

AN ANALYSIS STUDY OF VARIOUS CPU SCHEDULING SIMULATOR

DR. KALPESH RASIKLAL RAKHOLIA

HOD(COMPUTER SCIENCE) AT PKM COLLEGE-JUNAGADH

ABSTRACT

Scheduling is a fundamental operating system task. Simulation environment are used to study the behavior of scheduling algorithms. A simulation environment is developed for building and studying operating system software. The efficiency of the CPU scheduling algorithm in a multiprogramming system is the most important consideration. The real time operating system supports applications that should meet the time deadlines. To meet the constraints of the application in a real time for scheduling the task different algorithms are used. The main characteristics for the scheduling algorithms are IO throughput, waiting time, CPU utilization, response time, priority and total time required. The main objective of this paper is to compare the different scheduling simulators according to the above mentioned characteristics. By comparison we have illustrated features, advantages and disadvantages between various simulators.

KEYWORDS

CPU Scheduling, multiprogramming, process, response time, simulation, waiting time.

INTRODUCTION

A multiprogramming system consists of many running processes. The operating system scheduler makes the decision which one process to activate using a scheduling algorithm to maximize the CPU utilization. A scheduler is designed to select one or more processes according to the primary criteria. There are mainly three types of scheduler's Long term, Short term and Medium term scheduler. A long term scheduler act as a primary resource allocator. It is used when a new process is created and it controls the degree of multiprogramming by determining which process is admitted into the system for processing. A medium term scheduling involves suspending or resuming processes by swapping them out or into the memory. When the main memory gets freed, the operating system looks at the ready process and decides according to the priority which one to be swapped in or out. A short term scheduler is also called dispatcher. It occurs most frequently and decides which process is to be executed next. Simulators are needed to study the various scheduling algorithms available such as FCFS, Round Robin, SJF, etc. A Comparative study of different simulators should be done to determine their performances. Some of the available simulators are deterministic and while others are probabilistic. Due to internet requirements some of them are very slow. Some of them are java based so require Java Runtime Environment.

This paper compares various simulators available for CPU Scheduling.

CPU SCHEDULLING

Scheduling algorithms are mainly scheduling policies which allocate processes in such a way that optimizes CPU efficiency. Scheduling algorithms decide which of the processes in the ready queue is allocated to the CPU. The scheduling simulator explains the behavior of scheduling algorithms against a simulated mix of process loads. The user can specify the number of processes, and I/O blocking time for each process, and the duration of the simulation. At the end of the simulation a summary is explained. There are mainly four scheduling algorithms First Come First Serve (FCFS), Shortest Job First Scheduling (SJF), Round Robin Scheduling (RR), and Priority Scheduling. FCFS is a non-preemptive scheduling that follows first in first out basic. The oldest process in the ready queue will be selected for execution. The average waiting time for FCFS is often quite long. It suffers through Convey effect in which a long CPU bound job may hang the CPU and may force shorter jobs to wait longer. In SJF the process with the shortest expected processing time is selected for execution among the processes in ready queue. It gives the minimum average time and can be preemptive or non-preemptive. In Round robin algorithm the CPU suspends the current job when the reserved time slice or quantum is finished. The job is then placed at the end of the ready queue if it is not completed. If the quantum is too short, the CPU will suspend more time on context switching and if quantum is too long, the interactive process will suffer .So, the quantum should be chosen wisely. Priority Scheduling Algorithm, in this priority is associated with each process. The CPU is allocated to the process with highest priority.SJF is a special case of priority scheduling algorithm. The response time for the highest priority process is really good but at the same time the lowest priority process may suffer Starvation.

A COMPARITIVE STUDY OF VARIOUS SIMULATORS FOR CPU SCHEDULING

There are number of simulators existing for CPU Scheduling.

A Comparative study is done in order to find their performance using simple evaluation criteria.

CPUSS (CPU SCHEDULING SIMULATOR):-

"CPUSS is a framework that allows users to quickly and easily design and gather metrics for custom CPU scheduling strategies including FCFS, Round Robin, SJF, Priority First, and SJF with Priority Elevation rule".

Features of CPUSS:-

It works for algorithms such as FCFS, Round Robin with time quantum, Shortest Job First and Priority Scheduling.

It defines the process to schedule.

It computes average waiting time, mean response time, mean turnaround time, Idle CPU time, and Busy CPU time.

It creates log of results in SQL Server.

It has events such as simulation started or completed as well as process started, preempted, resumed or completed.

It has CPUSS Report Generator (CPUSSRG) which quickly and efficiently generates report.

It is very detailed and powerful simulator

with capabilities to gather different and

long list of metrics such as average waiting

time, CPU idle and busy time, mean

response time, mean turnaround time ,etc.

Drawbacks of CPUSS:-

It is complex due to its long list of metrics it can compute.

It is complicated for simple academic learning.

It has the windows-DOS environment which lacks user – friendliness.

Below is the figure showing snapshot of

CPUSS.

Source of figure:- <http://weblogs.asp.net/gbarnett/archive/2008/03/12/cpuss-using-the-sjf-expert-rule.aspx>

MOSS (MODERN OPERATING SYSTEMS SIMULATORS):-

It was developed by Ray Ontko and Alexander Reeder and appeared in the textbook by Tanenbaum in 2001.

It was developed for students and use for academia purpose. It consists of Java-based simulation programs.

It is a robust application.

Drawback of MOSS:-

It targets the users of the textbook and cannot be used independently and freely.

PSSAV (PROCESS SCHEDULING SIMULATION, ANALYZER, AND VISUALIZATION):-

It is an application for simulating the CPU which provides even customizable comparison between each scheduling algorithm.

Features of PSSAV:-

It works for algorithms such as FCFS, Round Robin with time quantum, Shortest Job First and Priority Scheduling.

CPU scheduling activities are animated.

It allows custom process configurations.

Data are represented in tabular form as well as charts.

It is simple simulator that is good for academic learning.

Drawbacks of PSSAV:-

It can only work for time quantum 2,4 and 6 in case of round robin scheduling.

It is not flexible.

It is algorithmic specific and doesn't support real time processes.

SDLCPUCHED/TKCPUCHED:-

It is CPU scheduler simulator using SDL in 2010 by Manuel Rodriguez-Cayetano. The above CPU schedulers developed doesn't support real time processes. Also, the multilevel queues are not supported by above CPU schedulers.

Features of sdICPUSched:-

It simulates both single and multilevel queue scheduling algorithms.

It has GUI interface and allows the results and events to be saved in files.

It has cross platform support and quick development.

It supports real time processes.

It uses flow chart for describing behavior of high-level algorithm.

It has powerful testing tools and allows tracing of messages exchanged among processes.

The sdICPUSched studied so far is best we

could find. The graphical user interface for the simulator is developed using Tcl/Tk language. Therefore, it's been given name as tkCPUSched.

Figure below is snapshot of main window of tkCPUSched.

PICOS:-

It is commercial operating system which was developed for extremely small embedded system. It is probabilistic in nature. It is event driven operating system.

Features of PicOS :-

It is an event driven Operating System.

It has better performance for applications.

Drawback of PicOS:-

If there is no event being awaited or if there is no process waiting for any event then its scheduling automatically becomes FCFS which results in long average waiting time and higher average turnaround time.

MYSIM:-

It is a lightweight tool for CPU Scheduling Simulation. It is probabilistic.

It is developed in 2012 by Fatai Adesina Anifowose.

Features of MySIM :-

It works for algorithms such as FCFS and Shortest Job First with probabilistic scheduling.

It shows better results in terms of average waiting time and average turnaround time.

It is suitable for Real time systems.

It is good for academic learning.

Drawbacks of MySIM:-

It doesn't include non-preemptive process.

It doesn't consider Round Robin algorithm.

CONCLUSION

This paper presents a comparative study of various CPU scheduling simulators. There are some deterministic schedulers such as CPUSS, MOSS, PSSAV and some probabilistic simulators such as MySIM. Every scheduler has some advantages and disadvantages. This comparison is useful for choosing the appropriate simulator for academia purposes and as well as for real time processes.

REFERENCES:

- Huang, Daochao, et al. "Multi-resource packing for job scheduling in virtual machine based cloud environment." *2015 IEEE Symposium on Service-Oriented System Engineering*. IEEE, 2015.
- Mishra, Sambit Kumar, et al. "Time efficient task allocation in cloud computing environment." *2017 2nd International Conference for Convergence in Technology (I2CT)*. IEEE, 2017.
- Alomari, Amirah, et al. "Resource Management in SDN-Based Cloud and SDN-Based Fog Computing: Taxonomy Study." *Symmetry* 13.5 (2021): 734.
- Petri, Ioan, et al. "Parallel computing for supporting complex energy simulation and optimisation." *InImpact: The Journal of Innovation Impact* 7.2 (2016): 386.
- KATHIRIYA, DR DHAVAL, and RAVIKUMAR S. PATEL. "Heterogeneous Framework for Indian Cybercrime Cases."
- Prajapati, Bhagirath Parshuram, and Dhaval R. Kathiriya. "Evaluation of Effectiveness of k-Means Cluster based Fast k-Nearest Neighbor classification applied on Agriculture Dataset." *International Journal of Computer Science and Information Security* 14.10 (2016): 800.
- Radadiya, Bankim L. *Design and Development of Website for Vedchha-Dambhar Seva Sahkari Mandli Ltd.* Diss. Institute of Agribusiness Management Navsari Agricultural University.
- Shukla, Parag C., and Bankim L. Radadiya. "Coexistence, Trends and Comparative Study between Traditional Relational Database Management System and Big Data."