Project Proposal

Implementing Preemption Threshold aware simulator, with support for RM, DM and EDF priority assignment policies

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Objective:

Implementing the timing simulator, which simulates and outputs the time based graphical representation of the set of input tasks, using priority assignments of RM, RM with preemption threshold, DM, DM with preemption threshold, and EDF.

Introduction:

Scheduling real-time tasks is complicated work since it requires pre-computed information about the task's timing properties. Although we know the system's timing properties, scheduling tasks is highly concentrated mental work. Moreover the system designer is responsible to see that system meets real time constraints. For guaranteeing feasibility of generated scheduling, several static and dynamic priority scheduling algorithms and corresponding schedulability tests are introduced such as *Rate-Monotonic* (RM), *Deadline-Monotonic* (DM) and *Earliest Deadline First* (EDF).
The *Preemption Threshold Scheduling* (PTS) is suggested to help fixed-priority scheduling to improve the overall system's timing performance [2]. The preemption threshold brings one more priority, preemption threshold, to the system. While the regular priority is used when scheduling the task, preemption threshold is used when being preempted by another task. Therefore while meeting task's deadline, we reduce useless preemption, which frequently occurs with traditional fixed priority scheduling. PTS slightly lengthen the execution time of higher tasks, but it reduces that of lower tasks. This helps enhancing the response time of overall system.

Project Outline:

Here are the major milestones we propose to cover:

- Implementing the scheduling simulator for the RM, DM and EDF priority assignment.
- Implementing the algorithm for finding the Preemption Threshold (PTS) given the input tasks having static priority assignment using Maximal Preemption Threshold Assignment (MPTA).
- Adding the support for preemption threshold in simulator.
- Graphical representation of results
- Future Work : Integrating PTS with EDF[4], and power management scheme support

Simulator Specification
Scheduling Method; time-based
Supported Scheduling Schemes; RM, DM, EDF, RM with PTS and DM with PTS
Maximum Number of Tasks to be simulated; 8
Maximum Simulation Time; 60 sec or System's Hyper Period

Simulator Input

The input fed into the simulator will be given in plain text file which has the following fields.

Simulation Time (T)

Total time duration for simulation in msec, valid when T is less than hyper period

Display Window

Start time (t_s): the start time of graphical displaying window

End time (t_e): The end time of graphical displaying window

Task Information: describes task's real time properties

Task ID	Task Name	WCET	BCET	Relative Deadline	Phase	Period

Simulator Output

The simulator provides two kinds of simulation results; simulation statistics and graphical representation of each task's execution on time frame in "DOT" format.

Simulation Statistics

Scheduling Scheme	Task ID	Task Name	# Jobs within T	# Tasks within T	# Missed Deadline within T

Scheduling Scheme:

Simulated scheduling scheme

Graphic Representation of job execution in "DOT" format

In this file, task's execution is represented in graphic. Job's release is represented by upward arrow and job's execution is represented by filled box. If the dead line is met, dead line is filled with black color, otherwise red line.

Project Plan:

1. Project Proposal: March 16, 2009
2. Develop the simulator for the RM, DM and EDF: March 25, 2009
3. Develop the preemption threshold finding algorithm: March 25, 2009
4. Integration of preemption threshold algorithm in simulator: April 2, 2009
5. Testing by doing Timing analysis for the different test benchmarks: April 16, 2009
6. Final Project Report: April 21, 2009

References:

[1] Jane W. S. Liu: *Real-Time Systems*, Prentice Hall, 2000 (ISBN-10: 0130996513)

[2] M. Saksena and Y. Wang: Scalable Real-Time System Design Using Preemption Thresholds, In Proceedings of IEEE Real-Time Systems Symposium, pages 25–36, November 2000.

[3] Y. Wang and M. Saksena: Scheduling Fixed-Priority Tasks with Preemption Threshold, In Real-Time Computing Systems and Applications, pages 328-335, December 1999.

[4] D. He, F. Wang, W. Li, and X. Zhang: Hybrid earliest deadline first/preemption threshold scheduling for real-time systems, In proceedings of 2004 International Conference on Machine Learning and Cybernetics, page(s): 433- 438, vol.1 Aug. 2004.