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CS8493

OPERATING SYSTEMS
(Common to CSE, IT)

UNIT No. 1

1.4 Multiprocessor and Multicore Organisation

What is Multiprocessor Operating System

Multiprocessor operating system allows the multiple processors, and these processors are connected with physical memory, computer buses, clocks, and peripheral devices. Main objective of using a multiprocessor operating system is to consume high computing power and increase the execution speed of the system.

Components of Multiprocessor Operating System

There are four major components, which are used in the Multiprocessor Operating System.

- CPU – CPU is capable to access memories as well as controlling the entire I/O tasks.
- IOP – I/P processor can access direct memories, and every I/O processor has to be responsible for controlling all input and output tasks.
- Input/Output Devices – These devices are used for inserting the input commands, and producing output after processing.
- Memory Unit-Multiprocessor system uses the two types of memory modules such as shared memory and distributed shared memory.

Types of Multiprocessor Operating System

Symmetric Multiprocessor

In this system, every processor has its own identical copy of the operating system, and they can make communication between each

other. In which all processors are connected to each other with peer to peer relationship nature, it means no master & slave relation.
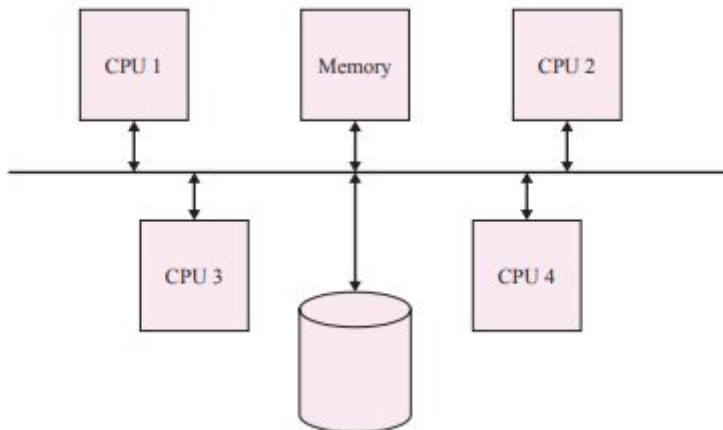
Asymmetric Multiprocessor

In this system, every processor is allotted predefined tasks, and the master processor has power for controlling the entire system. In which, It use the master- slave relationship.

Shared Memory Multiprocessor

In this system, each CPU contains sharable common memory.

Distributed Memory Multiprocessor

In this system, all types of processors consist of their own private memory.

UMA Multiprocessor

UMA Multiprocessor stands for "Uniform Memory Access Multiprocessor". In which, it allows access to all memory at the uniform speed rate for all processors.

NUMA Multiprocessor

NUMA Multiprocessor stands for "Non Uniform Memory Access Multiprocessor". In this system, it involves some areas of the memory for accessing at the faster rate, and left parts of memory are utilized for other tasks.
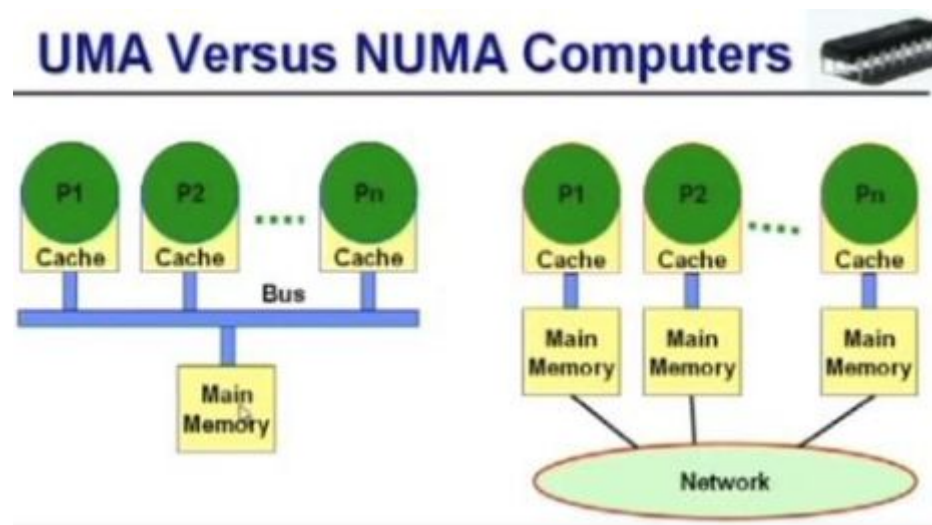
Advantages of Multiprocessor Operating System

There are list of several advantages of Multiprocessor operating system such as

Great Reliability

If due to any reason, any one processor fails then do not worry because, entire system will do work properly. For example – if a multiprocessor has 6 processors and any one processor does not perform properly, at this stage rest of them processors have to responsibilities for handling this system.

Improve Throughput

Enhancing the throughput of the system, the entire system is improved, if couples of processors work with getting collaboration.

Cost Effective System

Multiprocessor systems are cost effective compared to single processor systems in long life because this system is capable of sharing all input/output devices, power supplies systems, and data storage centers. In a multiprocessor, you do not need to connect all peripheral terminals separately with each processor.

Parallel Processing

Multiprocessor O/S gets high performance due to parallel processing. In this system, a single job is divided into various same small jobs, and executed as Parallel nature.

Disadvantages of Multiprocessor Operating System

- Multiprocessors have complicated nature in both forms such as H/W and S/W.
- It is more expensive due to its large architecture.
- Multiprocessor operating system has a daunting task for scheduling processes due to its shareable nature.
- Multiprocessor system needs large memory due to sharing its memory with other resources.
- Its speed can get degraded due to fail any one processor

- It has more time delay when the processor receives a message and takes appropriate action.
- It has big challenges related to skew and determinism.
- It needs context switching which can impact its performance.

Characteristics of Multiprocessor Operating System

There are numerous characteristics of Multiprocessor operating system, explain below

- The Multi processor system allows communication between multiple CPUs with their shared memory and input/output devices.
- Multi processor system can use different types of processor as per its own need, such as a central processing unit (CPU) or an input-output processor (IOP).
- Multiprocessors are split into multiple instruction streams and multiple data stream (MIMD) systems.
- Entire multi processor system is managed by the operating system, and it allows the communication between all processors and I/O devices as well.
- Multi processors have better reliability.
- If any processor fails due to any reason, then other processors can handle all functions of faulty processors.
- Multiprocessor organization provides many benefits for enhancing the system performance.
- Multiprocessing system has an optimized architecture due to parallel processing.

- In multiprocessors use different compilers, those are able to identify the parallelism in a user's program in automation mode.
- Main objective of using the compilers is to determine the all data dependency in the entire program.
- If, any program totally depends upon the data, which are created by other programs, then that data is executed firstly without getting any delay.
- If any data is executed concurrently, then other parts of the programs can use them.
- Multiprocessors are categorized with their memory management such as shared memory or tightly coupled multiprocessors.
- Every processor is known as a loosely coupled system because they contain their own private local memory.

Examples of Multiprocessor Operating System

Examples for Symmetric Multiprocessor – Windows NT, Solaris, Digital UNIX, OS/2 & Linux.

Examples for Asymmetric Multiprocessor – SunOS Version 4, IOS

Other Examples are

·   Intel Nehalem – Beckton, Westmere, Sandy Bridge

·   AMD Opteron – K10 (Barcelona, Magny Cours); Bulldozer

·   ARM Cortex A9, A15 MPCore

·   Oracle (Sun) UltraSpare T1, T2, T3, T4 (Niagara)