Multiple-Processor Scheduling

Poulami Dalapati
Dept. of CSE, LNMIIT Jaipur

What is Multi-processor scheduling?

- multiple CPU’s are available
- load Sharing becomes possible
- more complex as compared to single processor scheduling
  - there are cases when the processors are identical i.e. HOMOGENEOUS, in terms of their functionality, so any processor available, can be used to run any process in the queue.

Approaches

- Asymmetric Multiprocessing (A-SMP):
  - All the scheduling decisions and I/O processing are handled by a single processor which is called the **Master Server** and the other processors executes only the **user code**.
  - Simple
  - reduces the need of data sharing.

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- Symmetric Multiprocessing (SMP):
  - each processor is **self scheduling**.
  - All processes may be in a common ready queue or each processor may have its own private queue for ready processes.
  - scheduling proceeds further by having the scheduler for each processor examine the ready queue and select a process to execute.

Processor Affinity

- A processes has an **affinity** for the processor on which it is currently running.
- There are two types of processor affinity:
  - **Soft Affinity –** When an operating system has a policy of attempting to keep a process running on the same processor but not guaranteeing it will do so.
  - **Hard Affinity –**
    - Hard Affinity allows a process to specify a subset of processors on which it may run.

Note: Some systems such as Linux implements soft affinity but also provide some system calls like *sched_setaffinity()* that supports hard affinity.

Load Balancing

- keeps the **workload** evenly **distributed** across all processors in an SMP system.
- necessary only on systems where each processor has its own private queue of process which are eligible to execute.

Approaches to load balancing :

- **Push Migration –**
  - a task routinely checks the load on each processor and if it finds an imbalance then it evenly distributes load on each processors by moving the processes from overloaded to idle or less busy processors.
- **Pull Migration –**
  - Pull Migration occurs when an idle processor pulls a waiting task from a busy processor for its execution.

Virtualization and Threading

- a single CPU system acts like a multiple-processor system
- the virtualization presents one or more virtual CPU to each of virtual machines running on the system and then schedules the use of physical CPU among the virtual machines.
- have one host operating system and many guest operating systems. The host operating system creates and manages the virtual machines.
- Each virtual machine has a guest operating system installed and applications run within that guest.