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A Survey of Various Scheduling Algorithms in Cloud Environment

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Abstract—Cloud computing environments provide scalability for applications by providing virtualized resources dynamically. Cloud computing is built on the base of distributed computing, grid computing and virtualization. User applications may need large data retrieval very often and the system efficiency may degrade when these applications are scheduled taking into account only the 'execution time'. In addition to optimizing system efficiency, the cost arising from data transfers between resources as well as execution costs must also be taken into account while scheduling. Moving applications to a cloud computing environment triggers the need of scheduling as it enables the utilization of various cloud services to facilitate execution.

Keywords—Cloud computing, Scheduling, Virtualization

I. INTRODUCTION

Cloud computing is an extension of parallel computing, distributed computing and grid computing. It provides secure, quick, convenient data storage and computing power with the help of internet. Virtualization, distribution and dynamic extendibility are the basic characteristics of cloud computing [1]. Now days most software and hardware have provided support to virtualization. We can virtualize many factors such as IT resource, software, hardware, operating system and net storage, and manage them in the cloud computing platform; every environment has nothing to do with the physical platform.

To make effective use of the tremendous capabilities of the cloud, efficient scheduling algorithms are required. These scheduling algorithms are commonly applied by cloud resource manager to optimally dispatch tasks to the cloud resources. There are relatively a large number of scheduling algorithms to minimize the total completion time of the tasks in distributed systems [2]. Actually, these algorithms try to minimize the overall completion time of the tasks by finding the most suitable resources to be allocated to the tasks. It should be noticed that minimizing the overall completion time of the tasks does not necessarily result in the minimization of execution time of each individual task.

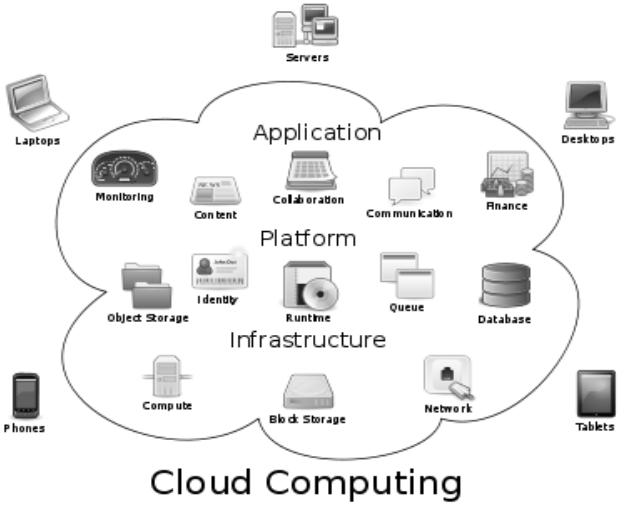

Fig. 1 overview of cloud computing

The objective of this paper is to be focus on various scheduling algorithms. The rest of the paper is organized as follows. Section 2 presents the need of scheduling in cloud. Section 3 presents various existing scheduling algorithms and section 4 concludes the paper with a summary of our contributions.

II. NEED OF SCHEDULING IN CLOUD

The primary benefit of moving to Clouds is application scalability. Unlike Grids, scalability of Cloud resources allows real-time provisioning of resources to meet application requirements. Cloud services like compute, storage and

bandwidth resources are available at substantially lower costs. Usually tasks are scheduled by user requirements. New scheduling strategies need to be proposed to overcome the problems posed by network properties between user and resources. New scheduling strategies may use some of the conventional scheduling concepts to merge them together with some network aware strategies to provide solutions for better and more efficient job scheduling [1]. Usually tasks are scheduled by user requirements.

Initially, scheduling algorithms were being implemented in grids [2] [8]. Due to the reduced performance faced in grids, now there is a need to implement scheduling in cloud. The primary benefit of moving to Clouds is application scalability. Unlike Grids, scalability of Cloud resources allows real-time provisioning of resources to meet application requirements. This enables workflow management systems to readily meet Quality of- Service (QoS) requirements of applications [7], as opposed to the traditional approach that required advance reservation of resources in global multi-user Grid environments. Cloud services like compute, storage and bandwidth resources are available at substantially lower costs. Cloud applications often require very complex execution environments .These environments are difficult to create on grid resources [2]. In addition, each grid site has a different configuration, which results in extra effort each time an application needs to be ported to a new site. Virtual machines allow the application developer to create a fully customized, portable execution environment configured specifically for their application.

Traditional way for scheduling in cloud computing tended to use the direct tasks of users as the overhead application base. The problem is that there may be no relationship between the overhead application base and the way that different tasks cause overhead costs of resources in cloud systems [1]. For large number of simple tasks this increases the cost and the cost is decreased if we have small number of complex tasks.

III. EXISTING SCHEDULING ALGORITHMS

The Following scheduling algorithms are currently prevalent in clouds.

3.1 A Compromised-Time-Cost Scheduling Algorithm:Ke Liu, Hai Jin, Jinjun Chen, Xiao Liu, Dong Yuan, Yun Yang [2] 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).

3.2 A Particle Swarm Optimization-based Heuristic for Scheduling Workflow Applications: Suraj Pandey, LinlinWu, Siddeswara Mayura Guru, Rajkumar Buyya [3] 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.

3.3 Improved Cost-Based Algorithm for Task Scheduling: Mrs.S.Selvarani, Dr.G.Sudha Sadhasivam [1] 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.

3.4 Resource-Aware-Scheduling algorithm (RASA): Saeed Parsa and Reza Entezari-Maleki [2] 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.

3.5 Innovative transaction intensive cost-constraint scheduling algorithm: Yun Yang, Ke Liu, Jinjun Chen [5] 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.

3.6 Scalable Heterogeneous Earliest-Finish-Time Algorithm (SHEFT): Cui Lin, Shiyong Lu [6] 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.

3.7 Multiple QoS Constrained Scheduling Strategy of Multi-Workflows (MQMW): Meng Xu, Lizhen Cui, Haiyang Wang, Yanbing Bi [7] 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 following table summarizes above scheduling strategies on scheduling method, parameters, other factors, the environment of application of strategy and tool used for experimental purpose.

Comparison between Existing Scheduling Algorithms

Scheduling Algorithm	**Scheduling Method**	**Scheduling Parameters**	**Scheduling factors**	**Findings**	**Environment**	**Tools**
A compromised-Time-Cost Scheduling Algorithm [3]	Batch mode	Cost and time	An array of workflow instances	1. It is used to reduce cost and cost	Cloud Environment	SwinDeW-
A Particle Swarm Optimization-based Heuristic for Scheduling [4]	Dependency mode	Resource utilization, time	Group of 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 for task scheduling [1]	Batch Mode	Cost, performance	Unscheduled task groups	1.Measures both resource cost and computation performance 2. Improves the computation/communication ratio	Cloud Environment	Cloud Sim
RASA Workflow scheduling [2]	Batch mode	make span	Grouped tasks	1.It is used to reduce make span	Grid Environment	GridSim
Innovative transaction intensive cost-constraint scheduling algorithm [5]	Batch Mode	Execution cost and time	Workflow with large number of 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 [6]	Dependency Mode	Execution time, scalability	Group of 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 QoS Constrained Scheduling Strategy of Multi-Workflows [7]	Batch/dependency mode	Scheduling success rate,cost,time, make span	Multiple Workflows	1. It is used to schedule the workflow dynamically. 2. It is used to minimize the execution time and cost	Cloud Environment	CloudSim

IV. 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.

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