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A STUDY ON TASK SCHEDULING ALGORITHMS IN CLOUD COMPUTING

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Abstract : Cloud computing is known as a supplier of dynamic administrations utilizing substantial adaptable and virtualized assets over the Internet. Because of curiosity of distributed computing field, there is no numerous standard errand booking calculation utilized as a part of cloud condition. Particularly that in cloud, there is a high correspondence cost that forestalls understood assignment schedulers to be connected in extensive scale conveyed condition. Today, analysts endeavour to assemble work booking calculations that are good and relevant in Cloud Computing condition Job planning is most imperative assignment in distributed computing condition since client need to pay for assets utilized in light of time. Henceforth effective usage of assets must be imperative and for that booking assumes a crucial part to get most extreme advantage from the assets. In this paper we are breaking down different assignment planning calculations in distributed computing.
Index Terms: cloud computing, scheduling

1. INTRODUCTION

In general cloud computing services can be classified into three basic types: Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) [1]. In IaaS grids or clusters, virtualized servers, its computational resources-CPUs, memory, networks, storage and systems software are delivered as a service. Some of the Examples which provides IaaS are Amazon's Elastic Compute Cloud (EC2) and SimpleStorage Service (S3) which provide (managed and scalable) resources as services to the user. Platform as a Service (PaaS) typically makes use of dedicated APIs to control the behaviour of a server hosting engine which executes and replicates the execution according to user requests Eg. Force.com, Google App Engine. In Software as a Service (SaaS) standard application software functionality is offered within a cloud. Examples: Google Docs, SAP Business by design.

Job scheduling is one of the major activities performed in all the computing environments. Cloud computing is one the upcoming latest technology which is developing drastically. To efficiently increase the working of cloud computing environments, job scheduling is one the tasks performed in order to gain maximum profit. The goal of scheduling algorithms in distributed systems is spreading the load on processors and maximizing their utilization while minimizing the total task execution time Job scheduling, one of the most famous optimization problems, plays a key role to improve flexible and reliable systems. The main purpose is to schedule jobs to the adaptable resources in accordance with adaptable time, which involves finding out a proper sequence in which jobs can be executed under transaction logic constraints. There are main two categories of scheduling algorithm.1) Static scheduling algorithm and 2) Dynamic scheduling algorithm. Both have their own advantage and limitation. Dynamic scheduling algorithm have higher performance than static algorithm but has a lot of overhead compare to it.

Scheduling Process Scheduling process in cloud can be generalized into three stages namely–

- Resource discovering and filtering– Datacenter Broker discovers the resources present in the network system and collects status information related to them.
- Resource selection– Target resource is selected based on certain parameters of task and resource. This is deciding stage.
- Task submission-Task is submitted to resource selected.

2. REVIEW OF LITERATURE ON SCHEDULING ALGORITHM

Scheduling algorithm in cloud computing is considered as NP-Hard problem. There is no known algorithm which gives optimal solution in polynomial time. In the literature there are many efforts have been made to find out optimal solution. In this paper some of the important scheduling algorithms are reviewed.

a. First Come First Serve Algorithm: Job in the queue which come first is served. This algorithm is simple and fast.
b. Round Robin algorithm : In the round robin scheduling, processes are dispatched in a FIFO manner but are given a limited amount of CPU time called a time-slice or a quantum. If a process does not complete before its CPU-time expires, the CPU is pre-empted and given to the next process waiting in a queue. The pre-empted process is then placed at the back of the ready list.

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c. Min–Min algorithm: This algorithm chooses small tasks to be executed firstly, which in turn large task delays for long time.
d. Max – Min algorithm: In the Max-min algorithm, rj represents the ready time of resource Rj to execute a task, while Cij and Eij represent the expected completion time and Execution time respectively. Task T_k with maximum expected completion time is chosen to be assigned for corresponding resource Rj that gives minimum execution time.

for all submitted tasks in meta-task; Ti
for all resources; Rj
Cij = Eij + rj
While meta-task is not empty
find task Tkconsumes maximum completion time.
AssignTk to the resource Rj which gives minimum execution time.
removeTk from meta-tasks set
updaterjfor selected Rj
updateCij for all j

Max-min algorithm allocates task Ti on the resource Rj where large tasks have highest priority rather than smaller tasks . For example, if we have one long task, the Max-min could execute many short tasks concurrently while executing large one. The total makespan, in this case is determined by the execution of long task. But if meta-tasks contains tasks have relatively different completion time and execution time, the makespan is not determined by one of submitted tasks.It would be similar to the Min-min makespan.For these cases, original Max-min algorithm losses some of its major advantages as load balance between available resources in small distributed system configuration and small total completion time for all submitted tasks in large scale distributed environment.

e. Most fit task scheduling algorithm: In this algorithm task which fit best in queue are executed first. This algorithm has high failure ratio.
f. Priority scheduling algorithm:The basic idea is straightforward: each process is assigned a priority, and priority is allowed to run. Equal-Priority processes are scheduled in FCFS order. The shortest-Job-First (SJF) algorithm is a special case of general priority scheduling algorithm. An SJF algorithm is simply a priority algorithm where the priority is the inverse of the (predicted) next CPU burst. That is, the longer the CPU burst, the lower the priority and vice versa. Priority can be defined either internally or externally. Internally defined priorities use some measurable quantities or qualities to compute priority of a process.
g. The Improved Max-Min Algorithm [3]
Improved Max-min supports load balance of available resources and allow concurrent execution of submitted tasks with higher probability rather than original Max-min. Here "Select task with max execution time Then assign to be executed by resource with min completion time"

for all submitted tasks in meta-task; Ti
for all resources; Rj
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AssignTk to the resource Rj which gives minimum completiontime.
RemoveTk from meta-tasks set
updaterjfor selected Rj
update
Cij for all j

h. MCT ALGORITHM : This algorithm finds the machine which has Minimum Completion Time for the particular task. It assigns the task to resources based on completion time. Completion time is calculated by adding the execution and the ready time of the resource. Completion Time = Execution Time + Resource Ready Time

for all submitted tasks in meta-task; Ti
for all resources; Rj
Cij = Eij + rj
While meta-task is not empty
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assign Tk to the resource Rj which gives minimum execution time.
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update rjfor selected Rj
update Cij for all j

i. A Compromised-Time-Cost Scheduling Algorithm:Ke Liu, Hai Jin, Jinjun Chen, Xiao Liu, Dong Yuan, Yun Yang [11] presented a novel compromised-time-cost scheduling algorithm which considers the characteristics of cloud computing to accommodate instance-intensive cost-constrained workflows by compromising execution time and cost with user input enabled on the fly. The simulation has demonstrated that CTC (compromised-time-cost) algorithm can achieve lower cost than others while meeting the user-designated deadline or reduce the mean execution time than others within the user-designated execution cost. The tool used for simulation is SwinDeW-C (**Swin**burne **De**centralised **W**orkflow for **C**loud).

j. A Particle Swarm Optimization-based Heuristic for Scheduling Workflow Applications: Suraj Pandey, LinlinWu, Siddeswara Mayura Guru, Rajkumar Buyya [12] presented a particle swarm optimization (PSO) based heuristic to schedule applications to cloud resources that takes into account both computation cost and data transmission cost. It is used for workflow application by varying its computation and communication costs. The experimental result shows that PSO can achieve cost savings and good distribution of workload onto resources.

k. Improved Cost-Based Algorithm for Task Scheduling: Mrs.S.Selvarani, Dr.G.Sudha Sadhasivam [9] proposed an improved cost-based scheduling algorithm for making efficient mapping of tasks to available resources in cloud. The improvisation of traditional activity based costing is proposed by new task scheduling strategy for cloud environment where there may be no relation between the overhead application base and the way that different tasks cause overhead cost of resources in cloud. This scheduling algorithm divides all user tasks depending on priority of each task into three different lists. This scheduling algorithm measures both resource cost and computation performance, it also Improves the computation/communication ratio.

l. Resource-Aware-Scheduling algorithm (RASA): Saeed Parsa and Reza Entezari-Maleki [10] proposed a new task scheduling algorithm RASA. It is composed of two traditional scheduling algorithms; Max-min and Min-min. RASA uses the advantages of Max-min and Min-min algorithms and covers their disadvantages. Though the deadline of each task, arriving rate of the tasks, cost of the task execution on each of the resource, cost of the communication are not considered. The experimental results show that RASA is outperforms the existing scheduling algorithms in large scale distributed systems.

m. Innovative transaction intensive cost-constraint scheduling algorithm: Yun Yang, Ke Liu, Jinjun Chen [13] proposed a scheduling algorithm which takes cost and time. The simulation has demonstrated that this algorithm can achieve lower cost than others while meeting the user designated deadline.

n. Scalable Heterogeneous Earliest-Finish-Time Algorithm (SHEFT): Cui Lin, Shiyong Lu [14] proposed an SHEFT workflow scheduling algorithm to schedule a workflow elastically on a Cloud computing environment. The experimental results show that SHEFT not only outperforms several representative workflow scheduling algorithms in optimizing workflow execution time, but also enables resources to scale elastically at runtime.

o. Multiple QoS Constrained Scheduling Strategy of Multi-Workflows (MQMW): Meng Xu, Lizhen Cui, Haiyang Wang, Yanbing Bi [15] worked on multiple workflows and multiple QoS.They has a strategy implemented for multiple workflow management system with multiple QoS. The scheduling access rate is increased by using this strategy. This strategy minimizes the make span and cost of workflows for cloud computing platform.

The table 1 summarizes above scheduling strategies on scheduling method, parameters, other factors, the environment of application of strategy and tool used for experimental purpose.

Scheduling Algorithm	**Scheduling Method**	**Scheduling Parameters**	**Scheduling factors**	**Findings**	**Environment**	**Tools**
A compromised-Time-Cost Scheduling Algorithm [11]	Batch mode	Cost and time	An array workflow instances	1. It is used to reduce cost and cost	Cloud Environment	SwinDeW-(
A Particl Swarm Optimization-based Heuristi for Schedulin [12]	Dependenc mode	Resource utilization, time	Group tasks	1. it is used for three times cost savings as compared to BRS 2.It is used for good distribution of workload onto resources	Cloud Environment	Amazon EC2
Improved cost based algorithm fo task schedulin [9]	Batch Mode	Cost, performance	Unschedule task groups	1.Measures both resource cost and computation performance 2. Improves the computation/communication ratio	Cloud Environment	Cloud Sim
RASA Workflow scheduling [10	Batch mode	make span	Grouped tasks	1.It is used to reduce make span	Grid Environment	GridSim
Innovative transaction intensive cost constraint scheduling algorithm [13]	Batch Mode	Execution cost and time	Workflow with lar number instances	1.To minimize the cost under certain user-designated Deadlines. 2. Enables the compromises of execution cost and time.	Cloud Environment	SwinDeW-(
SHEFT workflow scheduling algorithm [14]	Dependenc Mode	Execution time, scalability	Group tasks	1. It is used for optimizing workflow execution time. 2. It also enables resources to scale elastically during workflow execution.	Cloud Environment	CloudSim
Multiple Q Constrained Scheduling Strategy Multi-Workflows [15	Batch/dependency mode	Scheduling success rate,cost,time, make span	Multiple Workflow	1. It is used to schedule the workflow dynamically. 2. It is used to minimize the execution time and cost	Cloud Environment	CloudSim

Table 1. Comparison between some of the Existing Scheduling Algorithms

3. CONCLUSION

Scheduling is one of the key issues in the management of application execution in cloud environment. In this paper, we have surveyed the various existing scheduling algorithms in cloud computing and tabulated their various parameters along with tools and so on. we also noticed that disk space management is critical in virtual environments. When a virtual image is created, the size of the disk is fixed. Having a too small initial virtual disk size can adversely affect the execution of the application. Existing scheduling algorithms does not consider reliability and availability. Therefore there is a need to implement a scheduling algorithm that can improve the availability and reliability in cloud environment.

4. REFERENCES

[1] Michael Armbrust, Armando Fox, Rean Griffith, Anthony D.Joseph, Randy Katz; 'Above the Clouds: A Berkeley View of Cloud Computing'; The Regents of the University of California, 2009

[2] O. M. Elzeki, M. Z. Reshad and M. A. Elsoud, "Improved Max-Min Algorithm in Cloud Computing",International Journal of Computer Applications (0975 – 8887).

[3] Upendra Bhoi1, Purvi N. RamanuJ"Enhanced Max-min Task Scheduling Algorithm in Cloud Computing" International Journal of Application or Innovation in Engineering &Managenet (IJAIEM)" April 2013 ISSN 2319 - 4847

[4] Etminani .K, and Naghibzadeh. M, "A Min-min Max-min Selective Algorithm for Grid Task Scheduling," The Third IEEE/IFIP International Conference on Internet, Uzbekistan, 2007.

[5] Gao Ming and Hao Li "An Improved Algorithm based on Max Min for cloud task scheduling" springer

[6] Rajkumar Buyya, Rajiv Ranjan and Rodrigo N. Calheiros,; Modeling and Simulation of Scalable Cloud Computing Environments and the CloudSim Toolkit: Challenges and Opportunities. Proceedings of the 7th High Performance Computing and Simulation Conference (HPCS 2009, ISBN: 978-1-4244-4907-1, IEEE Press, New York, USA), Leipzig, Germany, June 21-24, 2009.

[7] Weiwei Chen, Ewa Deelman "WorkflowSim: A Toolkit for Simulating Scientific Workflows in Distributed Environments"

[8] Mrs.S.Selvarani1, Dr.G.Sudha Sadhasivam," improved cost-based algorithm for task scheduling in Cloud computing "in IEEE 2010.

[9] Saeed Parsa and Reza Entezari-Maleki," RASA: A New Task Scheduling Algorithm in Grid Environment" in World Applied Sciences Journal 7 (Special Issue of Computer & IT): 152-160, 2009.

[10] K. Liu, Y. Yang, J. Chen, X. Liu, D. Yuan and H. Jin, "A Compromised-Time- Cost Scheduling Algorithm in SwinDeW-C for Instance-intensive Cost-Constrained Workflows on Cloud Computing Platform", International Journal of High Performance Computing Applications, vol.24 no.4 445-456,May,2010.

[11] Suraj Pandey1, LinlinWu1, Siddeswara Mayura Guru2, Rajkumar Buyya1," A Particle Swarm Optimization-based Heuristic for Scheduling Workflow Applications in Cloud Computing Environments".

[12] Y. Yang, K. Liu, J. Chen, X. Liu, D. Yuan and H. Jin, An Algorithm in SwinDeW-C for Scheduling Transaction-Intensive Cost-Constrained Cloud Workflows, Proc. of 4th IEEE International Conference on e-Science, 374-375, Indianapolis, USA, December 2008.

[13] Cui Lin, Shiyong Lu," Scheduling ScientificWorkflows Elastically for Cloud Computing" in IEEE 4th International Conference on Cloud Computing, 2011.

[14] Meng Xu, Lizhen Cui, Haiyang Wang, Yanbing Bi, "A Multiple QoS Constrained Scheduling Strategy of Multiple Workflows for Cloud Computing", in 2009 IEEE International Symposium on Parallel and Distributed Processing.

[15] Nithiapidary Muthuvelu, Junyang Liu, Nay Lin Soe, Srikumar Venugopal, Anthony Sulistio and Rajkumar Buyya. "A Dynamic Job Grouping-Based Scheduling for Deploying Applications with Fine-Grained Tasks on Global Grids",in Australasian Workshop on Grid Computing and e-Research (AusGrid2005), Newcastle, Australia. Conferences in Research and Practice in Information Tech nology, Vol. 44.