Scheduling in Grid Computing using Master-Slave Scheduling Model

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Motivation

- Research in my undergraduate work

Brief Description

- Master-Slave scheduling model, involves two sets of processors
- Master process and Slave processor

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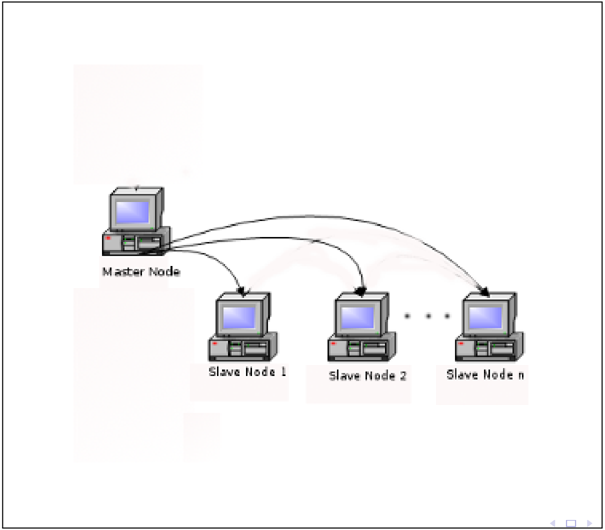
- Master-Slave scheduling model, involves two sets of processors
- Master process and Slave processor
- The master processors are responsible of preprocessing and postprecessing of work orders
- The slave processors are responsible for the actual execution of the orders

Master-Slave Model



Two different schedule

- **1. No-wait-in schedule**

Two different schedule

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- Each slave task must be scheduled immediately after the corresponding preprocessing task finishes
- Each postprocessing task must be scheduled immediately after the corresponding slave task finishes.

Two different schedules

- **2. Canonical schedule**

Two different schedules

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- Satisfies the following properties:
- No preemptions
- The preprocessing tasks begin on the master machine at time 0 and complete at time $\sum a_i$
- Slave tasks begin as soon as their corresponding preprocessing tasks complete.
- Postprocessing tasks are done in the same order as the slave tasks complete and as soon as possible.

Application of Master-Slave model

- parallel computing
- semiconductor testing
- industrial applications

Unconstrained Minimum Finish Time Problem (UMFT)

- UMFT problem is NP-hard.
- Apply the canonical schedule.
- Can rearrange the master tasks so that all preprocessing tasks complete before any postprocessing task starts.
- For any canonical schedule S, $\frac{C^S}{C^*} \leq 2$ and the bound is tight.

Applying Heurisitic in UMFT

- *A better bound is achieved by applying the following heuristic*:
- Let $S_1 = \{i : a_i \leq c_i\}$ and $S_2 = \{i : a_i > c_i\}$
- Reorder the jobs in S_1 according to nondecreasing order of b_i.
- Reorder the jobs in S_2 according to nonincreasing order of b_i.
- Generate the canonical schedule in which the a tasks of S_1 precede those of S_2.

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- Reorder the jobs in S_2 according to nonincreasing order of b_i.
- Generate the canonical schedule in which the *a* tasks of S_1 precede those of S_2.
- $\frac{C^H}{C^*} \leq \frac{3}{2}$ and bound is tight.

Order Preserving Minimum Finish Time (OPMFT)

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- Apply canonical schedule
- Its possible to construct an $O(nlogn)$ algorithm, by defining a canonical order preserving schedule (COPS)
- There is an OPMFT schedule which is a COPS in which the preprocessing order satifies that, jobs with $c_j > a_j$ come first, jobs with $c_j = a_j$ come next, and thejobs with $c_j < a_j$ come last.

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- *It works as follows:*
- the master preprocesses the n jobs in the order σ
- slave i begins the slave processing of job i as soon as the master completes its preprocessing.
- the master begins the postprocessing of the last job in σ as soon as its slave task is complete
- the master begins the postprocessing of job $j \neq k$ at the later of the two times (a) when it has finished the postprocessing of the succesor of j in σ, and (b) when slave j has finished b_j.

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- The Order-Preserving version of MFTNW.
- The Reverse-Order version of MFTNW.

Questions