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A Pollination Based Optimization for Load Balancing Task Scheduling in Cloud Computing

Peenaz Pathak
Department Of Computer Science
Scholar At Rayat Bahra Institute Of Engineering And Biotechnology
Kharar, Punjab
India

Kamna Mahajan
Department Of Computer Science
Assistant Professor At Rayat Bahra Institute Of Engineering And Biotechnology
Kharar, Punjab
India

Abstract: Load Balancing in Task Scheduling is a process of managing different tasks on the basis of their priority or job execution order. Jobs have to be acquired on different processors and load needs to be maintained for the execution. Task scheduling is considered to be one of the critical issues on the cloud environment as various users requests to access the data on the cloud environment. The jobs have to be allocated to the processors in such a manner so as to minimize the makespan and computation time. To achieve this objective various optimization techniques have been proposed which includes Genetic Algorithm in which initially dependency between the tasks are removed which are further executed using shortest job first and makespan is created. A new approach Pollination Based Optimization (PBO) is used to optimize the results of GA(Genetic Algorithm).The performance of these two techniques are then compared that will prove the effectiveness of the optimization methods.

Index Terms: Cloud Computing, Task Scheduling, Load Balancing, Genetic Algorithm, Pollination Based Optimization

I.INTRODUCTION

Cloud Computing includes computers connected through a communication network such as the internet. Clouds provide a very large number of resources and also provides the way of managing these resources [6].It reduces the cost of access to assemble client's information which offers greater flexibility, high performance and on demand services [1]. Cloud Computing acts as an online storage service as it avoids load on servers [9]. The scheduling algorithm aims to meet dynamic requirements of users and obtain high resource utilization. The main objective is to minimize job spanning i.e. the total job completion time. Balanced scheduling will decrease the job spanning [2]. A job is a series of tasks. All these tasks are independent of each other. Load Balancing aims to distribute the workload among various computing resources. It maximizes the throughput, minimizes response time and avoid overload [3]. Genetic algorithm (GA) [2] shows special advantage in combinatorial optimization. GA's are robust search and optimization techniques in a number of practical problems. In this paper, we propose Pollination Based Optimization (PBO) which is used to optimize the results of the makespan created and maximizes the probability of finding the best solution. It also reduces the response time and gives better results.

II.RELATEDWORK

Rajesh George Rajan [4] did a survey on various existing load balancing methods in different environments. **Ankush P. Deshmukh [5]** analyzed a comparative behavior of load balancing with different parameters, in which dynamic load balancing proved to be more reliable.

Ruhi Gupta [12] presented a review on different load balancing techniques and compared them on the basis of various parameters**.**

Himani Aggarwal [8] did a comparative study of various CPU scheduling algorithms**.**

Soumen Santra [3] explained the various scheduling algorithms that were proposed in cloud computing by using a simulation toolkit in which processes were analyzed on the basis of their arrival time[AT] and burst time [BT].

Karthick [1] explained A Multi Queue Scheduling (MQS) algorithm which was described to reduce the cost of both reservation and on-demand plans using the global scheduler.

Wang [2] In this paper, (original adaptive algorithm) AGA was used to enhance the overall performance of cloud computing environment. JLGA algorithm was proposed to achieve task scheduling with least makespan and load balancing. Further, the performance of AGA and JLGA were compared where JLGA proved to be more efficient.

Ms. Nithya.G [7] explained Multi Agent Brokering Approach to identify service providers in cloud environment. Jumper firefly algorithm(JFA) was implemented for increasing the efficiency and reducing the execution time.

Amritpal Kaur [10] proposed an algorithm called green scheduling algorithm so as to reduce the need for cooling systems in cloud environment. **Swachil J. Patel [11]** proposed an improvement in priority based job scheduling algorithm in cloud computing proved to have a better

makespan and consistency to achieve better performance. **Chanintorn [15]** proposed a queuing model to evaluate the performance of Reliable data scheduling algorithm using simulation and approximation methods.

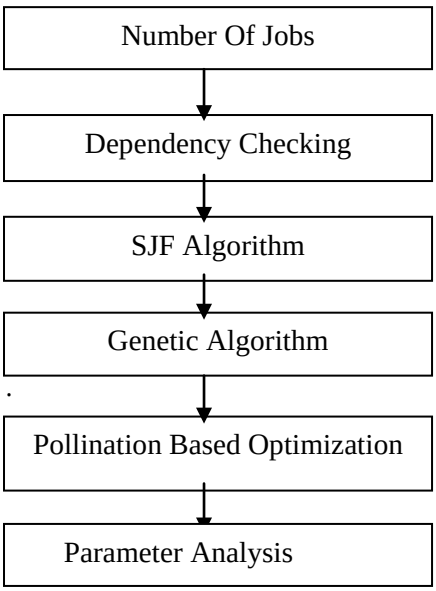
Andrei Tchernykh [16] analyzed a variety of scheduling algorithms with different cloud configurations and workloads considering two objectives: to maximize provider income and minimizing total power consumption. It focused on bi-objective analysis of online scheduling.

Gurtej Singh [17] proposed a bio inspired scheduling algorithm to solve dynamic, complex problems in cloud computing resource management environment. It also presented an overview of swarm scheduling and evolutionary scheduling algorithms.

III.PROBLEM FORMULATION

Cloud Computing comes with essential characteristic of sharing resources among different users under the concept of resource pooling. In resource pooling, multiple resources reside at a location and are allocated to services on demand. It uses virtualized environment for functioning services, because without virtualization computing is inefficient and not flexible. But it has some performance degradations of services and also has overheads of load management. Many researchers have already worked for making some efficient load balancer or scheduler algorithm for reducing the time consumption and maintaining the load. Load Balancing or Job Scheduling algorithm plays an important role in Cloud Computing. As job scheduling is the process to allocate different jobs to different processers to minimize the time spanning for completion of jobs, jobs have to be allocated in such a manner so that the processors response time for execution of job get reduces. Jobs have been divided into tasks for allocation to different processors on a machine. These tasks must be executed in a sequence so that minimum load would occur on the processor.

IV.FLOW OF WORK:



V.PROPOSED ALGORITHM:

Pollination Based Optimization is Bio-Inspired Algorithm. It literally means finding the best possible/desirable solution. So it gives optimized results means the best results [13,14].

Input: Number of jobs, processor & execution time

Output: Best execution sequence

Begin

Initialize all the jobs & processors

For 1 to ends of jobs

Check dependency between different jobs executions

Define number of iterations

For 1 to end of iteration

Number of nest=number of processor

p_{best} =for each nest (job, processor)

$job_i > job_j$

Shift I to second job

Sort the jobs according to shortest job

Compute p_{best} for each nest

p_{best} -nest fitness

End of iteration

Compute G_{best} for all over the algorithms

G_{best} =min (p_{best})

G_{best} Is the sequence having minimum execution time

VI.RESULTS

The calculated results from the load balancing and job scheduling in proposed techniques of genetic

algorithm and Pollination Based Optimization have been discussed here. The results of the proposed study are taken under four scenarios. In all the four scenarios both the number of the virtual machines and jobs are fixed. All the scenarios use shortest job first mechanism for job scheduling. System Response Time for any technique can be the total time consumed by the system for executing the

algorithm. The SRT that is system response time for both the techniques is also calculated for all the job sets.

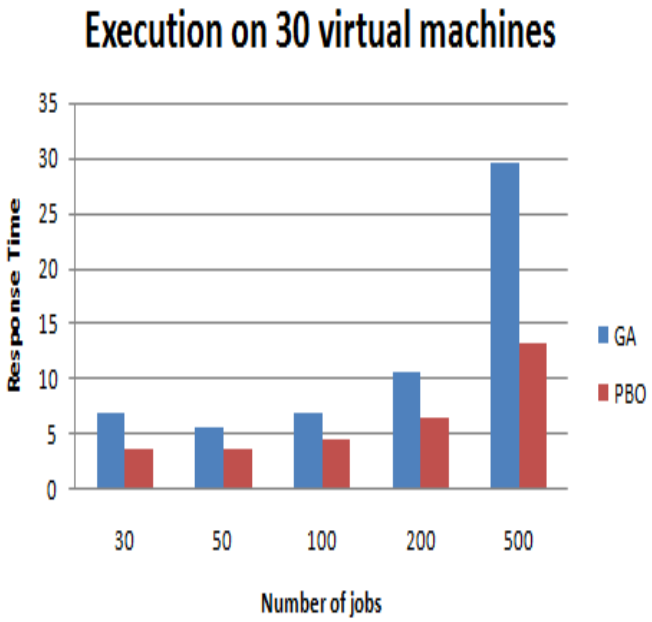
Scenario No.	No. of virtual Machines
1	30
2	50
3	70
4	100

Table 6.1 Different Scenarios for load balancing and job scheduling

In first scenario, 30 virtual machines have been used for load balancing and job scheduling process. The number of jobs can be taken as required but in this case jobs included for the process are taken as 30, 50, 100, 200, and 500 jobs. The different number of job sets has been involved for the purpose of clear evaluation. It simplifies the analytical process. The system response time, load and the total make span is calculated and the results of both techniques are compared. The overall time taken by the system for load balancing is tabulated in Table 6.2. On seeing the table, it is clearly visible pollination based organization has consumed lesser time than genetic algorithm. From the table it is very clear that Pollination Based Optimization took 3.4788 micro seconds on 30 virtual machines whereas genetic algorithm took 6.7548 micro seconds of system response time for same number of virtual machines and same number of jobs.

Number of Jobs	Virtual Machines	System Response Time (micro-sec)	
		GA	PBO
30	30	6.7548	3.4788
50	30	5.5224	3.6036
100	30	6.7704	4.3992
200	30	10.4833	6.2868
500	30	29.5934	13.0471

Table 6.2 Overall system response times for Load Balancing

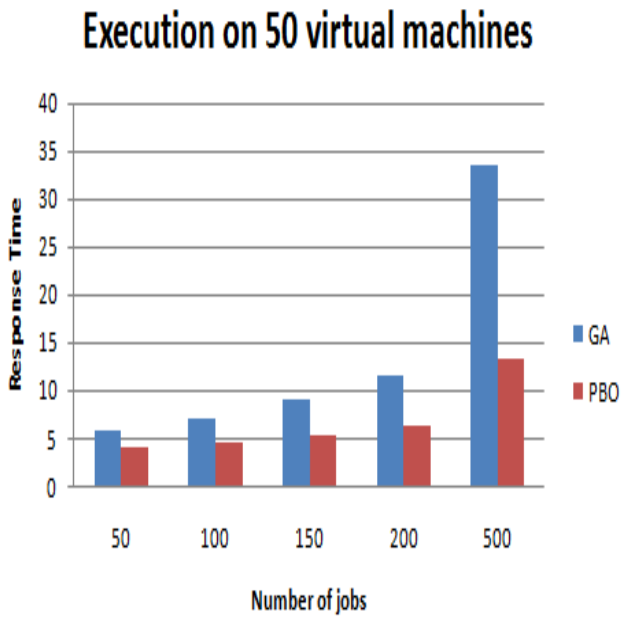


The Pollination Based Optimization has been executed in a time period approximately half of the time taken for genetic algorithm. Table 6.2 shows overall response time of the system through genetic algorithm and Pollination Based Optimization under load balancing.

Number of Jobs	Virtual Machines	System Response Time (micro-sec)	
		GA	PBO
50	50	5.772	4.1184
100	50	6.8796	4.3992
150	50	9.0481	5.3352
200	50	11.4661	6.1932
500	50	33.509	13.2913

Table 6.3 Overall system response times for Load Balancing

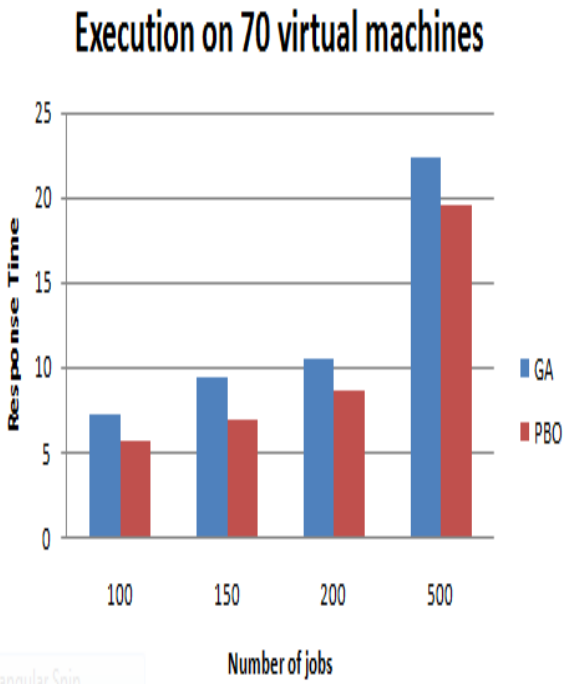
With a spike in number of jobs, system response time at PBO remains 4.3992 micro seconds whereas genetic algorithm increased to 6.8796. The growth in system response time for GA can be seen up to 500 jobs with 50 virtual machines with the difference of one-third in comparison to Pollination Based Optimization.



Number of Jobs	Virtual Machines	System Response Time (micro-sec)	
		GA	PBO
100	70	7.14	5.56
150	70	9.37	6.81
200	70	10.49	8.56
500	70	22.29	19.46

Table 6.4 Overall system response times for Load Balancing

In this scenario, 70 virtual machines have been used for load balancing and job scheduling process but the jobs required in this case are 100,150,200 and 500.The difference is clearly visible in table 6.4

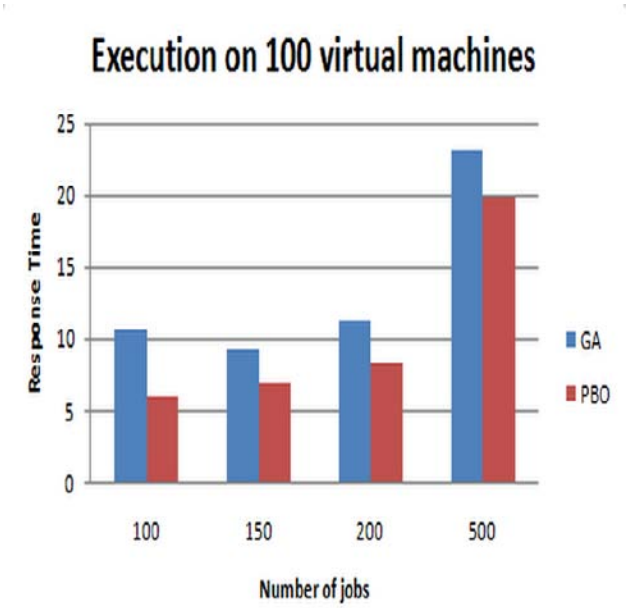


Number of Jobs	Virtual Machines	System Response Time (micro-sec)	
		GA	PBO
100	100	10.60	5.88
150	100	9.26	6.91
200	100	11.21	8.34
500	100	23.18	19.84

Table 6.5 Overall system response times for Load Balancing

In this scenario, 100 virtual machines have been used for load balancing and job scheduling process but the jobs required in this case are 100,150,200,500.

The results calculated from all four scenarios indicate that Pollination Based Optimization is efficient to implement if the priority is to minimize time.



VII.CONCLUSION AND FUTURE SCOPE:

Cloud Computing is internet based computing in which resources are provided to users on demand. A Pollination Based Optimization algorithm has been presented to find the better solution for the problem of scheduling and load balancing in Cloud Computing environment. The goal of the technique is to resolve the problem of high consumption of system time while scheduling the incoming jobs according to available virtual machines in Cloud environment. On the basis of the results calculated above it has been proved that PBO is better than GA if system response time is considered as it not only reduces the response time but also minimizes the makespan. As the extension of this work in future, various other optimization techniques can be applied and compared in order to minimize the total job completion time and to enhance the system performance.

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