Genetic Algorithm for the load Balancing in Cloud Computing

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Abstract

The cloud computing is the architecture which is decentralized in nature due to which various issues in the network get raised which reduce its efficiency. The cloud computing technology is applied to fulfill the demands of hosts over the internet. For the purpose of using or sharing the resource cloud computing can be used. The virtual machine migration is the major issue of cloud computing and it get raised when uncertainty get happened in the network. Due to extensive use of the virtual machine resources, machine gets overloaded which increase delay for the cloudlet execution. In the base paper, the threshold algorithm has been proposed which assign task to most capable machine and hosts maintain check points on the virtual machines. When the virtual machine get overloaded the task need to migrate to another virtual machine. In the research work, weight based technique will be proposed which migrate cloudlet from one virtual machine to another.

KEYWORDS: Genetic Algorithm, Cloud Computing, Load Balancing

I Introduction

Cloud Computing is service which provides on-demand and simple access of the network to several servers which provides computing resources like applications, storage, networks are in presence for other services which cloud provides which we can use to gain maximum efficiency [1]. User retrieved data and modified data which is stored by client or an organization in centralized data called cloud. Cloud is a design, where cloud service provider provides services to user on demand and this vital feature is known as CSP stands for "Cloud Service Provider". It means that the user or the client who is using the service must pay for whatever he/she is using or being used and served. Cloud computing is a technology that provides a complex number of applications in different topologies and each topology gives some expert specialized service. Public cloud is known as a most common model of cloud computing to all clients that is an open cloud to model [2]. In this model, cloud services are provided through virtualized environment developed using polled shared physical resources and share on public network such as internet. Same infrastructures shared by multiple clients. Through this model, operations under cloud are performed optimally. Private Cloud is designed and developed under the needs of single organization. Private cloud service provider gives you access to its network in a more secure way insuring that anyone outside of your network won't be able to access it [3]. This makes the private cloud more secure but less flexible considering public cloud e.g. Amazon Virtual Private Cloud, Microsoft Private Cloud. Hybrid cloud is collection of many clouds like private cloud and public cloud. All clouds have their own unique identities, but they all are determinate as a unit. It offers standardized get to information and application. Load balancing is a technique where the complete load of the

network is shared using various techniques amongst the different nodes to make resource utilization efficient and to enhance the response time of the job [4]. In the meantime, remove a state in which some of the hubs are under stacked while a few others are over stacked. Using many components while trying to balance load instead of a single component the reliability and availability of the data can be increased through redundancy. This load is measured in terms of statistics around CPU load, memory used, delay or network load. A program or an operating system on a virtual space within a host acting as an individual entity in itself catering to request and providing services like a physical system is called a Virtual Machine, despite being virtual within a host it acts as a complete system by itself. A virtual machine is usually created inside a bigger environment referred as host [5]. A host can have multiple virtual machines acting as an independent entity in itself. Genetic Algorithm began from the investigations of cell automata. It is led by John Holland and his partners. Fundamentally Genetic Algorithm is one of the seeking method, it is utilized as a part of the computer science. It finds solution for any optimization issues. The genetic algorithms are known as the evolutionary algorithms [6]. In this numerous methods are included by developmental science, for example: legacy, change, characteristic determination, and recombination. In the representation of the hereditary calculations the wellness capacity is characterized. The hereditary computation continues to instate the arrangements arbitrarily. It used to enhance it through monotonous application. In this case it involves many applications such as: selection, mutation and crossover operators. Numerous Researchers have embraced hereditary calculations as an answer for streamlining in different fields. The hereditary calculations goes about as an answer for improvement issue began picking up fame towards the end of the most recent century as used to tackle enhancement issues in development [7]. Its natural parallelism encourages the employments of circulated preparing machines, similar to Distribution Network Planning. Issues which have all the earmarks of being especially fitting for arrangement by GA incorporate Scheduling and State Assignment Problem. To solve color problem GA has been used many a times which shows efficiency of GA in this matter. Specialists have indicated enthusiasm for GA way to deal with take care of booking sorts of issues, similar to employment shop planning issue. It can be very viable to consolidate GA with other enhancement systems.

II Literature Review

Sheetal Karki et al. in 2018 [8] explains that the data is stored in a centralized virtual machine called cloud and the cloud provider companies are responsible to assign the offerings to the end users. The end users get entry to the offerings primarily based on their needs and are to be paid for what's being served. As the number of requests grows so the need for load balancing arises to maximize the useful resource utilization and energy consumption. Threshold and Check Pointing algorithm help in task migration when the virtual machines get overloaded at the time of cloudlet execution. The tasks are migrated from one

virtual machine to another or can be queued to be decided by threshold and check pointing algorithm minimizing the processing time, energy and resource consumption.

Sukhpreet Kaur et al. in 2017 [9] proposed an Improved Genetic Algorithm (IGA) for assigning the users task to the virtual machines. The agenda of this proposed method is to maximize resource utilization while maintaining minimized energy consumption and reduce the task execution cost. IGA gives higher output in terms of energy efficiency, cost and all the VMs distributed the tasks in such a way that the load is properly balanced. The graphical representation of the simulation shows that the Improved Genetic Algorithm is far more efficient than the existing Genetic Algorithm in terms of several parameters such as energy efficiency and cost and also depicts that all the VMs are allocated to the cloudlets in Improved Genetic algorithm while in Genetic Algorithm some VMs are not allocated to any of the Cloudlet.

WANG Bei et al. in 2016 [10] stated a Multi-Population Genetic Algorithm (MPGA) thinking about load balancing is followed for solving the task scheduling issues in cloud environment in place of Genetic Algorithm to keep away the earlier convergence. In order to enlarge the search efficiency, the min-min and max-min algorithm are used for the populace initialization. The simulation outcomes show that a higher task scheduling result can be carried out through the MPGA-based task scheduling algorithm, which means the algorithm can realize an effective task scheduling and is more appropriate for managing portions of tasks in comparison to adaptive genetic algorithm.

Mr. Mayur S. Pilavare et al. in 2015 [11] states that as cloud computing is connected via network with servers so there are many issues to be solved. Load balancing is the crucial issue over the cloud to be addressed. The Genetic Algorithm outperforms some existing load balancing techniques. By giving the prioritized input to the genetic algorithm the response time will be decreased and this minimizes the make span of given task set. Here the jobs are assumed having same priority that may not be the actual case so it can be taken for further work and the various selection techniques for GA can be changed for better performance and crossover and mutation techniques can be modified to get better performance.

Keke Gai et al. in 2015 [12] defines several earlier researches that have explored the optimizations of on-premise heterogeneous memories. This paper works in this problem and proposes a singular technique, cost-aware Heterogeneous Cloud Memory Model (CAHCM), aiming to offer an excessive-overall performance cloud-based heterogeneous memory carrier presenting. In this proposed method a set of vital factors influencing the performance of the cloud memories is considered, such as communication costs, energy performance, data move operating costs and time constraints. Ultimately, we enforce experimental

reviews to study our proposed model. Outcomes of the research have explored that this technique is feasible for being a cost-aware cloud-based solution.

Mahalingam et al. in 2015 [13] stated that one of the essential element for efficient operation in cloud computing is balancing the load. In this paper, the weight based optimized load balancing technique is proposed for the distribution of incoming jobs uniformly over various virtual machines or servers. The performance is analyzed by using the cloud simulator and comparing the current result with existing Round Robin and EIRP algorithms. Cloud simulation is used as a framework which enables modeling, simulation and applicable on making cloud computing infrastructure self-implied platform which has been used to model data centers, hosts, service brokers, scheduling and allocation policies. In the future work, the problem may be overcome like deadlock and server overflow. It may also implement a enhance service broker policy in the simulator to enhance new algorithm in the simulator.

III Research Methodology

The proposed algorithm is the enhancement in the improved genetic algorithm to reduce execution time for the task migration in cloud computing. The number of migration is reduced by changing the mutation calculation points by which the execution is made faster and more reliable than the existing approach. The genetic algorithm woks in three phases, the first phase is the initial population in which execution and failure rate of each virtual machine is taken as input. In the second phase, the cross over values is calculated and in the last step, the best value is selected from the multiple values which have least chances of failure. In this work, the enhancement in the improved genetic algorithm is proposed to reduce execution time. In the enhanced improved genetic algorithm following steps are there:-

1. Initial Population: The initial population is the execution time and failure rate of each virtual machine which is used for the task execution. The initial population is the virtual machine resource which is used for the task execution.

2. Cross over value calculation: Under the populace every chromosome x fitness value gets explored. According to their fitness value we pick two parent chromosomes from a populace, and in general bigger the populace bigger is the fitness value with a crossover possibility exceeds the parents to form a new offspring. If none of the crossover was done, offspring becomes exact replica of parents. With an offspring possibility recreates new offspring at every locus.

3. Best value Calculation: The best value is calculated from the crossover value calculated. Use the new generated populace for a farther run of the algorithm.
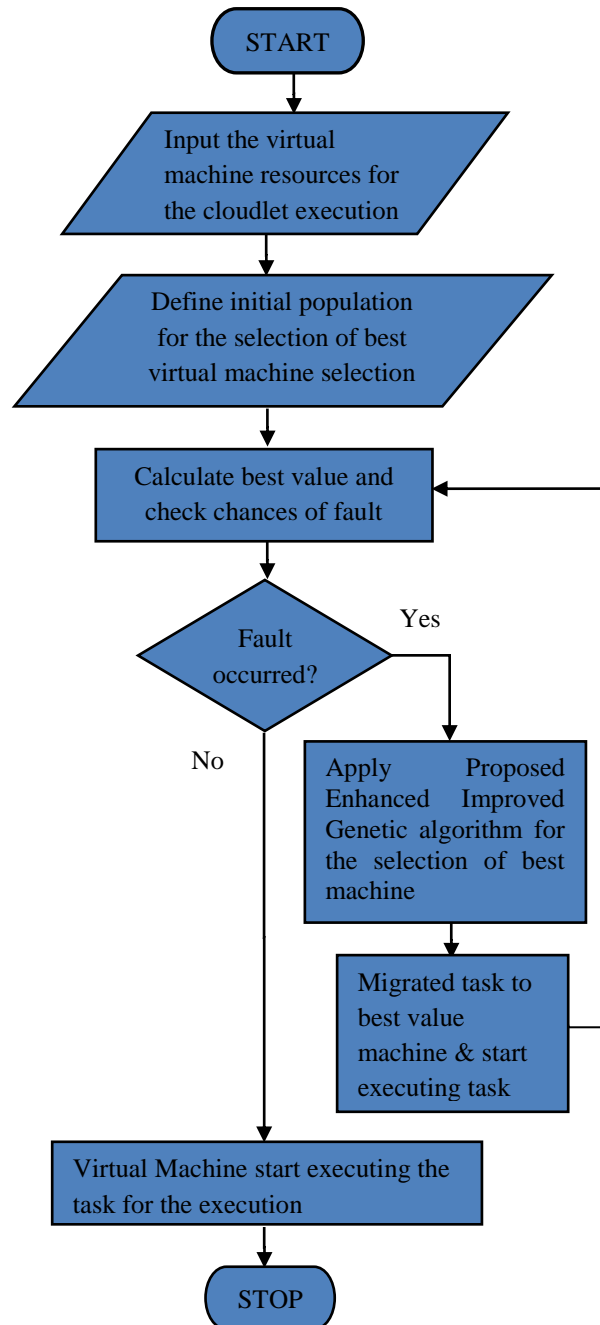
Figure 1: Proposed Flowchart

IV Experimental Results

The proposed research is implemented in MATLAB and the results are evaluated by comparing proposed and existing techniques with respect to certain performance parameters.
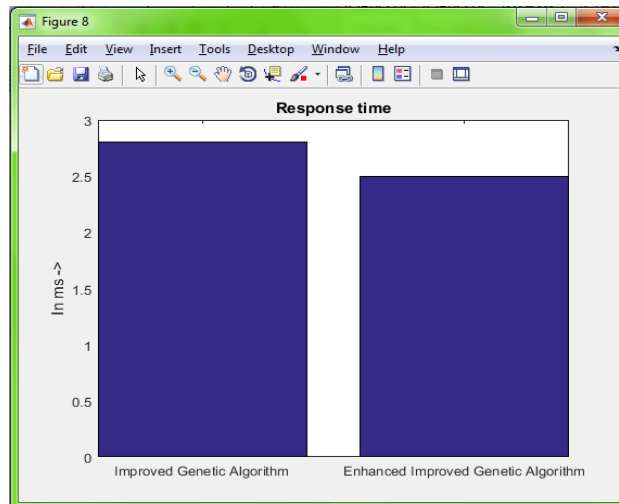

Fig 2: Comparison graph of Response Time

Figure 2 shows the response time of the improved genetic algorithm and proposed enhanced improved genetic algorithm compared for the performance analysis. The response time of enhanced improved genetic algorithm is less as compared to improved genetic algorithm.
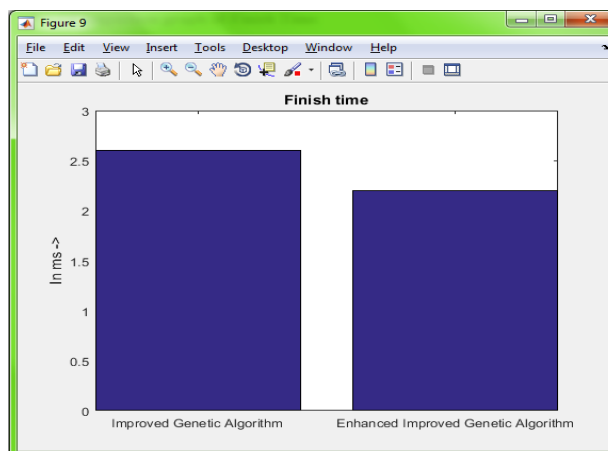

Fig 3: Comparison graph of Finish Time

Figure 3 shows the finish time of the improved genetic and proposed enhanced improved genetic algorithm compared for the performance analysis. The finish time of the enhanced improved genetic algorithm is less as compared to improved genetic algorithm.
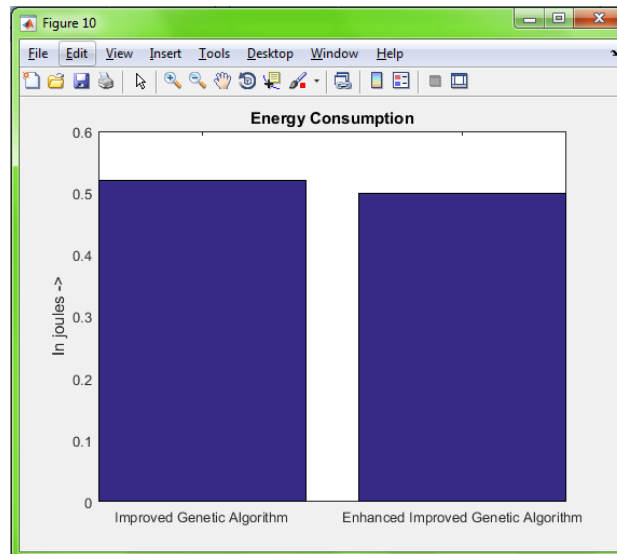

Fig 4: Comparison graph of Energy Consumption

Figure 4 shows the energy consumption of the improved genetic algorithm and proposed enhanced improved genetic algorithm compared for the performance analysis. The energy consumption of enhanced improved genetic algorithm is less as compared to improved genetic algorithm.
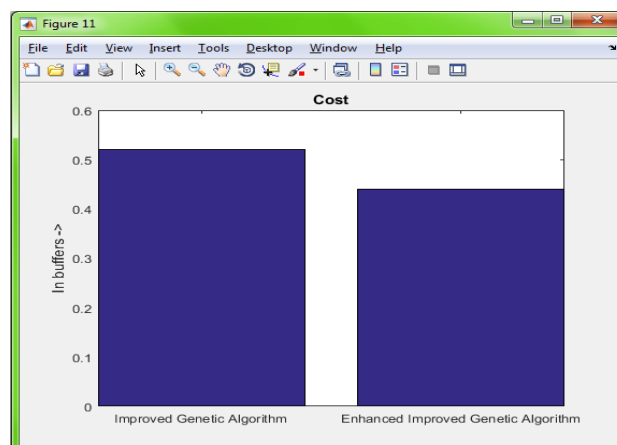

Fig 5: Comparison graph of Cost

Figure 5 shows the cost of the improved genetic algorithm and enhanced proposed improved genetic algorithm compared for the performance analysis. The enhanced improved genetic algorithm has less cost as compared to improved genetic algorithm.
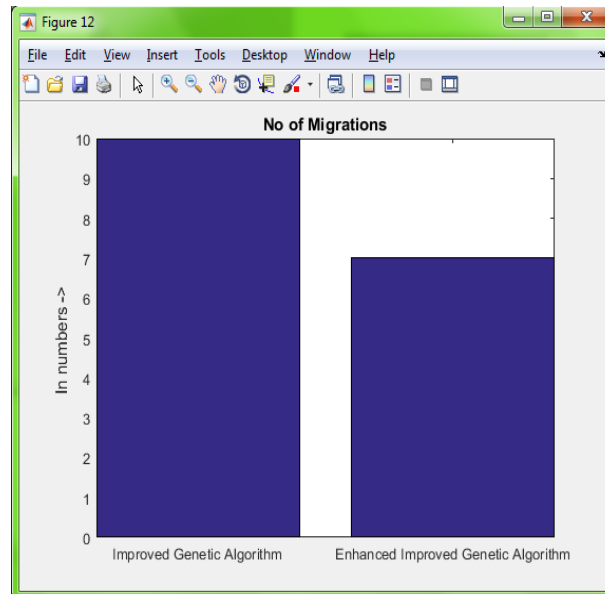

Fig 6: Comparison graph of No of Migrations

Figure 6 shows the number of migrations of improved genetic and proposed enhanced improved genetic algorithm compared for the performance analysis. The number of migration of enhanced improved genetic algorithm is less as compared to improved genetic algorithm.

V Conclusion

The cloud computing has the dynamic nature and due to which cloud network has various issues like security, quality of service and fault occurrence etc. The load balancing is the major issue of cloud network which reduce its efficiency. This work proposed a modification in the improved genetic algorithm such that the execution time can be minimized. The reliability and speed of the proposed algorithm are high due to which the chances that the fault will occur are minimized. MATLAB simulator is used to implement the proposed and existing algorithms. Comparisons amongst these two algorithms are made to evaluate their performances in terms of response time, finish time, energy consumption, cost and no of migrations. On the basis of the graphs it is concluded that the proposed enhanced improved

genetic algorithm shows high performance as compared to existing improved genetic algorithm for virtual machine migration.

VI References

[1] Barron, C., Yu, H., & Zhan, J., "Cloud Computing Security Case Studies and Research", Proceedings of the World Congress on Engineering, 2013, Volume II

[2] Wei Guo, Xinjun Wang, "A Data Placement Strategy Based on Genetic Algorithm in Cloud Computing Platform", 10th Web Information System and Application Conference, 2013

[3] Gowri G,Amutha.M, "Cloud Computing Applications and their Testing Methogology", International Jouranl of Innovative Research in Computer and Communication Engineering, 2014, pp. 2906-2914.

[4] Ruhi Gupta, "Review on Existing Load Balancing Techniques of Cloud Computing", International Journal of Advanced Research in Computer Science and Software Engineering, February 2014 Volume 4, Issue 2

[5] Tingting Wang, Zhaobin Liu, Yi Chen, Yujie Xu, "Load Balancing Task Scheduling based on Genetic Algorithm in Cloud Computing", IEEE 12th International Conference on Dependable, Autonomic and Secure Computing, 2014.

[6] Aarti Singh, Dimple Juneja, Manisha Malhotra, "Autonomous Agent Balancing Algorithm in Cloud Computing", International Conference on Advanced Computing Technologies and Applications (ICACTA), Procedia Computer Science 45,2015, pp 832 – 841.

[7] Wang jibin, zhao Zhigang xu , zhang Hu,Li liang,Hu and Guo ying, "I-sieve: An Inline High Performance Deduplication System Used in Cloud Storage", Tsinghua Science and Technology, 2015, pp. 17-27.

[8] Sheetal Karki, Anshika Goyal, "Performance Evaluation of Check Pointing and Threshold Algorithm for Load Balancing in Cloud Computing", International Journal of Computer Sciences and Engineering, Vol.-6, Issue-5, May 2018, pp 2347-2693.

[9] Sukhpreet Kaur, Dr. Jyotsna Sengupta, "Load Balancing using Improved Genetic Algorithm(IGA) in Cloud Computing", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET), Volume 6, Issue 8, August 2017, pp 2278-1323.

[10] WANG Bei, LI Jun, "Load Balancing Task Scheduling based on Multi-Population   Genetic Algorithm in Cloud Computing", Proceedings of the 35th Chinese Control Conference, July 2016, pp 27-29.

[11] Mr. Mayur S. Pilavare, Mr. Amish Desai, "A Novel Approach Towards Improving Performance of Load Balancing Using Genetic Algorithm in Cloud Computing", IEEE Sponsored 2nd International Conference on Innovations in Information Embedded and Communication Systems, ICIIECS'15, 2015.

[12] Keke Gai, Meikang Qiu, Hui Zhao, "Cost-Aware Multimedia Data Allocation for Heterogeneous Memory Using Genetic Algorithm in Cloud Computing", IEEE Transactions on Cloud Computing, 2015.

[13] Mahalingam, Nandhalakshmi Nithya, "Efficient Load Balancing in Cloud Computing Using Weighted Throttled Algorithm", International Journal of Innovative Research in Computer and Communication Engineering, 2015,vol.3, 5409 – 5415.