

Analysis of Various Task Scheduling Algorithms in Cloud Computing

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Abstract - Cloud computing is a one of the most leading technology that provides data storage, pool of resources and online access to computer services. The number of tasks in the cloud is huge and the system is dealing with massive tasks all the time, so it is difficult to handle and manage. Scheduling means the order in which the set of tasks to be executed. In Cloud computing environment there are large number of resource are available but the main challenge is to allocate the tasks in such a way so that we can utilize more resources. But before task allocation to the virtual machine we require more efficient task selection methods. Cloud computing provides various scheduling algorithms considering various parameters that can increase the performance of the system. This review paper focuses on various Scheduling algorithms in detail and the issues and the challenges faced by those scheduling algorithms.

Key Words: Cloud computing; Scheduling; Scheduling algorithms.

I. INTRODUCTION

Cloud computing is a distributed computing environment that includes a pool of resources, on-demand network access, various development platforms and useful software are delivered as a services to users on the basis of pay as per use over the internet. Rajkumar Buyya defined cloud computing as "Cloud is a parallel and distributed computing system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and presented as one or more unified computing resources based on service level agreement established through negotiation between the service provider and consumers"^[2]. The features of Cloud Computing are Cost effectiveness, scalability, reliability, fault tolerance, service-orientation, resource management and scheduling, utility based, portability, virtualization and service level agreement (SLA). Cloud computing components includes the web and central server to take care about the resource like data, storage, applications, etc. Cloud computing provides various types of service and deployment models. The service models are Infrastructure-as-a-service (IaaS), Platform-as-a-service

(PaaS) and Software-as-a-service (SaaS). The common deployment models are Public Cloud, Private Cloud, Hybrid Cloud and Community Cloud.

The main goal of cloud computing is to provide an efficient and easy access to remote and geographically distributed resources. Therefore the allocation of the resources and scheduling plays an important role on the performance and efficiency of the system. An efficient scheduling is a way to proper selection and allocation of the tasks to different virtual machine. User tasks need to be schedule properly with the resources for maximum utilization of the available resources.

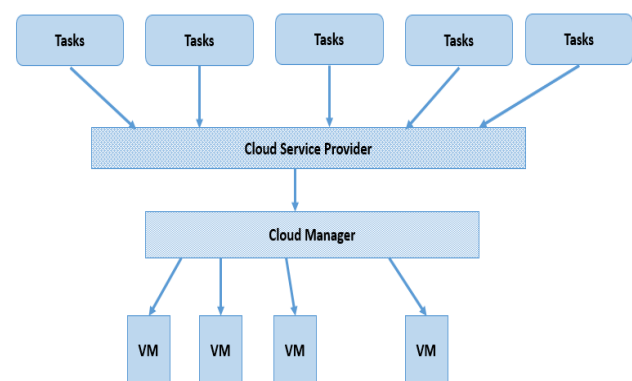


FIGURE 1. SCHEDULING MODEL

The scheduling process in the cloud computing environment consists of several components as shown in the Figure 1. The user jobs/tasks which arrives are and enter into the queue. The next component is scheduler. It determines the execution order of the task and allocation to virtual machine. For that cloud manager will calculate the Expected Time and Cost and according to that task selection is done so we can utilize time and efficient scheduling will be done.

The paper is organized as follows: In section II, describes the various scheduling parameters used to increase the performance of the system. Section III presents the existing scheduling algorithms. Open issues have been discussed in section IV and finally the paper is concluded in section V.

II. COMPARASION PARAMETERS

Scheduling of the jobs/tasks, consider certain parameters through which the performance of the system can be improved by improving those parameters. Various parameters used to compare various scheduling algorithms are discussed in this section:

- **Makespan:** It is defined as the total completion time of all the tasks in a job queue. The makespan should be reduced to increase the performance of particular algorithm.
- **Resource utilization:** Resource utilization is the use of the resource in such a way that increases the throughput of the system.
- **Deadline:** It is the period of time from submitting a task to the time by which it must be completed.
- **Execution time:** The exact time taken to execute the given task is known as execution time. The ultimate goal of any scheduling algorithm is minimizing the execution time.
- **Completion time:** The time taken to complete the whole execution of a job. It also includes the execution time and the delay caused by the cloud system.
- **Load balancing:** It is the method of distributing the entire load in a cloud network across different nodes so that at a time no nodes remain under loaded. The load should be balanced to increase the efficiency of the system.
- **Energy consumption:** Many different scheduling algorithms has designed to reduce the power consumption and improving the performance.
- **Performance:** Performance indicates the overall efficiency given by the scheduling algorithm in order to provide good services to the user as per their requirements.
- **Quality of service:** This include various user input constraints like meeting execution, performance, deadline, cost, makespan, etc.
- **Response time:** The elapsed time between the end of an inquiry or demand on a computer system and the beginning of a response.
- **Scalability:** It is the ability of the system to function well when it is changed in size to satisfy the user need.

III. EXISTING SCHEDULING ALGORITHM

In this paper we are describing various task scheduling algorithms in detail.

A Genetic Algorithm (GA) based Load Balancing Strategy for Cloud Computing [3]

Here the author finds the problems in workload across the multiple nodes in the cloud environment and because of that resource utilization is not done properly. So they propose the Genetic Algorithm thrives to balance the load of the cloud

infrastructure while trying minimizing the make span of a given task set. So here they try to solve the load balancing problem using the task scheduling. Using the GA the searching process is become more optimization and effective.

Cloud Task scheduling based on Load Balancing Ant Colony Optimization [4]

This Paper Proposes a cloud task scheduling policy based on Load Balancing Ant Colony Optimization (LBACO) algorithm. The main contribution of this work is to balance the entire system load while trying to minimize the makespn of a given tasks set. The LBACO is inherited from the Ant Colony Optimization (ACO). They can carry out new task scheduling depending on the result in the past task scheduling so it is very helpful in the cloud environment. The scheduling problem aims to minimize the total execution time of the tasks as well as to achieve a well – balanced load across all VMs in the cloud. Here they consider as all the tasks are independent but may be this algorithm will not work properly in case of dependent tasks.

Improved GEP Algorithm for Task Scheduling in Cloud Computing [5]

In this paper, the author proposes an improved GEP algorithm to solve the task scheduling issue. Like in the traditional GA algorithm only tasks the time cost consideration, but ignores the consumption of resources. In order to solve the problems exists in multi-task scheduling this proposed algorithm is quite suitable. Here in the algorithm double fitness function is used. Also the new ETCC (Expected Time and Cost to Compute) matrix is introduced which not only considers the running time of all tasks, but also takes the running cost of the tasks into consideration. This improved algorithm reduces the optimization time, and falls into the local optimal solution hardly at the same time.

Enhanced Genetic Algorithm based Task Scheduling in Cloud Computing [6]

In this paper author enhanced the genetic algorithm for task scheduling in the cloud computing environment. The goal of this algorithm is to achieve the optimization task scheduling. Here the genetic algorithm is enhanced using the new fitness function. Here the fitness function is based on the mean and grand mean value. The mapping of the resources and tasks are same as GA. First in this algorithm the selection of the tasks are done according to the priority of the task. Here the resource are sorted by the capability which is calculated using GA algorithm. For the calculation of mean value, they consider the makespan. This optimization can be implemented on both ends, for job scheduling as well as resource scheduling so that we can achieve more task optimization.

A task scheduling algorithm based on genetic algorithm and ant colony optimization in cloud computing [7]

The author propose new task scheduling algorithm based on genetic – ant colony algorithm. Here they take the advantage of strong positive feedback of ant colony optimization (ACO) on convergence rate of the algorithm into account. But the choice of the initial pheromone. It has a crucial impact on the convergence rate. The algorithm makes use of the global search ability of genetic algorithm to solve the optimal solution quickly, and then converts it into the initial pheromone as direct coding of ACO. Here they use reciprocal of task completion time as a fitness value. This paper chooses adaptive crossover methods. Larger crossover probability exchange some bit between individuals, so that it can avoid the occurrence of premature. Here single point mutation is done. Because of that effectively improves the searching efficiency of algorithm. The proposed algorithm works in the high scale of environment.

Here there is one comparison table is given below that describes about all the research papers

Table -1: Comparison table

| Approaches | Advantages | Disadvantages | Parameter |
|--|--|---|-----------------|
| A Genetic Algorithm (GA) based Load Balancing Strategy for Cloud Computing [3] | Can handle a vast search space, applicable to complex objective function, and can avoid being trapping into local optimal solution | Still not well efficient technique | makespan |
| Cloud Task scheduling based on Load Balancing Ant Colony Optimization [4] | Size of the tasks doesn't matter | Should not contain any precedence between the tasks | makespan |
| Improved GEP Algorithm for Task Scheduling in Cloud Computing [5] | Reduce the optimization time and good convergence | Not consider the dynamic multi – objective | Completion Time |
| Enhanced Genetic Algorithm based Task Scheduling in Cloud | Better task optimization and give high performance | Analysis can be made only by using limited number of jobs & resources | Execution time |

| | | | |
|---|--|----------------------------------|----------------|
| Computing [6] | | | |
| A task scheduling algorithm based on genetic algorithm and ant colony optimization in cloud computing [7] | Solve the slow convergence & improve the searching efficiency of algorithm | Become a quite complex technique | Execution time |

IV. OPEN ISSUES

Based on the survey conducted on various task scheduling algorithms we came to know that there is still lots of improvements that can be carried out. The major issues in scheduling algorithms are response time, cost, resource allocation, deadline, energy consumption and many other. Some techniques can be adopted to improvise the various issues and ultimately increase the performance of the system.

V. CONCLUSION AND FUTURE SCOPE

In this paper, we have conducted the survey of various task scheduling algorithms in cloud computing. A brief description of each algorithm is described and learn new techniques in this paper. The issues of the algorithm are addressed so that more efficient scheduling technique can be developed in future which can fulfill the various parameters and increase the performance of the system.

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