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SCHEDULING ALGORITHMS IN MULTI CLOUD ENVIRONMENTS – A SHORT REVIEW

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ABSTRACT

It is essential to schedule the workloads to cloud in an efficient manner. Whether user is using single cloud or multi cloud environments, according to the available resources and needs, the incoming jobs or tasks has to be scheduled. Hence this short review paper focuses on different available scheduling algorithms and its categories**.**

Keywords: Scheduling, task, Workflow, Resource, Multi-cloud

HIGHLIGHTS:

1. **This short review on scheduling algorithms will help understand fundamentals.**
2. **The collection of manuscripts will help getting started about Scheduling Algorithms in multi-cloud environments.**

INTRODUCTION

In a multi-cloud system, each cloud has its own data center consisting of a set of servers to deploy the virtual machines. Each cloud service provider has its own scheduler that assigns the tasks to the virtual machines using its own scheduling strategy. Note that the scheduling strategy of the clouds may be different. For example, Amazon Elastic Compute Cloud and Microsoft Azure use different scheduling strategies. The future cloud computing may have multiple cloud providers run various applications. In that case, the service providers may adopt a centralized management approach to achieve some common goals [1]. Some of the benefits of multi-cloud environment are: i) Lowering vendor lock-in problem: Customers no need to depend upon a single cloud provider, ii) Flexibility: Due to the usage of multiple cloud service providers, an organization can smoothly distribute workloads, iii) Lower risk of DDOS attacks: iv) Resilient architecture: Since resource resides on multi cloud, it leads to resilient architecture [2].

Scheduling algorithms used in cloud service providers

The Amazon web service provides AWS batch scheduler helps to evaluate when, where and how to run jobs that have been submitted to a job queue. Jobs run in approximately the order in which they are submitted as long as all dependencies on other jobs have been met [3]. Azure scheduler lets us to run jobs such as calling HTTP/S end points or posting messages to Azure Storage queues on any schedule, making it ideal for recurring actions like cleaning up logs, kicking off backups and other maintenance tasks. We can integrate jobs into our applications that run immediately on a recurring schedule, or anytime in the future and call services both inside and outside of Azure [4]. Kubernetes has become the de facto cloud native platform to run various workloads. In Alibaba cloud, more and more stateful or stateless applications as well as the application operators now run in Kubernetes clusters. Physical server executes batch jobs and containers execute online services. The server executes online workload and the payment, transaction, browsing request re handled by a container. Each offline workload has n number of jobs. Each job has n number of tasks and each task has n number of instances [5]. Salesforce uses Apex scheduler. The Apex scheduler lets us to delay execution so that we can run Apex classes at a specified time. This is ideal for daily or weekly maintenance tasks using Batch Apex. Salesforce schedules the class for execution at the specified time. Actual execution may be delayed based on service availability. We can have 100 scheduled Apex jobs at one time [6].

Cloud Scheduling Algorithms

Scheduling is a decision-making procedure that allows resource distribution between several processes by considering their execution command on the set of accessible resources. The scheduler performs the part of selecting a job in which the computational source will complete each job, thus distributing tasks to perform

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simultaneously in cloud distributed system. Accordingly, the execution time of all jobs and the execution time of each job is in accordance with the generated schedule. The scheduler arranges the tasks in resource lines generally following an independent framework. Therefore in cloud computing scheduling plays a significant role to allocate resources to each task proficiently and efficiently. In a cloud environment, if the jobs are not organized properly, performance decreases and does not provide desired outcomes [7].

Scheduling methods are classified into three main groups namely: i) task scheduling, ii) resource scheduling and iii) workflow scheduling. Task scheduling can be defined as choosing the most appropriate and suitable resources for the execution of the task. The task can also be defined as users' queries send to the different server, and these queries also accomplished within required time period. The distribution of virtual resources among servers is done by resource scheduling. Workflow scheduling is to scheduling workflow comprised by an entire job in an efficient order [8].

Task Scheduling Algorithms

There are a number of task scheduling algorithms proposed for cloud computing environments.
Comparison of a few number of task scheduling algorithms are discussed in Mosleh et al 2017 [9]. The parameters considered in different task scheduling algorithms are: i) Execution Time, ii) Response Time, iii) Makespan iv) Throughput, v) Resource Utilization, vi) Load Balancing, vii) Fault Tolerance, viii) Energy Consumption, ix) Scalability, x) Performance, and xi) Quality of Service [10].

Resource Scheduling Algorithms

Resource allocation is used to assign the resources in an optimal way. Resource allocation algorithms are classified into three main categories: i) Dynamic scheduling algorithms, ii) Agent based scheduling algorithms, and iii) Cost optimization based scheduling algorithms. Dynamic scheduling algorithm is classified into five categories namely: i) Linear Scheduling for Tasks and Resources (LSTR), ii) Profmin Vm Max Avai Space and Profmin Vm Min Avai Space, iii) Round robin based resource selection, iv) Multiple Criteria Decision Analysis (MCDA) method, and v) Dynamic Resource Allocation using Virtual Machines. Agent based scheduling algorithm is classified into seven categories namely: i)Negotiation Strategy for Buyer and Seller, ii) Intelligent Multi Agent for Virtualization, iii) Agent based scheme architecture, iv) Multi agent system architecture, v) Agent based resource allocation model (ARAM), vi) Adaptive resource allocation model, and vii) Market based model. Cost optimization based scheduling algorithm is classified into three categories namely: i) Lightweight scaling algorithm, ii)Optimal resource allocation technique, and iii) Compromised-Time-Cost scheduling algorithm [11].

Workflow Scheduling Algorithms

Workflow scheduling is one of the prominent issues in the cloud computing which tries to map the workflow tasks to the VMs based on different functional and non-functional requirements. A workflow consists of a series of interdependent tasks which are bounded together through data or functional dependencies and these dependencies should be considered in the scheduling. Workflow scheduling algorithm is classified into three main categories namely: i) Heuristic scheduling algorithm, ii) Metaheuristic scheduling algorithm, and iii) Hybrid scheduling algorithm. Heuristic scheduling algorithm is classified into sixteen categories namely: i) Heterogeneous Earliest Finish Time, ii) Priority Impact Scheduling Algorithm, iii) Deadline and Budget distribution-based cost-time optimization, iv) Iterative ordinal optimization-based algorithm, v) Compromised-Time-Cost, vi) Time and Cost optimization, vii) Multiple QoS constrained, viii) Deadline constraint scheduling, ix) Hybrid cloud optimized cost, x) Workflow task scheduling algorithm based on the resources' fuzzy clustering, xi) QoS based algorithm, xii) Concurrent level based algorithm, xiii) Resource-efficient workflow scheduling, xiv) Security-aware and Budget-aware workflow scheduling strategy, xv) Meeting deadlines of scientific workflows, and xvi) Workflow scheduling. Metaheuristic scheduling algorithm is classified into six categories namely: i) Particle Swarm Optimization, ii) Ant Colony Optimization, iii) Simulated Annealing, iv) Genetic algorithm, v) Cat Swarm Optimization, and vi) Enhanced Superior element multitude optimization. Hybrid scheduling algorithm is classified into four categories namely: i) Ant colony optimization and Max Min scheduling, ii) Genetic algorithm and Best fit and Round robin, iii) Particle Swarm Optimziation and Heterogeneous Earliest Finish Time, and iv) Market Oriented Hierarchical scheduling [16].

CONCLUSION

Scheduling is one of the main issues in cloud computing. It also plays a role for saving the time and price of executing tasks and also utilizing resources in an efficient manner. This work analyzes the different types of

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scheduling algorithms in cloud environment. This short review is helpful for researchers who are planning to understand the fundamentals of scheduling algorithms whether single cloud or multi cloud systems.

REFERENCES

1. https://doi.org/10.1016/j.procs.2015.04.081
2. http://www.doi.org/10.35940/ijrte.F7882.038620
3. https://docs.aws.amazon.com/batch/latest/userguide/job_scheduling.html
4. https://azure.microsoft.com/en-in/pricing/details/scheduler/
5. https://doi.org/10.1007/978-3-030-76776-1_15
6. https://developer.salesforce.com/docs/atlas.en-us.apexcode.meta/apexcode/apex_scheduler.htm
7. https://doi.org/10.7717/peerj-cs.509
8. https://dx.doi.org/10.14569/IJACSA.2018.090550
9. http://ojs.sabauni.net/index.php/SJITN/article/view/87
10. https://doi.org/10.1109/IC3I.2016.7917943
11. https://www.primescholars.com/articles/a-comparative-analysis-of-resource-scheduling-algorithms-in-cloud-computing.pdf
12. http://dx.doi.org/10.1016/j.jnca.2016.01.018