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Review of Scheduling Algorithms in Cloud Computing Environment

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Abstract
Cloud Computing refers to the use of computing, platform, software, as a service. It's a form of utility computing where the customer need not own the necessary infrastructure and pay for only what they use. Computing resources are delivered as virtual machines. In such a scenario, task scheduling algorithms play an important role where the aim is to schedule the tasks effectively so as to reduce the turnaround time and improve resource utilization. This paper reviews various scheduling algorithms in cloud environment.

Keywords – Cloud Computing, Scheduling Algorithm.

1. Introduction

An extension of parallel computing, distributed computing and grid computing, cloud computing provides a secure, quick, convenient data storage and computing power using internet. The main characteristics of cloud computing include virtualization, distribution and dynamic extensibility. Virtualization allows running of two or more operating systems on one PC or an embedded controller. Thus it helps in effective utilization of resources and thus building an effective system. Cloud computing provides with tremendous opportunities and facilities and in order to make their proper and effective use, scheduling algorithms are required in cloud environment. It is the responsibility of cloud resource manager to optimally dispatch tasks to the cloud resources. Various scheduling algorithms are available for cloud environment. The main task of cloud scheduling algorithms is to minimize the total completion times of tasks by finding the most suitable resources to be allocated to the tasks. However, minimizing the overall completion time of tasks may not necessarily result in minimization of execution time of each individual task. The main objective of this paper is to review various scheduling algorithms in cloud environment (Kumari & Monika, 2015).

2. Literature Review

Various papers from year 2012 to present were studied and following observations were made:

(Tilak & Patil, 2012) performed a comparison between existing scheduling algorithms. The algorithms reviewed by the authors include Compromised-Time-Cost Scheduling Algorithm, Particle Swarm Optimization-based Heuristic for Scheduling Workflow Applications, Improved Cost-Based Algorithm for Task Scheduling, Resource-Aware-Scheduling Algorithm, Innovative transaction intensive cost-constraint scheduling algorithm, Scalable Heterogeneous Earliest-Finish-time Algorithm, Multiple QoS Constrained Scheduling Strategy of Multi-Workflows. The authors have concluded that any of the existing algorithms doesn't guarantee reliability and availability. Hence, there is a need to implement a better scheduling algorithm that ensures better reliability and availability.

(Backialakshmi & Sofia, 2014) surveyed various cloud scheduling algorithms and performed their comparison by implementing them with the help of a simulation tool i.e. CloudSim. The parameters used for comparison include throughput, makespan and cost. The results of the experiments show that scheduling algorithms enhance the

makespan as well as throughput of the resources in cloud environment.

(Kumari & Monika, 2015) reviewed various Task Scheduling algorithms such as FCFS (First Come First Serve) Algorithm, Round Robin Algorithm, Min-Min Algorithm, Min-Max Algorithm, Priority Scheduling Algorithm and Most fit Task Scheduling Algorithm. Pros and Cons of all the algorithms have been discussed by the authors and an algorithm has been proposed which is based on Round Robin Algorithm. It is expected that the proposed algorithm will prevent longer waiting queues and may provide better and efficient results than traditional approaches.

Work done by (Lepakshi & C S R, 2013) include review of various scheduling algorithms such as Priority Constrained Scheduling strategy of Multiple Workflows for Cloud Computing, Adaptive Resource Allocation for Pre-emtable Jobs in Cloud Systems, Improved Cost-Based Algorithm for Task Scheduling in Cloud Environment, Three-Phases Scheduling in a Hierarchical Cloud Computing Network, A Community Cloud Oriented Workflow System Framework and its Scheduling Strategy, Aggregated-DAG Scheduling for Job Flow Maximization in Heterogeneous Cloud Computing. Various conclusions have been made by the authors. Makespan can be reduced by grouping the tasks. It has also been concluded that that cloud environment has a higher degree of unpredictability with respect to source availability. So as the size of cloud may increase in the coming future, there is a need of better task scheduling algorithms.

(Er. & Sidhu, 2014) compared scheduling algorithms such as PSJN, Shortest Job Scheduling, Optimized ABC Algorithm, Improved Cost Based Algorithm, User Priority Guided Min-Min Scheduling Algorithm, Ant Algorithm, MACO, ACO for scheduling data intensive application. It has been observed by the authors that disk space management is the main issue in virtual environment and heuristic algorithms work as best scheduling algorithm.

(Singh, Paul, & Kumar, 2014) performed a comparison of various scheduling algorithms such as Deadline and Budget Distribution based Cost-Time Optimization Algorithm, Improved cost-based Algorithm for task scheduling in Cloud Computing Environment, PSO-Based Heuristic for Scheduling Workflow Applications in Cloud Computing Environments, Multi-Objective Task Assignment in Cloud Computing by Particle Swarm Optimization, Independent tasks Scheduling based on Genetic Algorithm, Genetic Simulated Annealing Algorithm for Tasks Scheduling. These algorithms have been implemented on various tools such as Java Environment, CloudSim, JSwarm Package, Matlab etc and have been compared on various parameters such as cost, time, performance, QoS etc. further enhancement in all the algorithms has been proposed by the authors.

(Chawla & Bhonsle, 2012) assessed various task scheduling types such as Cloud Service Scheduling, User Level Scheduling, Static and Dynamic Scheduling, Heuristic Scheduling, Real Time Scheduling and Workflow Scheduling. Author has proposed to use a cost based scheduling policy as the future scope.

3. Need of Scheduling

Main benefit of using cloud is application scalability. Scalability of Cloud Resources allows real-time provisioning of resources to meet application requirements. Tasks are usually scheduled by user requirements. In order to overcome the problems imposed by network properties between user and resources, new scheduling algorithms need to be proposed. Existing scheduling strategies can be merged together to provide better and efficient job scheduling. Earlier, scheduling algorithms were implemented in grids. Due to reduced performance in grids, there is a need to implemented scheduling algorithms in cloud (Tilak & Patil, 2012).

4. Existing Scheduling Algorithms in Cloud Environment

Different scheduling algorithm in cloud

computing for planned scheduling are as listed below:

- **Green Energy-Efficient Scheduling Algorithm (**Chia-Ming Wu, Ruay-Shiung Chang, Hsin-Yu Chan**)** – This algorithm has been proposed for cloud data centre with a dynamic voltage frequency scaling (DVFS) technique. This algorithm can efficiently increase resource utilization and it can also decrease the energy consumption for executing jobs. The DVFS technique is commonly used in electrical devices such as cell phones, PDAs and PCs to reduce the power consumption.
- **Improved differential evolution algorithm (**Jinn-TsongTsai, Jia-Chen Fang, Jyh-Horng Chou**)** - IDEA optimizes task scheduling and resource allocation based on the proposed cost and time methods on cloud computing environment. This cost model includes the processing, receiving model and time model includes receiving, processing and waiting time.
- **Dynamic Resource Allocation Algorithms (**Wei Wang, GuosunZeng, Daizhong Tang, Jing Yao**)** – This algorithm performs pre-emtable task optimization and hence can increase the utilization of cloud environment. Two algorithms have been proposed as online dynamic resource allocation for Infrastructure as a Service. Resource allocation is adjusted dynamically and this algorithm uses updated information of current tasks being executed. Performance is improved in this scheduling algorithm.
- **Job Scheduling Algorithm** – Cloud datacenter needs a job scheduler in order to arrange resources for execution of jobs. Therefore, an algorithm based on Berger model was proposed which is known as job scheduling. This algorithm establishes dual fairness constraint. The first constraint focuses at classifying user tasks according to QoS preferences and the second constraint defines resource fairness justice function so as to judge the fairness of the resources allocation.
- **Just In-Time Scheduling Algorithm** – This algorithm provides fault tolerance against premature termination of spot instances and is also more robust against performance variations of Cloud resources. This algorithm takes ready tasks and maps them onto Cloud resources. The algorithm along with a suitable instance type also selects an apt pricing.
- **Adaptive Energy-Efficient Scheduling Algorithm (**Jiandun Li, Junjie Peng, Zhou Lei, Wu Zhang**)** – Based on the combination of Dynamic Voltage Scaling and adaptive task duplication strategy, this algorithm improves flexibility of system. The first phase of this algorithm is used to obtain an optimal threshold by using an adaptive threshold-based task duplication strategy. In second phase, groups are scheduled on DVS processors so that it is possible to reduce energy of processor in case of task dependencies.
- **Hierarchical Reliability-Driven Scheduling Algorithm** – since, grid computing is insufficient to provide reliability requirements in an application, so, a hierarchical reliability –driven scheduling algorithm was proposed. This algorithm works with a local as well as a global scheduler. The main task of local scheduler is to measure the reliability of an application.

5. Conclusion

Scheduling in cloud environment is a critical task because of distributed environment. Various scheduling algorithms have been proposed by different authors. Each scheduling algorithm has certain pros and cons and also the existing algorithms don't ensure reliability and availability. New algorithms need to be proposed and developed that can provide better efficiency and performance.

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