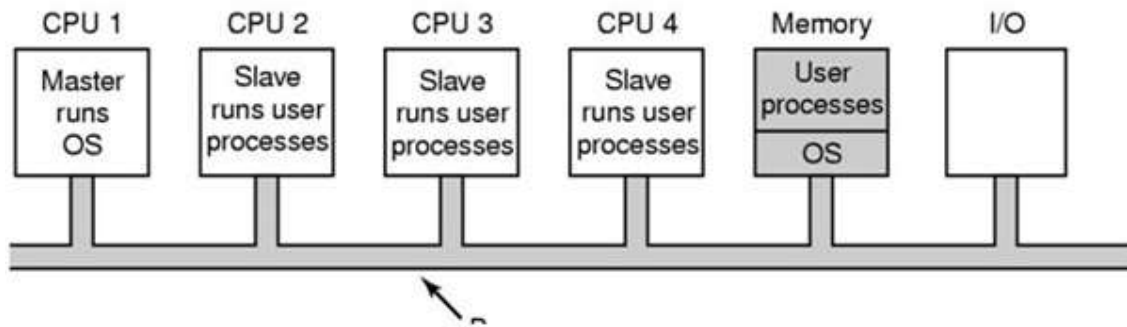


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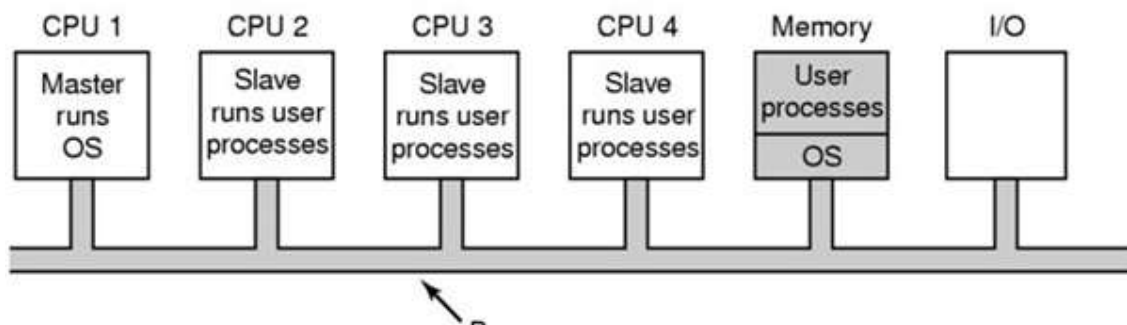
2. Master slave multiprocessor

In this type of multiprocessor model, there is a single data structure which keeps track of the ready processes. In this model, one central processing unit works as master and other central processing unit work as a slave. In this, all the processors are handled by the single processor which is called master server. The master server runs the operating system process and the slave server run the user processes. The memory and input-output devices are shared among all the processors and all the processor are connected to a common bus. This system is simple and reduces the data sharing so this system is called **Asymmetric multiprocessing**.



3. Symmetric multiprocessor

Symmetric Multiprocessors (SMP) is the third model. In this model, there is one copy of the OS in memory, but any central processing unit can run it. Now, when a system call is made, then the central processing unit on which the system call was made traps to the kernel and then processes that system call. This model balances processes and memory dynamical. This approach uses Symmetric Multiprocessing where each processor is self-scheduling. The scheduling proceeds further by having the scheduler for each processor examine the ready queue and select a process to execute. In this system, this is possible that all the process may be in common ready queue or each processor may have its own private queue for the ready process.



There are mainly three sources of contention that can be found in a multiprocessor operating system.

- **Locking system**

As we know that the resources are shared in the multiprocessor system so there is a need to protect these resources for safe access among the multiple processors. The main purpose of locking scheme is to serialize access of the resources by the multiple processors.

- **Shared data**

When the multiple processor access the same data at the same time then there may be a chance of inconsistency of data so to protect this we have to use some protocols or locking scheme.

- **Cache coherence**

It is the shared resource data which is stored in the multiple local caches. Suppose there are two clients have a cached copy of memory and one client change the memory block and the other

client could be left with invalid cache without notification of the change so this kind of conflict can be resolved by maintaining a coherence view of the data.



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 Sort an array of 0's, 1's and 2's in linear time complexity
 Checking Anagrams (check whether two string is anagrams or not)
 Relative sorting algorithm
 Finding subarray with given sum
 Find the level in a binary tree with given sum K
 Check whether a Binary Tree is BST (Binary Search Tree) or not
 1[0]1 Pattern Count
 Capitalize first and last letter of each word in a line
 Print vertical sum of a binary tree
 Print Boundary Sum of a Binary Tree
 Reverse a single linked list
 Greedy Strategy to solve major algorithm problems
 Job sequencing problem
 Root to leaf Path Sum
 Exit Point in a Matrix
 Find length of loop in a linked list
 Toppers of Class
 Print All Nodes that don't have Sibling
 Transform to Sum Tree
 Shortest Source to Destination Path

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