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Research paper

Experimental Evaluation of Energy Saving Task Scheduling (ESTS) in Cloud Computing

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Abstract

Cloud Computing provides services, on-demand access, infrastructure, storage of data and application. It possesses the reliability, availability and the scalability. One of the issues in cloud computing is Energy Saving. In this paper, the proposed work is Energy Saving Task Scheduling (ESTS) methodology. The aim of this methodology is to show the performance comparison of all the task scheduling types. Task scheduling or Job scheduling is referred to as policies that control the work order to be performed by a computer system. Types of Task Scheduling are Shortest Job First (SJF), First Come First Serve (FCFS), Round Robin (RR) and Priority Scheduling. In each type of schedule, the processes used by the parameters were calculated. Finally, the performance comparison is made in scheduling algorithms and shows better results. This method is implemented in net beans toolkit.

Keywords: *Cloud Computing, Energy Saving, ESTS methodology, Task Scheduling*

1. Introduction

Cloud Computing is one of the fastest technology in the world. Cloud Computing provides storage resources, services, and information to users over the Internet based on their demands using a variety of applications [1]. Cloud Computing has a paradigm to provide computing as a utility service. The cloud computing characteristics are: a) rapid and elastic provisioning computing power; b) pooled computing power to better utilize and share resources; c) broadband access for fast communication; d) on demand access for computing as utility services; and e) pay-as-you-go for the parts used without a significant upfront cost like that of traditional computing resources [2]. In cloud computing, the end-users simply use the services available through the cloud computing paradigm and pay for the used services.

The cloud computing paradigm can offer any conceivable form of services, such as computational resources for high -performance computing applications, web services, social networking, and telecommunications services [11]. Cloud computing describes a new Internet-based IT services to increase the use and delivery model, usually involving the Internet to provide dynamic and scalable and often virtualized resources [12, 13].
Proposed a method to provide continuous security assessment in cloud environments. [14, 15]

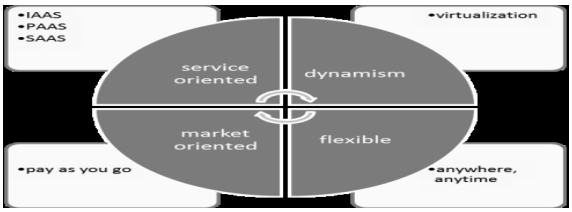

Fig.1: Cloud Computing Characteristics [5]

2. Problem Statement

The problem is an increase in energy consumption. To avoid this situation, we have to virtualize the servers, organize and improve the stored data in a data center. There are two levels of energy consumption, namely, *hardware level* and *software level Hardware level* describes the power fluctuation, disk and memory management. *Software level* describes the overload and improper scheduling [5].

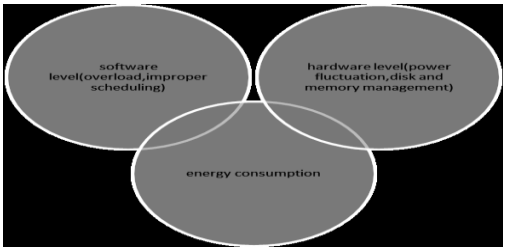

Fig.2: Levels in energy consumption [5]

3. Literature Review

Task Scheduling refers to a set of policies to control the order of work to be performed by a computer system. A role of a good scheduler is it adapts the scheduling strategy according to the changing environment and the type of task. The main advantage of task scheduling algorithm is to achieve a high performance computing and the best system throughput [6].

Task scheduling plays a key role to improve flexibility and reliability of systems in cloud. The drawback of task scheduling is viewed as the searching for an optimal assignment of set of subtasks of various tasks over the available set of resources [7]. As the number of users of Cloud Systems increased, the tasks to be scheduled in Cloud improved proportionally. Therefore, there is a requirement for the algorithms to schedule tasks on the cloud systems. Algorithms needed to schedule tasks are service oriented and differ in different environments [8].

A task that includes data processing, accessing software, or storage functions. The data center classifies tasks according to the Service Level Agreement (SLA) and requested services. Each task is then assigned to one of the servers. In turn, the servers perform the requested task, and a response, or result, is transmitted back to the user [9].

4. Energy Saving

Energy saving has become a primary issue because of economic, environmental and marketing aspects of energy in every field. This concern has a high influence on the information and communication technology (ICT) sector. The scope of energy saving is to decrease the energy consumption. The energy consumption depends on its capacity and its utilization [3]. Cloud Computing has the various techniques to optimize the energy consumption. The techniques are Server Virtualization, Dynamic Server Provisioning, and Load Dispatching, Operating System Processor Scheduling, Advance Clock Gating Common, Rectifying Cooling Methodology, Targeting Network Infrastructure in Cloud [4].

5. Task Scheduling

A task is an activity that uses set of inputs to produce a set of outputs. In Cloud systems, the applications will run on virtual systems where the resources are distributed and allocated dynamically. In Task Scheduling, there are four types. They are Shortest Job First (SJF), First Come First Serve (FCFS), Round Robin (RR) and Priority.

i) Shortest Job First (SJF):

This is also known as Shortest Job Next (SJN). It schedules the jobs within the shortest duration of time. SJF gives the minimum average waiting time for a given set of processes. The waiting time of the short process decreases the waiting time of the long process. Consequently, the waiting time decreases. Shortest Job First can be preemptive or non-preemptive. Preemptive Shortest Job First will preempt the existing running process. Non-preemptive Shortest Job First will allow the executing process to finish its CPU burst [10]. It is very easy to implement in batch systems where CPU burst time was known in advance but difficult to implement in interactive systems.

ii) First Come and First Serve (FCFS):

The other name for FCFS is run to completion or run until done. In this module, the processes executed on a FCFS basis. Implementation is based on FIFO (First in First Out) queue. Here, a new process is entered in the tail of the queue and schedules from the head of the queue. The performance metrics are Average Waiting time and the parameters are burst time and Arrival time which is measured in milliseconds (ms). The main problem in FCFS is it cannot utilize resources in parallel.

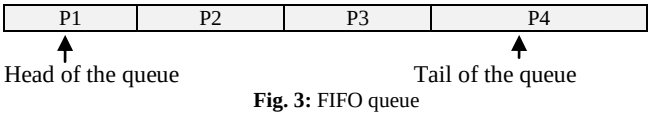

Fig. 3: FIFO queue

iii) Round Robin (RR):

It is one of the simplest and fairest algorithms. In this module, the processes are dispatched in FIFO queue manner. A limited amount of CPU time is called a time quantum or time slice is defined. If a process does not finish before the CPU time is out, the process is preempted and given to the next process waiting in the queue.

The preempted process is placed at the back of the ready list. RR is preemptive at the end of a time slice, therefore, it is effective in time sharing environments. In any event, the average waiting time is quite long in RR scheduling.

iv) Priority:

It is one of the scheduling processes based on priority. In this module, the scheduler chooses the tasks to work as per the priority. It also involves priority assignments to every process and processes with higher priority are carried out first. Priorities can be either static or dynamic. Static priorities are allocated during creation. Dynamic priorities are assigned depending on the behavior of the processes.

Priorities can be defined either internally or externally. Internally defined priorities use some measurable quantity or quantities to compute the priority of the process. External priorities are set by criteria outside the operating systems [10]. The main drawback in Priority Scheduling is indefinite blocking. The solution to this drawback is aging. Aging is used for improving the priority processes that wait in the system for a long period of time.

6. ESTS Methodology

In this methodology, the types of scheduling were done using more number of processes and these processes were calculated by their parameters. The parameters are Arrival time, Waiting time, Burst time, Turnaround time (TAT) and Average Turn Around time (ATAT).

7. Experimental Result

In this paper, we presented the graph table and graph implementation of all the types of scheduling algorithms. The scheduling algorithms were implemented in net beans toolkit. The graph of scheduling algorithms and its comparison shows the better result. The figure below shows the comparison of all the scheduling algorithms of various processes. These processes were calculated by the Turnaround Time (TAT) and Average TAT (ATAT) can be calculated as follows:

a) TAT = Completion Time – Arrival Time.
b) ATAT = Total TAT

Total Number of Processes

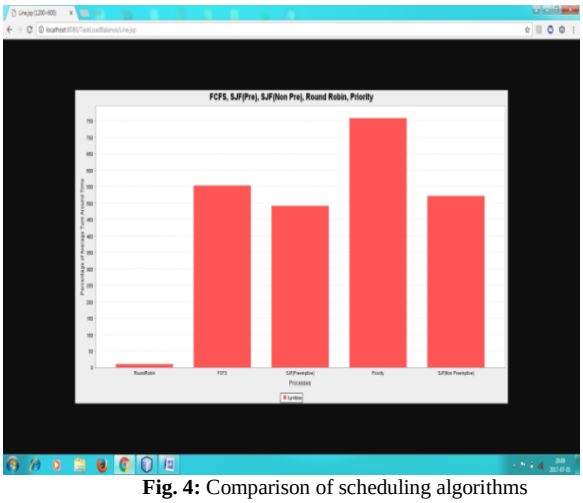

Fig. 4: Comparison of scheduling algorithms

8. Conclusion

The ESTS implementation was done in Net beans toolkit. The task scheduling explains how to schedule more number of processes using various scheduling types. The tasks or processes were measured in seconds or milliseconds. The comparisons of all the scheduling types were analyzed and performed manually.

9. Future Enhancement

In the future, we have an idea that implementing big data analytics in Hadoop environment which is used in Linux. We will use the big data in real-time applications like toll plaza, hospitality management, trading system etc., using MySQL. Implementation can be done in cloud sim toolkit 3.0 versions.

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