**Real-time CPU Scheduling Simulator for Multiprocessors**

**Designed as a Teaching Tool**

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**Abstract**

Simulation is a powerful tool that can be employed when designing and selecting scheduling strategies for an operating system. Such simulations allow the consideration of far more details and far more processes than manual or theoretical comparisons. Besides, in order to help students better understand the real-time CPU scheduling algorithms for multiprocessors, we need an educational tool to simulate and analyses the executing procedure of real-time CPU scheduling algorithms. In this simulator, we will focus on some real-time CPU scheduling algorithms such as G-EDF, P-EDF, PF, and LLF in a multiprocessor environment.

Keywords - multiprocessors, real-time scheduling algorithms, G-EDF, P-EDF, PF, LLF

**Introduction**

CPU scheduling is a fundamental function in operating-system. The idea of scheduling is that provides computer resources shared by multiprocessors. The CPU is one of the important computer resources. Therefore, CPU scheduling becomes significant in achieving the system design goals. Multiprocessor architectures become more and more attractive.

A lot of algorithms have been designed, in order to implement real-time CPU scheduling for multiprocessors. However, when we learn these algorithms from textbooks, the problems come out, which includes that it is hard to clearly understand the internal structure of scheduling algorithms. In addition, textbooks often simplify the diagram of various CPU scheduling algorithms. As a result, students are not able to visualized comprehend how the algorithms exactly work in real operating systems. Indeed, in such a context, it is hard to compare and evaluate scheduling algorithms on their performance as well as energy efficiency.

Finally, we decided that a more global simulation tool is needed in order to detect the adequacy between scheduling policies and architectures. This real-time CPU scheduling simulator provides development of a simulator for CPU scheduling. It can be used for measuring performance of several scheduling algorithms. It simulates: (1) global earliest deadline first (G-EDF). (2) Partitioned earliest deadline first (P-EDF). (3) Least laxity first (LLF). (4) Portable executable (PE).

**Related work**

Like other scheduling simulator, this simulator performs scheduling analysis and simulation of multiprocessor real-time CPU scheduling algorithms and measures performance of different scheduling algorithms. It also serves as a tool which makes users much easier to understand what is going on inside the system and why a different set of processes is a candidate for the allocation of the CPU at different time.

However, this simulator pays more attention to making contribution to education. It can be used by students in operating system courses or by anyone interested in learning CPU scheduling algorithms in an easier and a more effective way. So, we will spend more time on designing a user-friendly user interface, showing the algorithm execution results step by step in an appropriate way, and implementing more useful teaching-oriented functions. Students can increase their understanding of the CPU scheduling concepts studied by making their own scheduling decisions through the very easy-to-use graphical user interface of the simulator.

**Methodology**

1. Discuss with professor Yuting Zhang to get the idea about scheduling algorithm simulator
2. Read related papers
3. Analyze some real-time scheduling algorithms
4. Design simulator module
5. Design user interface
6. Implement user interface
7. Implement specific algorithms
8. Integrate simulator models
9. Test simulator

**Schedule**

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|  | **Task List and Assignment** |
| **Week 1 (6/09 - 6/15)** | · Discuss with Prof. Yuting Zhang. (All) · Choose project topic (All) · Group meeting (All) |
| **Week 2 (6/16 - 6/22)** | · Write project proposal (All) · Read related papers (All) · Design simulator module (All) · Design user interface (All) · Group meeting (All) |
| **Week 3 (6/23 - 6/29)** | · Read G-EDF and PF algorighm research papers (Junjie Wang) · Read P-EDF algorithm research papers (Xin Shan) · Read LLF algorithm research papers (Yingyuan Zhang) · Read other related multiprocessors CPU scheduling paper (All) · Analyse and introduce algorithms (Junjie Wang)  · Implement user interface (Xin Shan, Yingyuan Zhang) · Implement simulator module (Xin Shan, Yingyuan Zhang) · Group meeting (All) |
| **Week 4 (6/30 - 7/06)** | · Implement user interface (Xin Shan, Yingyuan Zhang) · Implement simulator module (All) · Testing (Junjie Wang) · Group meeting (All) |
| **Week 5 (7/07 - 7/13)** | . Implement user interface (Xin Shan, Yingyuan Zhang) . Implement simulator module (All) . Group meeting (All) |
| **Week 6 (7/14 - 7/20)** | · Implement simulator module (All) · Group meeting (All) |
| **Week 7 (7/21 - 7/27)** | · Integrate simulator module (All) · Testing (All) · Write final paper (All) · Prepare presentation (All) · Group meeting (All) |
| **Week 8 (7/29)** | · Presentation (All) |

**Conclusion**

After years of existence only in the leading-end of the computing spectrum, multiprocessor systems are increasingly commonplace nowadays, and the scheduling algorithms on multiprocessors has become more and more significant while real-time scheduling algorithm accounts for a large part of it. This simulator will be a good platform to present and analyze the real-time scheduling algorithm and help students and anyone interested in learning CPU scheduling algorithms better understand these algorithms.