# Improved Genetic Algorithm for load balancing in Cloud Computing

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***Abstract-*** The cloud computing is the technology which has decentralized nature. Due to such unique nature of the network, load balancing is the major challenge. This research work, is based on the load balancing in cloud computing. In the previous research work, the genetic algorithm is applied for the load balancing but it is analyzed that it has high execution time and resource consumption. The improvement in the genetic algorithm is proposed which can use less number of resources for the load balancing. The proposed algorithm is implemented in MATLAB and simulation results shows that proposed in efficient in terms of various parameters

***Keywords-*** Load balancing, Genetic Algorithm, fault tolerance

## I. INTRODUCTION

Cloud Computing in nutshell is set or subset of services granting a person or organization access to computing resources like you would on a simple desktop, such resources could be application in an remote location its storage and all you could in a normal system but as they may exist on a remote location, only way for you to access them is via cloud services. User retrieved data and modified data which is stored by client or an organization in centralized data called cloud [1]. 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. In cloud computing, there is no need to know the physical location, configuration of the system which provides the service. The basic features of cloud computing are: virtualization, homogeneity, modern security, on demand scale, minimum cost software, geographic distribution service orientation [2]. One can use the application without installation and just by accessing internet user can manage their personal files at any location through cloud computing. Using feature of centralizing storage cloud computing provides more efficient computing and resource allocation, bandwidth and memory. IaaS is the technique of achieving processing, storing and run software which is given to the end customer. It is also referred as the "Resource Code" which provides resources as the services to a user. This work is done by the service provider. PaaS provides computational resources using which applications and resources can be host and developed [3]. As the name implies this type of cloud computing providers provide the development environment as a service where user can write applications and develop software. The software as a service is the capability of using applications where the applications are run on cloud infrastructure. The users use the services of these applications through internet connections. This kind of cloud offers the implementation of some specific business thread that gives specific cloud capabilities [4]. This cloud is known as a most common model of cloud computing to all clients that is an open cloud to model. 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. Such 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. This makes the private cloud more secure but less flexible considering public cloud. Hybrid cloud is collection of many clouds like private cloud and public cloud [5]. All clouds have their own unique identities, but they all are determinate as a unit. It offers standardized get to information and application. While working with private clouds sometimes we need some more storage space so we use some of public clouds this is known as cloud bursting. In this case organization will only have to pay for the extra space being consumed. 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. 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 [6]. 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. 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 methods; 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 [7]. 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.

## 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. 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] said that to assign task to a virtual machine an Improved Genetic Algorithm (IGA) can be used to maximize resource allocation at the same time maintaining optimized energy consumption and provide efficient execution time. At any time IGA ensures that ever node is balanced optimally else it defeats the purpose IGA. It must be considered that in order to achieve this it is always mandatory by design that every cloudlet is allocated to a virtual machine which is not provided by existing genetic Algorithm thus IGA exceeds in many parameters such as Energy efficiency, cost and utilization when compared to traditional genetic algorithm.

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.

Mahalingam et al. in 2015 [11] 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. Load has been uniformly distributed under the simulation results demonstrated by proposed algorithm. 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.

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.

Mr. Mayur S. Pilavare et al. in 2015 [13] 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.

## 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 populations are the virtual machine resources which are used for the task execution.
2. **Cross over value calculation:** Under the populace every chromosome x fitness value get 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.

The process of implementation can be applied in following steps:
Step 1: The network is deployed with the finite number of virtual machines.
Step 2: The cloudlets are assigned to most capable virtual machines. The virtual machines are selected which has least probabilities of failure and execution time.
Step 3: When the fault is occurred in the network, the proposed enhanced improved genetic algorithm plays the role for the selection of most appropriate virtual machine.
Step 4: The cloudlet is migrated to other virtual machine and the next cloudlet is executed by the virtual machine.

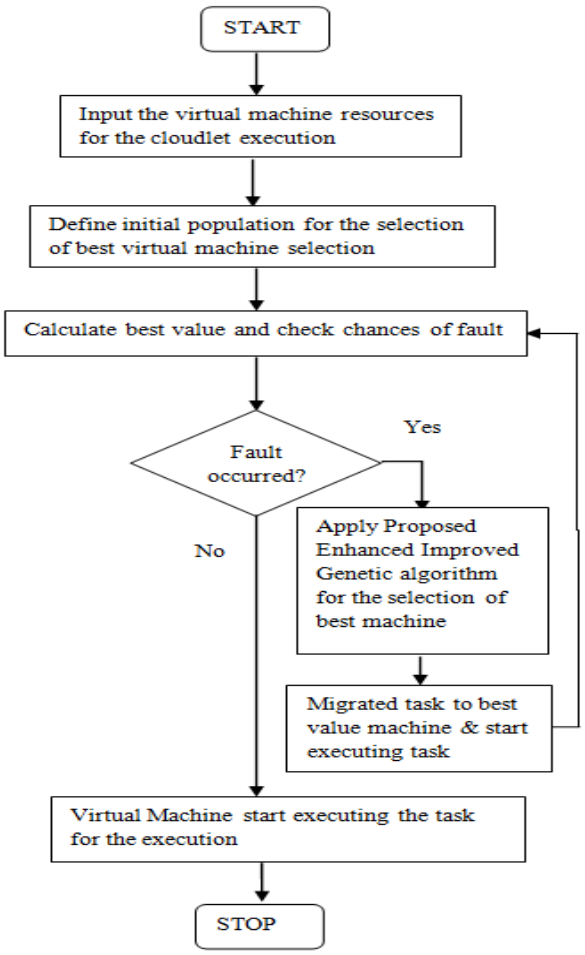


Fig.1: Flowchart of Proposed Enhanced Improved Genetic Algorithm

## IV. EXPERIMENTAL RESULTS

The proposed work has been implemented in MATLAB and the results have been evaluated in terms of several parameters.

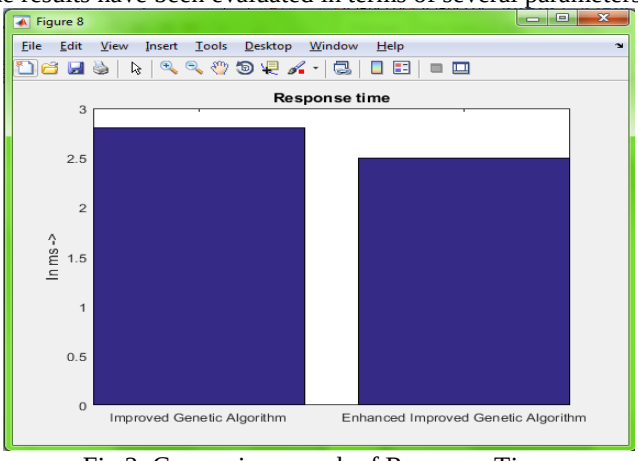


Fig.2: Comparison graph of Response Time

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.

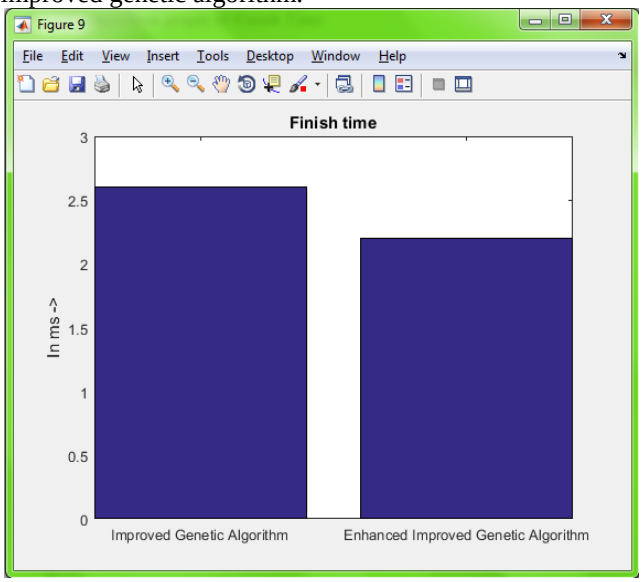


Fig.3: Comparison graph of Finish Time

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.

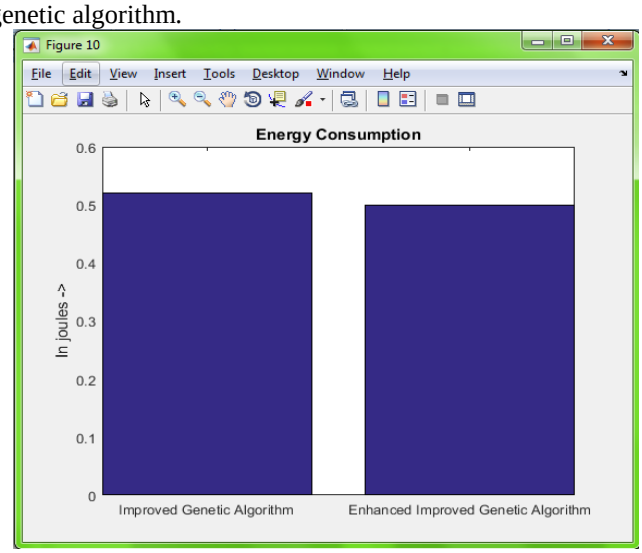


Fig.4: Comparison graph of Energy Consumption

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.

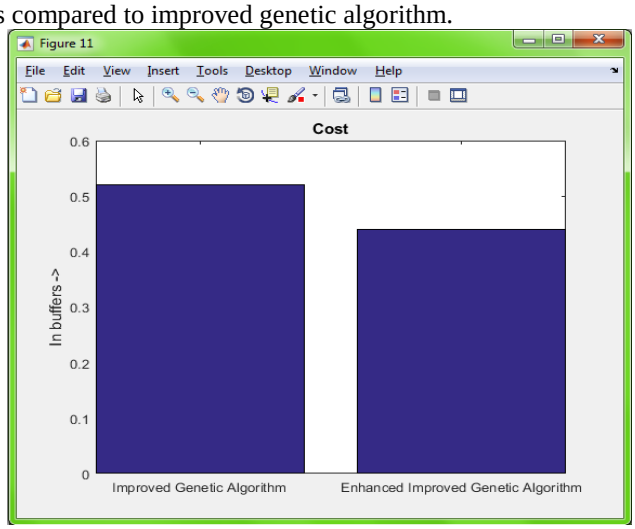


Fig.5: Comparison graph of Cost

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.

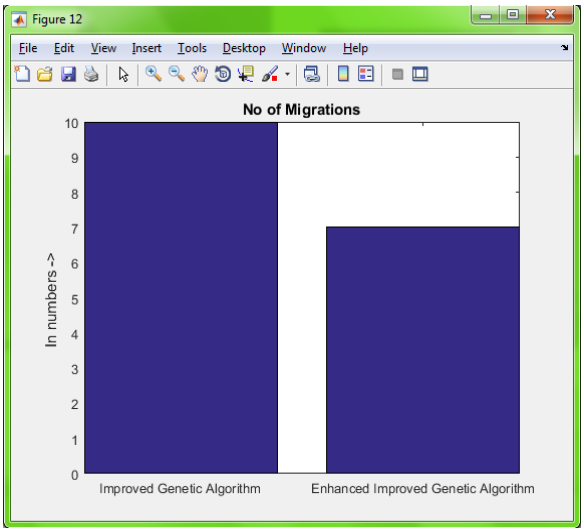


Fig.6: Comparison graph of No of Migrations

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. The algorithm that is imposed on existing work in cases when faults are detected to perform virtual machine migration is known as enhanced genetic algorithm. The complexity and the execution time of improved genetic algorithm that performs virtual machine migration are high. 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. It is concluded that the proposed enhanced improved genetic algorithm shows high performance as compared to existing improved genetic algorithm for virtual machine migration.

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