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Towards The Various Cloud Computing Scheduling Concerns: A Review

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***Abstract*- Cloud computing has become very popular in recent years. Virtualization is the prime feature of cloud computing therefore dealing with the virtualized resources is a mediocre thing. Cloud computing provides different types of resources that can be accessed via internet to perform a particular job. Though the large amount of resources is available but is must to schedule the resources in such a manner that each job can receive the resources for completing itself. So the scheduling algorithms are needed by a cloud to arrange resources for executing jobs. There are various algorithms available that can used to schedule the resources for job execution. Thus the comprehensive way of different type of scheduling algorithms in cloud computing have been thoroughly covered in this review paper and related issues and challenges have been highlighted.**

Keywords— Cloud Computing, Green Energy-Efficient, Improved Differential Evolution, Dynamic Resource Allocation, Job Scheduling, The Proposed Just In-Time, Adaptive Energy-Efficient, Hierarchical Reliability-Driven, ANT Colony, Dynamic Level Scheduling, Compromised-Time-Cost

I. INTRODUCTION

Cloud computing is advance technology in recent years. A program runs on many connected computers at the same time in distributed system network. The devices used to access these resources do not have any specific limitations. It is hardware machine of company. Cluster of distributed computers providing on-demand computational resources over a network [1]. National Institute for Standard Technology (NIST) defines cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g. networks, servers, storage, applications and services) that can be released with minimal management effort or service provider interaction. It works on pay-per-use model.

Cloud Computing provides everything as a service, the three basic service layers of cloud computing are: Infrastructure, Platform and Applications that are popularly referred to as IaaS (Infrastructure as a Service), PaaS (Platform as a Service) and SaaS (Software as a Service) that helps business organizations, academic institutions, government organizations in cutting down operational expenses [2].

Based on resource ownership, Cloud computing comes in three forms: public clouds, private clouds and hybrid clouds [3].Private cloud is one in which the services and infrastructure are maintained on a private network. Public cloud is one in which the services and infrastructure are provided off-site over the Internet. Hybrid cloud includes a variety of public and private options with multiple providers.

Now cloud is used to implement scheduling. Tasks are scheduled by user requirements. Initially, scheduling algorithms were being implemented in grids. Grid performance is very less than the Cloud performance [4].The scheduling strategies proposed to overcome the problems between user and resources. For large number of simple tasks when they execute one by one in cloud system increases the cost and the cost is decreased if we have small number of complex tasks.

When the number of users in cloud gets increased then the scheduling becomes difficult. Therefore, there is a need to go for a better scheduling algorithm than existing one. Since cloud computing the different kinds of researches are going on, the research area which includes cloud systems development and management, resource allocation and scheduling, security issues, cloud storage, scalability, program models and so on. This can be done by comparing and evaluating the various existing algorithms, thereby identifying the loop holes in the existing algorithms. Scheduling plays more important role in cloud computing [5].

Moreover, rest of the paper is organized as: Section II describes the various comparison parameters used. Section III presents various scheduling algorithms. Based on the literature survey, various open issues have been discussed in IV and the paper is finally concluded in Section V.

II. COMPARISON PARAMETERS

Various parameters have been used in this section to compare various scheduling algorithms:

A. Execution time

The execution time or CPU time of a given task is defined as the time spent by the system executing that task, including the time spent executing run-time or system services on its behalf. In which program is running and single instruction, such as addition or multiplication is carried out in the of a computer instruction.

B. Response time

The elapsed time between the end of an inquiry or demand on a computer system and the beginning of a response. The response time is the sum of the service time and wait time. Technically response time is the time of system takes to react to a given input.

C. Make span

It is used in manufacturing. It is the time difference between the start and finish of a sequence of jobs and tasks. If we do not reduce the make span of that product the order would not shipped on time.

D. Energy Consumption

It is the consumption of energy or power. It is also defined in some quarters as the use of energy as a raw material in the process of manufacturing utilities.

E. Throughput

It refers to how much data can be transferred from one location to another in a given amount of time. A benchmark is used to measure throughput. In general terms it is the rate of production or the rate at which something can be processed. It is used to measure the performance of Hard Drives and RAM.

F. Scalability

It is the ability of a computer application or product to continue to function well when it is changed in size or volume in order to meet a user need. The increasing demands and growing amount of the work is known as scalability.

G. Resource utilization

Resource utilization is the use of a resource in such a way that increases through output. The sources used to perform particular task. The objective is to maximize customer service levels, minimize lead times, and optimize inventory levels.

H. Load Balancing

It is especially important for networks where it is difficult to predict the number of requests that will be issued to a server. For using load balancing scheme busy web sites typically employ two or more web servers.

I. Fault tolerance

Fault tolerance is defined as how to provide, by redundancy, service complying with the specification in spite of faults having occurred or occurring. It is setup configuration that prevent a computer network device from failing in the event of an un-expected problem or error.

III. Existing Scheduling Algorithms

A. Compromised-Time-Cost Scheduling Algorithm

The algorithm [6] Compromised-time and cost execution along with the user input is proposed. For user defined deadlines this work is focus on minimizing the cost. During workflow execution it provides the just in time graph of time cost relationship. The multiple concurrent instances on the dynamic cloud computing platform are used for change the schedule.

B. Adaptive Energy-Efficient Scheduling Algorithm

The AES algorithm justifies threshold automatically, thus improving the system flexibility. In [7] paper Author presented an Adaptive Energy-efficient Scheduling (AES), which combines the Dynamic Voltage Scaling (DVS) technique with the adaptive task duplication strategy. In the first phase, author proposes an adaptive threshold-based task duplication strategy, which can obtain an optimal threshold. In the second phase, it schedules the groups on DVS-enabled processors to reduce processor energy whenever tasks have slack time due to task dependencies. The algorithm can effectively save energy while maintaining a good performance.

C. Dynamic Resource Allocation Algorithms:

The author proposed [8] two online dynamic resource allocation algorithms for the infrastructure-as-a-service (IaaS) cloud system with preemptable tasks. The resource optimization mechanism with preemptable task execution can increase the utilization of clouds. It is importantly improves the performance situation where resource contention is fierce and based on the updated information of the current task executions. This algorithm adjusts the resource allocation dynamically.

D. ANT Colony Algorithm

The new state transition rule called pseudo-random-proportional is introduced by ant colony algorithm (ACA) [9]. The algorithm balances the entire system load while executing all the jobs according to the environment. They need more storage space and computing time. The scientific problem is very complex. The grid efficiently resources balance the workload as well as minimize the make span.

E. Hierarchical Reliability-Driven Scheduling Algorithm

Grid scheduling algorithms do not adequately consider the reliability requirements of an application. In [10] Recognition of this problem author designs a hierarchical reliability-driven scheduling architecture that includes local scheduler and global scheduler. The local scheduler measure task reliability of an application in a Grid virtual node. The algorithm in global scheduler based on quantitative evaluation of independent application reliability. The experiment based on graphs of some real applications show that hierarchical scheduling algorithm performs much better than existing scheduling algorithms in terms of system reliability, schedule length, and speedup.

F. Improved differential evolution algorithm (IDEA)

It is a multi-objective optimization approach. In [11] author proposed a scheduling algorithm which Optimize task scheduling and resource allocation based on the 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. This algorithm combines the Taguchi method and a differential evolution algorithm (DEA).

G. Just In-Time Scheduling Algorithm

The just in-time scheduling algorithm maps ready tasks submitted by the task dispatcher onto Cloud resources. The proposed algorithm [12] is fault tolerant against the premature termination of spot instances and also robust against performance variations of Cloud resources. The algorithm along with a suitable instance type also selects an appropriate pricing. The two pricing models spot and on-demand instances to reduce the cost of execution while meeting the workflow deadline. A just in-time scheduling heuristic that uses spot and on-demand resources to schedule workflow tasks in a robust manner and an intelligent bidding strategy that minimizes cost.

H. Job Scheduling Algorithm

In [13] author proposed an algorithm known as job scheduling based on Berger model. The job scheduler is needed by a cloud data centre to arrange resources for executing jobs. The algorithm establishes dual fairness constraint. Firstly it classifies tasks by QoS preferences, and establishes the general expectation function in accordance with the classification of tasks. Secondly it defines resource fairness justice function to judge the fairness of the resources allocation. According to constraints, the algorithm always assigns tasks onto the optimal resources in order to satisfy the QoS requirements of users.

I. Cloud-DLS: Dynamic Level Scheduling Algorithm

This paper focuses on trustworthiness in cloud computing. The Cognitive trust model is used in dynamic level scheduling (DLS) & hence trusts dynamic level scheduling algorithm is introduced in [14]. The trustworthiness in cloud computing resources is difficult. In this the two kinds of trust i.e. direct trust degree, recommendation trust degree is obtained to obtain the trusted scheduling and extends the traditional DLS algorithm. The requirement of user tasks in trust is meeting in this algorithm.

J. Green Energy-Efficient Scheduling Algorithm

This algorithm can efficiently increase resource utilization and it can also decrease the energy consumption for executing jobs. In [15] author proposed a scheduling algorithm for cloud data centre with a dynamic voltage frequency scaling (DVFS) technique. The DVFS technique is commonly used in electrical devices such as cell phones, PDAs and PCs to reduce the power consumption. In experiment point of view this scheme can reduce more energy consumption for executing jobs. Author provides a green-efficient scheduling algorithm using the DVFS technique for Cloud computing data centers.

IV. Open Issues

Based on the survey of various cloud scheduling techniques a lot of literature survey have been done we come to know that there is still a lot to make improvements in the scheduling algorithms. The biggest issues of scheduling algorithm in cloud computing are the cost and time, resource allocation, response and access time which results in algorithms performance. Efficiency of the energy usage is also another issue that took a lot concern. But Scheduling is one of the key issues in the management of application execution in cloud environment.

V. Conclusion

In this paper, we have surveyed the various existing scheduling algorithms in cloud computing and made a comparison study of all. We have used various parameters to make a comparison. Due to challenges associated with Scheduling such as energy efficiency, resource allocation, preempt able tasks, scheduling algorithms in cloud computing are more challenging as compared to other networks. We also noticed that disk space management is critical in virtual environments. There are various drawbacks yet like the user input constraints execution cost, deadlines, transmission cost, energy efficiency, performance issues, and make span. Therefore there is a need to implement a scheduling algorithm in cloud computing.

TABLE I. Comparison Between Existing Scheduling Algorithms Issues

Scheduling Algorithms	Execution Time	Response Time	Make span	Energy Consumption	Through--put	Scalability	Resource Utilization	Load Balancing	Fault Tolerance
Compromised-Time-Cost Scheduling Algorithm	×	×	✓	×	×	×	×	×	×
Adaptive Energy-Efficient Scheduling Algorithm	×	×	✓	✓	×	×	×	×	×
Dynamic Resource Allocation Algorithms	×	✓	×	✓	×	×	×	✓	×

ANT Colony Algorithm	×	×	✓	✓	×	×	×	×	×
Hierarchical Reliability-Driven Scheduling Algorithm	×	×	×	×	✓	×	×	×	×
Improved differential evolution algorithm (IDEA)	✓	✓	✓	×	×	×	✓	×	×
Just In-Time Scheduling Algorithm	✓	×	✓	×	✓	×	×	×	✓
Job Scheduling Algorithm	✓	×	×	×	×	×	×	✓	×
Dynamic Level Scheduling Algorithm	×	×	×	×	×	×	×	×	×
Green Energy-Efficient Scheduling Algorithm	×	×	✓	✓	×	×	✓	×	×

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