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Cloud Scheduling Using Enhanced Genetic Algorithm

Sanjolly Dhuria¹, Jasdeep Singh Mann², Sandeep Singh³

¹Research Scholar, ^{2,3}Assistant Professor, Department Of Computer Science And Engineering, Bhai Maha Singh College Of Engineering, Sri Muktsar Sahib, Punjab

Abstract: With high adaptability and great recovery of data as per users' demand, cloud computing provides various benefits in term of services. In Cloud Computing the main interest includes, designating jobs to the Cloud nodes efficiently such that the work and task handling is done as accurately as possible, while keeping an eye on other affecting constraints such as diversity and tremendous connection delays. Decentralized cloud scheduling algorithm, it depends on the prior knowledge of the applications and constant information about the load on the node. In current work genetic with fuzzy based approach is used. This approach is based on identifying and comparing all possible solutions to find the optimized solution with the hard constraints. Only those resources are selected which follows the hard constraints. Various types of performance parameters are being used for comparing the performance of both existing and presented techniques. These parameters are like load, time, cost and the generations. In all the parameters Fuzzy with genetic based approach is performing better as compared to SAMPGA.

Keywords: Cloud Computing, Genetic Algorithm, Simulating Annealing Multi-population genetic algorithm, Multi-population genetic algorithm, Fuzzy Logic.

I. INTRODUCTION

The term "Cloud" means a "network or Internet". In another form we can say that cloud provides the services via private network or public Network. Applications such as E-mail, Web-Conferencing and Customer relationship management all are run in cloud through internet. The Concept of "Cloud Computing" comes after the grid computing and many other types of computing. Cloud Computing refers to operating, connecting and constructing the applications online. It delivers three types of services like Infrastructure as a Service (IaaS), Platform as a Service (PaaS) and Software as a Service (SaaS) to customers virtually on pay per use basis. It is the mixture of both hardware and software based computing resources delivered as a network service. Cloud computing depends on allocation of resources to attain consistency and economies of scale alike usefulness over a network. Cloud computing is becoming increasingly popular day by day. Cloud service contributors offer services to large scale cloud environment with cost gains. Also, there are some famous giant scaled applications such as social networking and internet business. By using cloud computing these applications can give advantage in terms of decreasing the amount.

The fame of clouds has been inspired by the use of virtualization as their built-in technology. It is a technique that allows two or more operating systems to run simultaneously on a PC only. Virtualization helps a lot in the effective use of resources and creates an effective system. Virtualization makes the cloud computing different as compared to the other computing.

A. Need Of Job SchedulingS

Job scheduling becomes a difficult task, with the increasing number of customers. Keeping the balance in relation to the following parameters, job scheduling plays an important role in effective cloud resource management.

- 1) Load Balance - Load balancing and task scheduling are almost connected to each other in the cloud environment, Task scheduling is responsible for the optimal mapping of tasks and resources. The task scheduling algorithm can maintain load balancing. Therefore, load balance becomes another significant measure in the cloud.
- 2) Quality of Service - The cloud is primarily intended for users with computing and cloud storageservices. These resources are being provided to the users such the quality of the service is ensured.
- 3) Economic Principles - Cloud computing resources are broadly distributed worldwide. As a business model, cloud computing works according to various needs and provides relevant services. That's why the demand charge is reasonable.
- 4) The best running time - According to the needs of users, jobs can be divided into different categories, and then for each task, the best running time is determined based on different goals of each task.
- 5) The throughput of the system - Mainly for cloud computing systems, optimized performance of task scheduling can be measured by throughput of the system, and it is also a goal to consider the development of the business model.

B. Resources In Cloud

In cloud computing scheduling of scarce resources among multiple clients is also a great challenge. Various clients are requesting the same resources from remote locations so we have to keep multiple resources of two natures:-

- 1) Sharable resources
- 2) Non-sharable resources

Sharable resources are generally file resources that can be shared amongst multiple users. All can access in read mode; i.e. will access their individual copy for non-changing mode. But when one user will access the file in write mode then exclusive rights will be provided. And when the multiple clients are requesting for the file resources then the type & the mode of these resources will be checked; so that no client can access the file in update mode.

File resources include

- a) Image sharing
- b) Document sharing
- c) Contacts sharing
- d) Video sharing
- e) Database tables

Non-sharable resources are generally hardware resources which can be processing or memory; for it on multiple requests, queue of request will be generated. So that scheduler run by virtual machine can schedule the multiple requests. Any client requiring the resource for smaller expected time, once that time period will be known scheduler uses min-min and max-min scheduling techniques on required time for efficient utilization of resources.

II. LITERATURE SURVEY

- 1) *Xing Jia Wei, Wang Bei, Li Jun(2017)*: As cloud computing is increasing rapidly, effective task scheduling algorithm plays a significant role to improve the resource usage and increase the overall exposure of the cloud computing environment. However, task scheduling is the severe challenge needed to solve urgently in cloud computing. Therefore, the simulated annealing multi-population genetic algorithm (SAMPGA) is proposed for task scheduling in cloud computing which is the combination of simulated annealing algorithm (SA) and multi-population genetic algorithm (MPGA) in this paper. In population initialization, SAMPGA adopts max-min algorithm to enhance the search efficiency. SA incorporated into SAMPGA is employed to avoid local optimum and improve the performance of global optimum, while a family evolution strategy based on adaptive mechanism in MPGA is proposed to find better solution and improve convergence speed. Finally, experiments have been performed to calculate the efficiency of the proposed method in MATLAB. Compared with MPGA, SA and simulated annealing genetic algorithm (SAGA), the results of simulation show that the SAMPGA has more excellent performance in terms of the completion time, completion cost, convergence speed and degree of load imbalance
- 2) *Shuibing He, Yang Wang (2016) et. al.*: Author in this paper has proposed the optimization of the system by shifting the load in terms of caching the system. Rather than optimizing the outer memory where the file system will stored permanently. The performance enhancement in terms of the file system in the disk space will be slow. This type of optimization is not free. Rather it is cost based system. Where system enhancement will be not free rather will be having load shifting amongst machines. As we know the cloud infrastructure is based on 'pay per use' model where various clients requests are being shifted from one machine to other machine in cache memory itself.
- 3) *Vatsal Gajera(2017) et al.*: Author in this paper optimized the existing algorithm of MIN-MIN and Max-Min, it is the normalization technique where the performance is being enhanced with new algorithm like Normalized Multi-Objective Min-Min and Max-Min algorithm. With the real time working of the system the performance has shown the improvement in terms of the resource utilization.
- 4) *S. Devipriya(2013) et al.*: Cloud computing is one of the services which is being provided by the cloud administrator to the linked client. Various clients can put the service request to the central machine so that the highly efficient system can be built and the time efficient services are being provided to the clients at the remote places. It also provides the storage capability client can store the data at the remote place. Cloud provides the ability to provide the shared computing for the enhancement of the shortest response time, minimum completion time and increased resource utilization.
- 5) *Rajwinder Kaur et al.*: Cloud computing requires efficient use of resources and also increase the performance of the system. So that minimum cost can be incurred in on to the resources utilization.

III. SCHEDULING ALGORITHMS

A. Min-Min Algorithm

- 1) **MIN-MIN Algorithm:** It is one of the scheduling algorithms where various tasks are collected. Each task will be allocated with given set of resources. In MIN-MIN scheduling algorithm a task is selected with minimum completion time requirement. This task will be allocated to the resource which has minimum expected completion time. This algorithm will works in two different phases. In first phase the tasks list is prepared. This task list may be called as Meta task list. Each task has completion time attached to it. That task will be selected which has minimum completion time. Once the task is selected it will be removed from the Meta task list. This chosen task will be allocated to the resource which has minimum expected completion time.
- 2) **MAX-MIN Algorithm:** It is similar to the Min-Min algorithm. It also consisting of two phases. In first phase the tasks are collected and put into the tasks list. That task will be selected which has maximum time of completion. Once that task is selected the task will be removed from the Meta tasks list. This largest task will be allocated with that resource which has minimum completion time which is contradictory to the min-min algorithm where smallest task will be allocated with the smallest resource completion time. But in Max-Min the largest task will be allocated with the smallest completion time resource.
- 3) **Improved MAX-MIN Algorithm:** RASA is the improved algorithm where the hybridization of Max-Min and Min-Min algorithm will be performed. It takes advantages of Max-Min and Min-Min algorithms. It selects the algorithm alternatively amongst these two so that the advantages of both the algorithms will be taken place.

IV. ALGORITHM

A. Population of 5 data centers(d_1, d_2, d_3, d_4, d_5) with processing time p_i is taken.

- 1) Five virtual machines are taken for request process as (v_1, v_2, v_3, v_4, v_5).

B. Identify the virtual machine current queue size (q_i), and datacenters availability time (A_i).

- 1) Fitness value= $q_i + A_i$.
- 2) Identify the maximum fitness value

C. Identify the best resource with least availability time as A_i .

D. Identify the hard constraints like

- 1) Processing ability.
- 2) Current Queue length.
- 3) Availability time.

For each resource check the hard constraints for optimal selection.

E. Allocate the resource R_i to the process P_i .

F. Goto step 2.

V. FLOWCHART

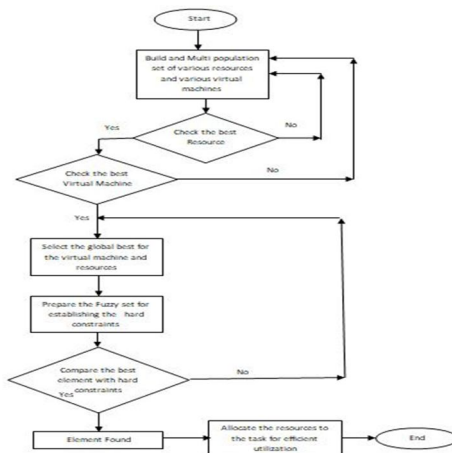


Fig.1 Flowchart

VI. RESULTS AND DISCUSSIONS

In current research the improvement over to the SAMPGA algorithm has been done. In previous research resource awareness is performed. This resource awareness is to know the resource current status before being allocated to the process. In current research based on Enhanced Genetic based optimal resource is identified, which is better ways of sufficient.

- 1) *Load*: It is at the time which virtual machine starts working.
- 2) *Time*: It is the time at which virtual machine stop working after the execution of on batch of tasks.
- 3) *Cost*: Total power consumption for each execution of batch of processes.
- 4) *Generations*: It is the total no. of processes executed per unit interval of time.

A. Comparison For Load

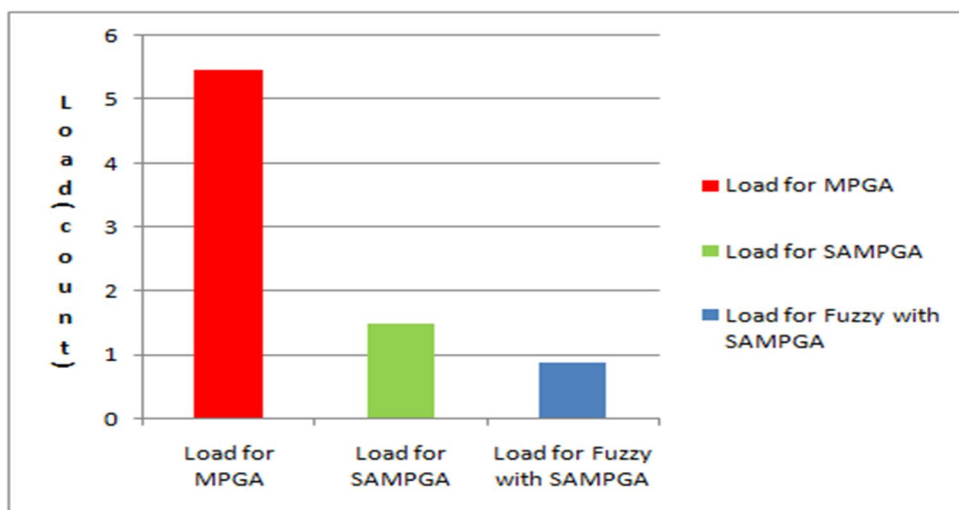


Fig. 2 Comparison for Load

Fig. 2 shows the comparison of Load for all the existing and the current techniques. The graph shows that the Fuzzy with SAMPGA is performing better as compared to the existing MPGA and SAMPGA. SAMPGA based technique is based on selection of the element from the multiple population set. And migrating the element from one set to other set for comparison of the best element with other population set. Load means the extra work the cloud processor has to do for the identification of the best solutions.

B. Comparison for Time

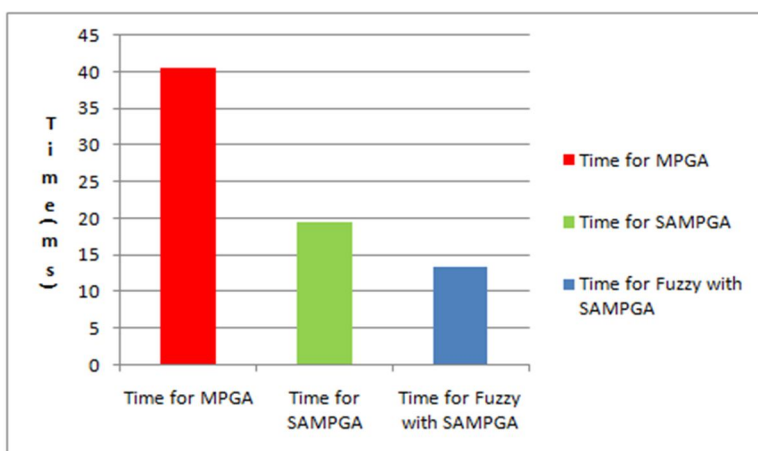


Fig. 3 Comparison of Time

Fig. 3 shows the performance comparison for Time parameter for the existing and the current techniques. In the current technique less time is taken in comparison to the technique based on SAMPGA and the MPGA. Because rather than identification of the optimal from the whole population it will be better to identify the population set which follows the hard constraints.

C. Comparison for Cost

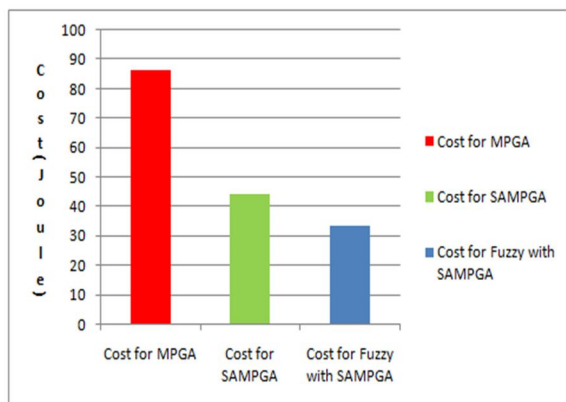


Fig. 4 Cost Comparison

Fig. 4 shows the current research based on Fuzzy with SAMPGA is better technique as compared to the existing techniques like MPGA and the SAMPGA. Less cost means less energy, with less energy the element which is optimal can be identified. This means on the basis of the cost and energy the current technique performs better compared to the existing technique.

D. Comparison for Generations

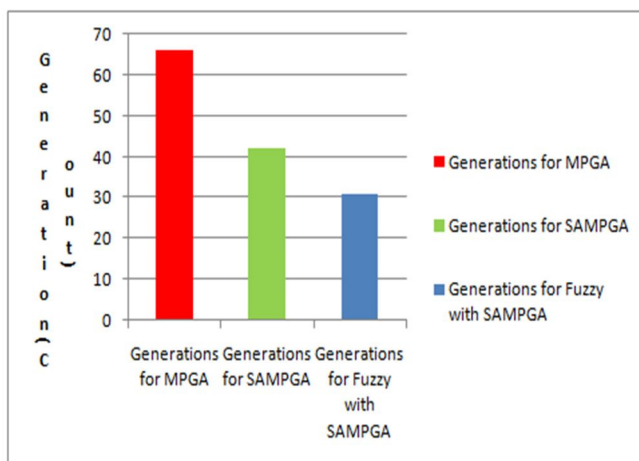


Fig. 5 Generation Comparison

Fig. 5 shows the comparison of the Generation of the sets for both crossover and mutation. In current research number of generations is less as compared to the based techniques. In previous techniques more numbers of generations are being performed. This directly delays the whole process.

E. Percentage Improvement For Fuzzy and SAMPGA with MPGA

Table 1 Comparison of performance between MPGA and Fuzzy with SAMPGA

Parameter	MPGA	Fuzzy with SAMPGA	Percentage Improvement
Load	5.4	0.87	16%
Time	40.57	13.21	33%
Cost	86.14	33.19	39%
Generations	66	31	47%

Table 1 shows the percentage improvement for the current technique in comparison to the base technique. The current technique based on fuzzy and SAMPGA is having all the parameters improved. It has improved all the parameters i.e. Load, Time, Cost and generations.

F. Percentage Improvement For Fuzzy AndSAMPGA With SAMPGA

Table 2 Comparison of performance between SAMPGA and Fuzzy with SAMPGA

Parameter	MPGA	Fuzzy with SAMPGA	Percentage Improvement
Load	1.47	0.87	40%
Time	19.56	13.21	32%
Cost	44.32	33.19	25%
Generations	66	31	26%

Table 2 shows the percentage improvement for the current technique in comparison to the base technique. The current technique based on fuzzy and SAMPGA is having all the parameters improved. It has improved all the four parameters i.e. Load, Time, Cost and generations.

VII. CONCLUSION

Cloud is the most emerging type of technology for the networks. Various types of remote applications are emerging which are using cloud based services for the cost efficient technology solutions. Cloud can be of two types. One is the public cloud and one is the private cloud. In public cloud various number of users request for the resources at the cloud. But when the users grows beyond the limit then the resources usage will be challenged. Under such circumstances there requires cloud scheduling for the efficient usage of the resources. Various types of genetic based techniques are being used. These are based on optimization techniques where large number local best and the global best resource is identified. In existing research SAMPGA based technique is used. It is based on building multiple population set. And migrate the best element of the one population set to other population set for comparison purpose. But sometime this whole exercise ends with local best solutions. In current research the genetic with fuzzy based approach is used. This approach is based on identifying by comparing the optimized solution with the hard constraints. Only those resources are selected which follows the hard constraints. Various types of performance parameters are being used for the comparing the performance of both existing and current techniques. These parameters are like load, time, cost and the generations. In all the parameters Fuzzy with genetic based approach is performing better compared to SAMPGA.

VIII. FUTURE WORK

Present research is based on selection of the best resource based on optimization based technique. Each time optimized resource is compared on the basis of hard constraints. In future there may be selection of hard constraints while selection of the element from one population set.

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