

# ***IMPROVED GA USING POPULATION REDUCTION FOR LOAD BALANCING IN CLOUD COMPUTING***

Ronak R Patel

Information Technology Department  
Sardar Patel College of Engineering  
Anand, Gujarat, India  
er.ronak@hotmail.com

Dhaval S Patel

Computer Engineering Department  
Sardar Patel College of Engineering  
Anand, Gujarat, India  
dhaval\_patel0838@yahoo.com

Swachil J Patel

Computer Engineering Department  
Sardar Patel College of Engineering  
Anand, Gujarat, India  
pswachil@gmail.com

Tushar T Desai

Computer Engineering Department  
Parul Polytechnic Institute  
Vadodara, Gujarat, India  
er.tushar.it@gmail.com

**Abstract**— Cloud computing is a new hype in computer industry, which has different thoughts by different researchers. But beyond those thoughts, cloud has some limitation also which needs to be more focused. Basically cloud is based on use par pay scenario identified by user's services. But for each and every rewarding, that services cloud needs some predefine requirement circumstances to follow which affect different parameters like response time, resource utilization, balancing load, indexing of resources as well as jobs & etc. Lots of soft computing techniques like genetic, honey bee, stochastic hill climbing, and ant colony, throttled and other algorithm are used to please those parameters to improve the scheduling of resources as well as jobs in cloud environment. Our proposed work focused on utilization of resource and response time based on genetic algorithm but we modified that genetic algorithm with the help of partial population reduction method that will help to satisfy the request of user services.

**Keywords**— *Cloud Computing; Consistency; GA; Load Balancing; PRM; RT*

## **I. INTRODUCTION**

In past ten years, cloud computing achieved lots of milestone beyond the belief. Up-till now lots of researches are done and lots are carried out which will helpful to grown up cloud limitations. We know that cloud is a interconnected high speed network which allows great facility like elasticity , on-demand resource provisioning , utilization of resource based on indexing , pay what you need and etc. But achieving this there is a roadmap which handled satisfaction of users whose concern with cloud services. Our work is focused on scheduling of jobs as well as utilization of resources in healthy formed which will help for reducing the load.

Load in cloud is be based on memory required, CPU(Virtual Machine) capacity which will helpful for completion of user job, network for connection with cloud service broker or most first delay load. Cloud is new technology based on distributed environment so sharing of work among different resource helpful to improve the utilization of ideal resources as well as getting good performance. But load balancing is a process of ensuring the uniformly distribution of work load on the pool system node or processor so without distressing, the running job is completed. Load balancing algorithm mainly defined in two natures: Static algorithm & Dynamic algorithm. In static algorithm prior comprehension of resources is required, so shifting of load not depends on current state of resources. So it's only helpful to handle low variant load. In Dynamic first derived those resources that are light weighted for allocating the upcoming load. For this real time communication with network is needed which can increase the traffic throughout network. But same as static, dynamic also check the current state of resource either they are loaded or ideal, the allocation is accomplished.

For concluding work on load balancing we followed some research which has different soft computing techniques to handle load on cloud environment [10]. Soft computing techniques which are available in cloud environment give implicit & partial results first time. In honey-bee first checks whether the system is balanced or not based on capacity of load on all the resources [2]. If system is balanced then new jobs are allocated on resources otherwise algorithm is not going to perform the scheduling & wait for balancing the system. In SHC random selection is apply and based on that selection jobs are allocated on particular resource first then store the performance of that resources for future allocation purpose [3]. In ACO first random search is applied on resources then based on that search identified which is the best resource to accomplish the jobs requirement and then allocation is done

[6]. Last but not least GA is one of the soft computing technique which is based on natural selection process focused on four main step population generation, selection, mutation & crossover [1].

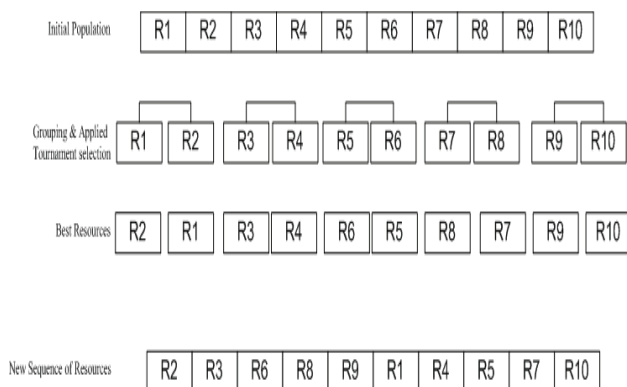
But In genetic after population generation all the chromosome either they are healthy or not they are be a part of the whole process of GA, which will increase the time as well as load on environment. So very first our proposed work is based on partial population reduction, once population is generated then applied a tournament selection scenario on that to identify the best resource at very first stage for handle upcoming load.

The objective of this paper is proposed a GA based on population reduction in cloud computing. This algorithm mainly focused on balance the load on most justified resource and also response time to complete the allocated jobs on that. The rest of paper organized by following selections: section 2 PR in GA with example. Section 3 proposed algorithm on cloud, section 4 experimental set up section 5 result analysis.

## II. POPULATION REDUCTION IN GA

Main objective of population reduction is to identify healthy chromosome from define groups. After identifying that chromosome make one set which is known as initial population for genetic process. Basically PRM is the processes to separate the finest resources based on population. Proposed work carried on R set of resources. First we have to group of that resources based on the configuration and service provided by them. Then apply the tournament selection for finding which resources are better from those groups. Then that set of resources which are fit, now generated as a new population for handling more load.

Steps of PR are shown in figure 1.



**Fig. 1. Population Reduction Method**

The After applying the PR we had a new population, then we applied GA algorithm on this new set. Next step of GA is finding a fitness value based on population, for finding the fitness value applied equation 1.

$$F(R) = [LT-TS/LT+TS]+[LT/HL]-[PS/HPS] \quad (1)$$

In equation no 1, LT means length of job in MI, PS means Processing speed of Resources in MIPS which is helpful for execution of jobs. HL mean highest length of job from job set & HPS means highest processing speed of resource from resource set.

## III. PROPOSED ALGORITHM

The proposed algorithm is focused on load balancing in cloud environment, so for that it consist in six level to identified the selection process: original population for define the chromosome, apply Population reduction method to identify best chromosome form set of population, calculate the fitness value with the help of equation no 1, then selection process is carried out for further steps of GA, next step is crossover it's just identified best fit pair of chromosome based on rearranging bits of them and get new set with good and healthy chromosome for future use, now last step is mutation, in that based on toggling of bits from 0 to 1 and 1 to 0 a new population is define for next population and new set is ready for further execution.

Proposed algorithm defined in table 1. In that proposed algorithm set of jobs and resources are created for performing the process of allocation. PRM is executed based on section 2.

**TABLE I. PROPOSED ALGORITHM**

1. Enter set of Jobs  $J = \{J1, J2, J3, \dots, Jn\}$ .
2. Enter set of Resources  $R = \{R1, R2, R3, \dots, Rn\}$
3. Initializing a population of resources based on processing speed and encodes them in to binary string like chromosome.
4. Now apply PRM.
  - a. Divide the generated Population in equal groups of N.
  - b. Then applied selection method (Tournament selection) on set of N Groups.
  - c. Gather the information from step b and choose the healthy chromosome for further GA process.
5. Now calculate fitness value of new population based on equation 1.
6. Check no of iteration are covered or not for most favorable solution:
  - a. Identified that chromosome that has lowest fitness value replace that by good fitness value and generate a new list.
  - b. Apply multipoint crossover for generating new chromosome.
  - c. Mutation is applied for define new set based on probability.
  - d. Used new identified chromosome to satisfy the process and other are moved in to next round.
  - e. Check the iteration condition.
7. Condition is satisfied then end.

#### IV. EVALUATION PARAMETER

This section is focused on that parameter who just identified the performance of the algorithm. We consider two parameters: Response Time & Consistency.

**RESPONSE TIME:** It is calculated based on how faster resource are satisfy the jobs, our proposed work mainly focused on this because we are providing the PR method for identifying good resources so that resources are handle all the upcoming jobs in effective manner which increase overall performance of system.

**CONSISTENCY:** It means to handle the over-loaded, Under-loaded & ideal resources in effective manner so that all resources are utilized properly and give the consistent allotment.

#### V. EXPERIMENTAL RESULTS

Improved GA using PR gives superior and satisfactory results. Proposed work mainly identified that resource that has excellent population rather than other and only gives them priority to complete the jobs as soon as possible. It's also handling the overloaded resource and transfers that load to ideal but those who are selected after PRM. For examine our proposed work we used cloudsim simulator for checking the allocation as well as load on resources [9]. Once resources are entered into cloud simulator then first population is define then on that population PRM method is applied and then after completion of all the jobs it will give the response time of the resource to satisfy the jobs. For checked we take 100 jobs with large data and perform proposed algorithm on different range of resources.

#### VI. CONCLUSION

Load balancing is key problem in any distributed system that area is needs more focus for research. There are lots of soft computing techniques are there, we applied all that technique and identified that all that techniques either provide random selection or natural selection, so in that case those resources are also consider who has no capability to handle the jobs. That makes overburden on the cloud environment. Our proposed work is only focused that resource who are capable to handle jobs in valuable way and also identified overloaded resources and their replacement. This algorithm needs to be further improved by different selection methods which are helpful to handle resources.

#### REFERENCES

- [1] G. Eason, B. Noble, and I.N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," *Phil. Trans. Roy. Soc. London*, vol. A247, pp. 529-551, April 1955.
- [2] Dinesh Babu L D, P.Venkata krishna, "Honey bee behavior inspired load balancing of tasks in cloud computing environments" *Applied Soft Computing* Volume 13 Issue 5, Elsevier, May 2013 ,Pages 2292-2303.
- [3] Brotoji Mondala, Kousik Dasgupta, Paramartha Dutta, "Load Balancing in Cloud Computing using Stochastic Hill Climbing-A Soft Computing Approach", in *Elsevier*, 2012, pp. 783 – 789.
- [4] Rajveer Kaur, Supriya Kinger, "Enhanced Genetic Algorithm based Task Scheduling in cloud computing", *International Journal of computer Application*, Volume 101-No.14, September 2014, (0975-8887).
- [5] Chun-Yan LIU, Cheng – Ming ZOU, Pei WU, "A task Scheduling algorithm based on genetic algorithm and ant colony optimization in cloud computing", *13th International Symposium on Distributed Computing and Applications to Business, Engineering and Science*, IEEE, 2014, 978-1-4799-4169-8/14.
- [6] Santanu Dam, Gopa Mandal, Kousik Dasgupta, and Paramartha Dutta "An Ant Colony Based Load Balancing Strategy in Cloud Computing" *2014 Advanced Computing, Networking and Informatics-Volume 2*, Springer International Publishing Switzerland.
- [7] Shridhar G.Domanal, G.Ram Mohana Reddy "Load Balancing in Cloud Computing using Modified Throttled Algorithm" : Department of Information Technology National Institute of Technology Karnataka Surathkal, Mangalore, India
- [8] Sheeja Y S, Jayalekshmi S "Cost Effective Load Balancing Based on honey bee Behaviour in Cloud Environment" *2014 First International Conference on Computational Systems and Communications (ICCCS)* | 17-18 December 2014 | Trivandrum.
- [9] Rodrigo N. Calheiros, Rajiv Ranjan, Anton Beloglazov, C'esar A. F. De Rose and Rajkumar Buyya1, "CloudSim: a toolkit for modeling and simulation of cloud computing environments and evaluation of resource provisioning algorithms"
- [10] Aayush Agarwal, Manisha G, Raje Neha Milind, Shylaja S S "A SURVEY OF CLOUD BASED LOAD BALANCING TECHNIQUES", in *Proceedings of Int. Conf. on Electrical, Electronics, Computer Science & Mechanical Engg*, April-2014.

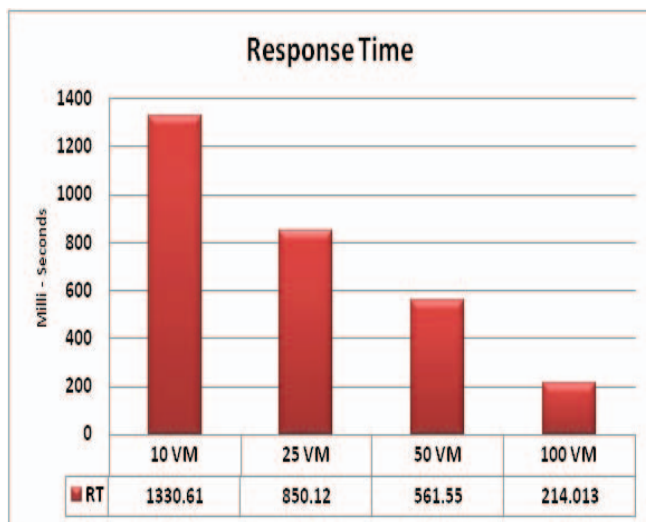


Fig. 2. Experimental Results