Survey on Load Balancing in Cloud Computing using Optimization Techniques

Meenakshi Priya[1#] Ben Sujitha[2#]

[#1] *PG scholar, Department of CSE,*

Kalasalingam Academy of Research and Education, Krishnakoil, India, priyaa0320@gmail.com

[#2] *Associate Professor, Department of CSE,*

Kalasalingam Academy of Research and Education,Krishnakoil,India, bensujitha.b@klu.ac.in

Abstract— Cloud computing is a web based technology which follows pay per use model that provides services includes software and hardware on demand. One of the major concerns of cloud computing is load balancing which disturb the workload among host in cloud data center. Since Cloud computing offers the pools of resources, load balancing become a prominent issue in cloud computing. Load balancing aims to increase system performance and resource utilization. Many research works have been proposed to implement load balancing techniques that disturb workload among the host aids in increased throughput, minimizes the migration time and service downtime. This paper discusses some of the existing algorithm proposed by researchers to solve the problem of load balancing in cloud computing.

Keywords—Load Balancing, Optimization Technique, Cloud computing, Ant Colony, Honey Bee, PSO, GA

I. INTRODUCTION

In recent years, cloud computing has become a prominent technology which provides services for user on demand over internet. Cloud computing is the collection of virtual servers that provides resources to user on pay per use. The main aim of cloud computing is to reduce operational cost and capital cost by sharing resources such as SaaS (Software as a Service), IaaS (Infrastructure as a Service), PaaS (Platform as a Service) over internet where the end user doesn't need to install and configure the software/hardware that required. Figure 1 shows the outline sketch of cloud computing environment.

A. Cloud Deployment Model

Cloud computing provides computing services which are deployed as public, private, community and hybrid cloud.

(a) Public cloud

The public cloud infrastructure is developed, owned and managed by cloud service providers. The cloud computing resources are accessed by public at free of cost or minimal charge. security has become the drawback of public cloud.

(b) Private Cloud

The private cloud infrastructure is organized and managed by a single organization and computing resources are access by the employee of the organization. Since the resources are accessed only by the employees of the

organization, security has become the important boon of private cloud.

(c) Hybrid Cloud

Hybrid cloud is the combination of public and private cloud. when private cloud computing resources are exhausted, the user can access the resources from public cloud. This method of accessing resources is called as cloud bursting.

(d) Community Cloud

The Community cloud infrastructure is organized, managed and accessed by specific community people.

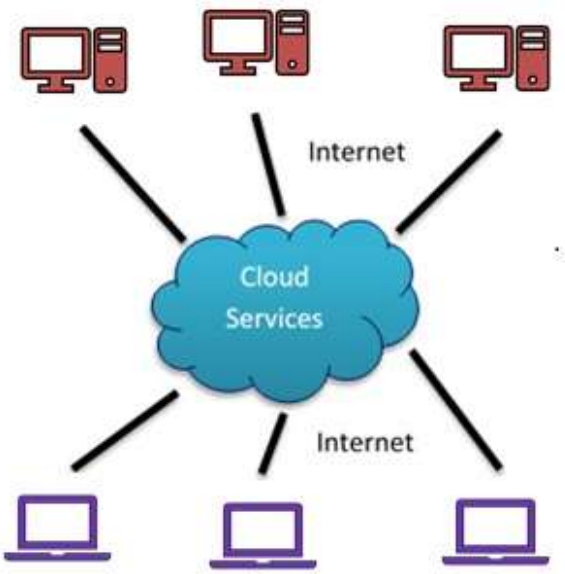

Figure: 1. Cloud Computing Environment

B. Cloud Delivery Model

Cloud computing resources are delivered in various form which comprises of IaaS (Infrastructure as a Service), SaaS (Software as a Service) and PaaS (Platform as a Service).

(a) Infrastructure as a Service (IaaS)

Cloud provides the virtual resources data center, virtual machine, virtual devices over the internet. companies can use of resources with eliminates the work of installation in their system.

(b) Software as a Service (SaaS)

Cloud provides application software, database and other third-party software over the internet.

(c) Platform as a Service (PaaS)

Cloud offers complete application deployment environment which includes execution runtime, database, operating system and deployment and development tools.

II. LOAD BALANCING

The most important characteristics of cloud computing is scalability. Day by day cloud users is getting increased where they access the computing resources through web by sending requesting that may variation in load. Load balancing is a remarkable module of cloud computing. It is a process of rescheduling the load from an overloaded machine to underloaded machine which improves the performance of the system and maximize the resource utilization. Figure 2 shows the overview of load balancing scenario.

Depending upon the initiators, load balancing algorithm can be divided into 5 main categories:

1. Sender initiated – Load balancing algorithm is initialized by sender.
2. Receiver initiated – Load balancing algorithm is initialized by receiver
3. Symmetric – Algorithm involves both sender and receiver
4. Static - Algorithm doesn't rely upon the system's current state
5. Dynamic – Algorithm rely upon the system's current state.

The qualitative metrics for achieving load balancing are as follows:

1. Throughput – To improve the system performance, it is necessary to achieve maximum throughput. Throughput is the total number of task have completed per unit of time
2. Overhead – To make load balancing technique work correctly, overhead should

be minimum. Overhead is the collection of inter-process component and movement of task.

3. Fault tolerance – Fault tolerance portrays the facility of a load balancing technique works uniformly despite of node failure.

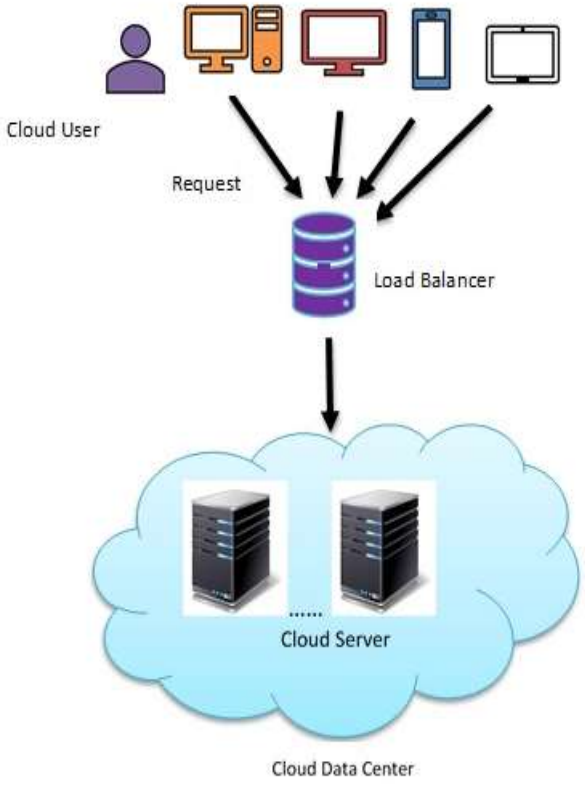

Figure:2. Overview of Load Balancing scenario

4. Migration time – Migration time is the time take to transfer the task/load from one host/node to another. Minimum migration time gives the utmost efficacy of the system.
5. Response time – Time taken to respond to the request by the load balancing algorithm. Response time should be minimum for achieving high efficiency.
6. Resource utilization – It is used to check whether the resources are utilized in efficient manner.
7. Performance – performance is used to check the efficiency of system

III. Optimization Techniques for Load Balancing

Many Optimization techniques are developed for load balancing which provides an optimal solution by considering single or multi-objective parameters. Few optimization techniques for load balancing are discussed below:

(a) Genetic Algorithm (GA)

Genetic Algorithm [14, 15] inspired by the mechanism of natural selection and developed by John Holland. It provides a pool or population of workable solutions to a given problem and NP-Hard problem.GA randomly initializes the population and parent is selected by applying fitness function to the population. Then it applies crossover and mutation to generate new off-spring and new off-spring replaces the individuals in the population until the best solution is obtained [15].

(b) Ant Colony Optimization (ACO)

Ant Colony Optimization (ACO) [16] is a novel nature-inspired metaheuristic proposed by M.Dorigo for hard combinatorial optimization problems. The Algorithm [17] is based on the behaviour of ant finding the path between the nest and food. Ant starts seeking the path from the nest to source of food and source of food to nest. When one ant finds the path where the food is located then the other ants will start following the ant thus by forming a single path which provides the best solution [17].

(C) Particle Swarm Optimization (PSO)

Particle Swarm Optimization [12,13] is swarm Intelligence computational algorithm proposed by Kennedy and Eberhart which inspired by the behaviour and movement dynamic of birds and fish. The main advantage of PSO is an efficient algorithm which use very few parameters and very simple to implement. PSO works on the principle of bird

flocking. A group of particles is initialized, and fitness function is applied to each particleto obtain global best and local best value. Each particle updates its velocity and position by fitness function until optimal solution is obtained.

The pseudo code of PSO as follows [17]:

Initialize the population randomly
While(Population Size)
{
Loop
Calculate fitness
If fitness value is better from the best fitness value(Pbest) in history then
Update Pbest with the new Pbest
End loop
Select the particle with the best fitness value from all particles as Gbest
While maximum iterations or minimum error criteria is not attained
{For each particle Calculate particle velocity Update particle position
Next
} }

(d) Honey Bee Algorithm

In Nature, [18] Bees looks for food by exploring the fields of their hives and they collect, accumulate the food for later use by other bees. The aim of the honey bee algorithm is to create a multi-agent system (group of bees) that will provide the solution for combinatorial optimization problems [18]. The two steps in honey bee algorithm as: foraging and waggle dancing. Foraging is the solution generation phase, while the role of the waggle dance (the information exchange phase) is to examine quality of the existing solutions and direct the generation to the new ones [18].

IV. RELATED WORKS

Veenita Kunwar et all [1] surveyed and discussed the existing load balancing techniques and done a comparative analysis based on the load balancing parameters.

Acharya et all [2] proposed a cloud load balancing policy based on swarm Intelligence Ant Colony Optimization which aims to minimizes the makespan.The proposed approach monitored and collected the node information periodically. VMs are identified and grouped as under loaded, overloaded and balanced VMs based on the load information. Ant calculated the probability based upon the rules and load information and balance the load by migrating the task to destination VMs. The proposed approach is simulated in cloudsim.

Walaa Hashem et all [3] presented Load Balancing Algorithm based on Honey Bee behavior (LBA_HB) which share the workload in order to avoid underloaded and overloaded VM by schedule the request to the VM which satisfies the conditions.The proposed work is simulated in Cloudsim and result is compared with existing algorithms.

Anu et all [4] discussed various task scheduling methods based on scheduling algorithm and policy which considers many load balancing metrics such as time, cost, reliability, throughput, performance. They discussed advantage and drawback of the algorithm and mentioned their shortcomings for future development.

Jyothsna [5] projected a model based on behavior of honey bee foraging strategy which monitor the load of each VM and determine the under-loaded and over-loaded machines. Task in this methodology is taken in to account as bee and load will be equally disturbed to the best VM. The migration process will continue until the destination VM load reach threshold. The proposed method will begin the search once more if VM's threshold reached.

An Efficient Load balancing technique is proposed by Jigna et all [6] based on Particle swarm optimization Which aims to minimize the Make span by balancing the load among VMs. The Algorithm considers each task of VMs as Particle and balance the load by calculating the best and global position of each task. The proposed alogirthm is simulated in Cloudsim.

Sonalijain [7] came up with a new scheduling algorithm based on Genetic Algorithm which aims to reduce makespan and increase the efficiency of resource utilization by migrating the task over nodes. The proposed Algorithm use Dijkstra's method for reducing search space. The algorithm is simulated in cloudsim and performace is compared with Adaptive Genetic Algorithm (AGA) and Job Spanning and Load Balancing Genetic Algorithm (JLGA).

Shyam et all [8] proposed a Load balanced Min-Min (ILBMM) algorithm based on genetic Algorithm which consider larger task in order to minimize the makespan.In the proposed method, Min-Min algorithm performed to select the task with minimum execution time from the heaviest loaded node and rescheduled the task to improve the efficiency of resource utilization.

Anureet et all [9] proposed a technique based on Honey Bee algorithm which balance the load between the tasks by considering QoS parameters.The aim of this paper is to maximum throughput by calculating the CPU time and communication cost.

Dynamic Adaptive Particle Swarm Optimization algorithm (DAPSO) has been implemented by Ali et all [10] which improves the performance of PSO algorithm that aims to minimizes makespanand increase the utilization of resources. The proposed method combines PSO and cuckoo search Algorithmto optimize the task run time by improving the population. They compared the performance of DAPSO with the existing algorithm.

Shahrzad et all [11] came up with a Load Balancing technique which migrates the extra task from an overloaded VMs to the under loaded VMs by applying endocrine and PSO technique. The proposed technique finds the best trade off among VM which aims to minimize the time span during the transfer of extra task and simulated in CloudSim.

V. CONCLUSION

Load balancing has become a major concern in cloud computing. Load balancing is the concept of sharing the workload among the nodes in cloud data center that aims to improve the performance, increase the throughput, reduce the overhead and efficient utilization of resources. Many research works have been proposed by researcher for efficient load balancing based on different parameters which includes migration time, cost, performance, and throughput. In this paper we have discussed few existing techniques for load balancing for efficient utilization of resources which improves the system performance.

REFERENCES

[1] VeenitaKunwar,NehaAgarwal,Ajay Rana and J.P.Pandey, "Load Balancing in Cloud – A Systematic Review" , Advances in Intelligent system and computing,654, Springer,2018.

[2] Acharya Mitali Nilesh, Prof. Chirag A. Patel, "Load Balancing In Cloud Computing Using Ant Colony Optimization", International Journal of Computer Engineering & Technology (IJCET), Volume 8, Issue 6,2017.

[3] Walaa Hashem, HebaNashaat, and RawyaRizk ," Honey Bee Based Load Balancing in Cloud Computing", KSII TRANSACTIONS ON INTERNET AND INFORMATION SYSTEMS VOL. 11, NO. 12,2017

[4] AnuRani,Dr.Kanwal Garg ,"A Review on Task Scheduling Algorithm in Cloud Computing Environment", International Journal of Scientific & Engineering Research, Volume 7, Issue 12,2016

[5] S.Jyosthsna "Distributed Load Balancing in Cloud using Honey Bee Optimization", International journal of Emerging Trends & Technology in Computer Science (IJETTCS),Volume 5,Issue 6,2016

[6] Jigna Acharya, Manisha Mehta, Baljit Saini, "Particle Swarm Optimization based load balancing in cloud computing", International Conference on Communication and Electronics Systems (ICCES),2016.

[7] Sonali Jain," Task Scheduling in Cloud Computing Using Genetic Algorithm", International Journal of Computer Science Engineering and Information Technology Research (IJCSEITR), Vol 6, Issue 4,2016.

[8] ShyamsinghrajputVirendrasinghKushwah,"A Genetic based Improved Load Balancing Min-Min Task scheduling Algorithm for Load Balancing in Cloud Computing", International Conference on Computational Intelligence and Communication Networks,2016.

[9] Anureetkaur, Bikrampalkaur ,"Load Balancing in tasks using Honey Bee Behavior Algorithm in Cloud Computing",IEEE,2016.

[10] Ali Al-maamari,Fatma A.Omara,"Task Scheduling using PSO Algorithm in Cloud computing Environments", International Journal of Grid Distribution Computing ,Vol 8,No 5,2015

[11] ShahrzadAslanzadeh,ZenonChaczko,"Load Balancing Optimization in Cloud Computing : Applying Endocrine-Particle Swarm Optimization: ,IEEE ,International Conference on Electro/Information Technology,2015

[12] https://www.mii.lt/antanas/uploads/Heuristic%20Algorithms/Lectures/Lect4/PSO2.pdf

[13] Kennedy, J. and Eberhart, R. C., "Particle swarm optimization". Proc. IEEE int'l conf. on neural networks Vol. IV, pp. 1942-1948. IEEE service center, Piscataway, NJ,1995

[14] K. F. Man, K. S. Tang,S.Kwong, "Genetic Algorithms: Concepts and Applications", IEEE TRANSACTIONS ON INDUSTRIAL ELECTRONICS, VOL. 43, NO. 5,1996

[15] https://www.tutorialspoint.com/genetic_algorithms/genetic_algorithms_tutorial.pdf

[16] Marco Dorigoa, Christian Blumb, "Ant colony optimization theory: A survey", Elsevier,2015

[17] https://en.wikipedia.org/wiki/Ant_colony_optimization_algorithms.

[18] Tatjana DAVIDOVIC ,Dusan TEODOROVI ˇ C , Milica SELMI ˇ C, " BEE COLONY OPTIMIZATION PART I: THE ALGORITHM OVERVIEW", Yugoslav Journal of Operations Research 25 Number 1, 33–56,2015.