Optimizing Load Balancing Technique for Efficient Load Balancing

Patel Bhoomi Kiritbhai[1], Nirav Y. Shah[2]
[1]*ME Student, Silver oak College of Engineering & Technology, Gota, Ahmedabad, Gujarat, India*
[2]*Asst. Prof, Silver oak College of Engineering & Technology, Gota, Ahmedabad, Gujarat, India*

***Abstract*- Cloud computing is a vigorous technology by which a user can get software, application, operating system and hardware as a service without actually possessing it and paying only according to the usage. Load balancing is a critical aspect that ensures that all the resources and entities are well balanced such that no resource or entity neither is under loaded nor overloaded. The load balancing algorithms can be static or dynamic. In this paper, an enhanced dynamic load balancer based on Swarm algorithm as load balancer has been implemented which permits the user to input the number of hosts, VMs, job requests and also the type of application to perceive priority considerations for executing the jobs. The results obtained from the proposed load balancer portrays that it is adept to achieve better performance, resource utilization, response time and load balancing than the existing load balancing process.**

***Index Terms*- Cloud Computing, Load Balancing, Swarm Based Algorithm, Evolutionary Based Algorithm**

I. INTRODUCTION

A. Cloud Computing Overview

Cloud computing is delivery of computing services like servers, storage, databases, networking, software over internet. Cloud computing offer these computing services by cloud provider. Charge for Cloud computing services based on usage, similar to how you are billed for water or electricity at home. Cloud computing service charged based on pay as you use concept. By using Cloud computing, users are able to access software and application from wherever they need, while it is being hosted by an outside party in cloud. Cloud computing means to store and access data and programs over internet instead of computer's hard drive. Example of Cloud computing are Google drive: cloud apps like Google docs, Google sheets, Google slides, Google services like Gmail, Google maps, Amazon cloud drive. Agreement between user and provider is maintained through Service Level Agreement (SLA) to avoid user's dissatisfaction.

B. *Cloud Computing Working*

We can access cloud computing through any devices like mobile, laptop, tablet, office computer which have internet access wherever we are located. We have to pay on duration of usage because cloud computing is based on pay-as-you-use concept.

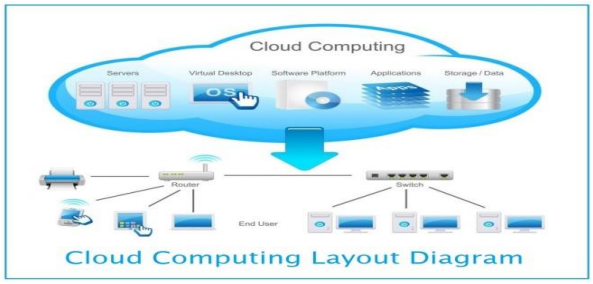

Fig.1 Cloud Computing working [15]

C. *Cloud computing deployment models:*

Cloud computing deployment models are divided into 4 parts:

1. Public Cloud:

It is available to everyone, open for all, may be free. It allows system & service to be easily accessible to general public. Ex. Google, Amazon EC2, Microsoft Windows Azure.

2. Private Cloud:

It is used by single organization. It is managed internally or by a 3rd party. It solves some security issues. Ex. Amazon VPC (Virtual Private Cloud), UEC (Ubuntu Enterprise Cloud)

3. Hybrid Cloud:

It is a combination of public & private cloud. Organization use public cloud to meet temporary capacity needs that cannot be provided by private cloud. Organization use hybrid cloud for processing big data. Ex. Windows Azure, VMware Vcloud.

4. Community Cloud:

Allow system & services to be accessible by group of organization. It is use by specific community of

consumer from organization that have shared security requirement, policy.

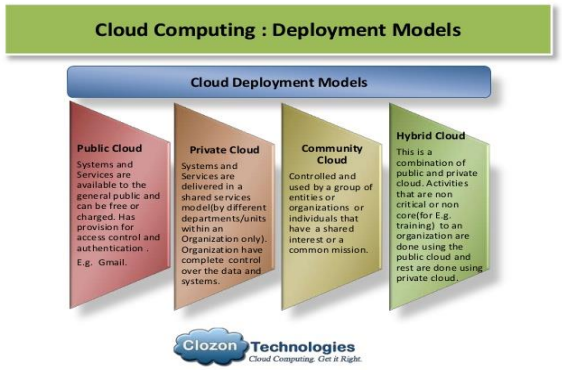

Fig.2 Cloud computing deployment models [16]

D. Cloud computing service models:

Cloud computing service models are divided into 3 parts:

1. IaaS (Infrastructure As A Service):

Flexible & innovative services are available on demand. Infrastructure presented in form of virtualization. It is used for cost saving, time saving, reuse of existing resources. It serves foundation for PaaS, SaaS. Ex. Amazon EC2 (Elastic Compute Cloud) .

2. PaaS (Platform As A Service):

Provide platform where created software is installed. Cloud provider provides development tools on their infrastructure. It allow user to change & upgrade OS. Develop & deploy new web application into cloud within minute on fixed budget. Ex. Microsoft Windows Azure, Google App Engine.

3. SaaS (Software As A Service):

It is distribution model that deliver software over internet. These software or application is called as web service. User can access SaaS application & service from any location using computer or mobile device which has internet connection. No data is lost if your computer or device breaks. Ex. Google App, Google Doc, Gmail.

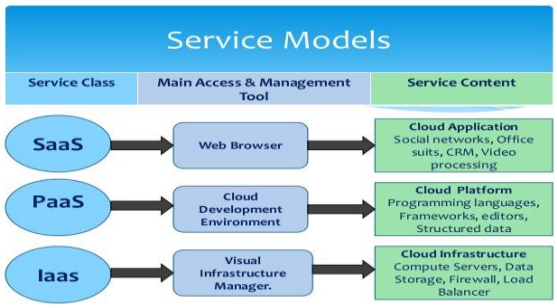

Fig.3 Cloud Computing service models [17]

II. BACKGROUND THEORY

A. Need For Load Balancing In Cloud Computing:

Cloud computing have various issues are load balancing, security and privacy, reliability, availability, portability, SLA, virtual migration etc. load balancing is an idiom for distributing workloads across multiple computing resources. Management of resources and requests in cloud environment is load balancing. Cloud service provider manages large number of user's request to provide service according to user's demand. Needs and goals of load balancing are optimize resource use, increase throughput, minimize response time, avoid overloading of single resource, cost efficiency, scalability and flexibility, fault tolerance, migration time, better performance. Important strategy for load balancing is to ensure that all computing resources are distributed efficiently and improve resource utility.

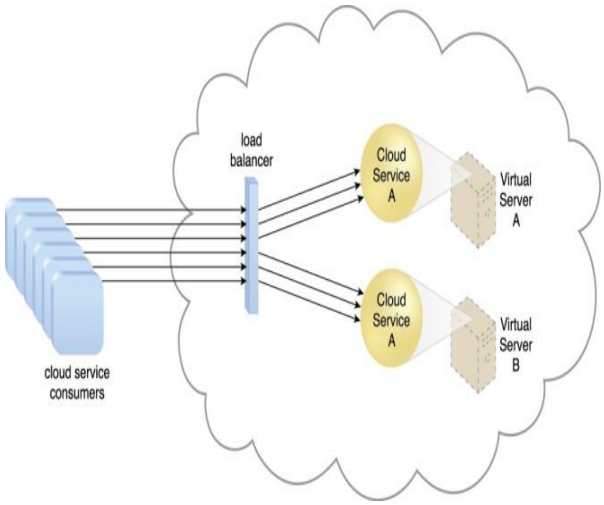

Fig.4 Load Balancing Working [18]

Load balancing have two methods: static and dynamic. Static load balancing is easy to implement with reduced performance. Dynamic load balancing is complex to implement with increased performance. So in this paper I will use dynamic load balancing method. Dynamic Load balancing means re-balance load of each processor with speed and scalability. It minimizes communication cost of application after rebalance. It monitors changes on workload and redistribute work accordingly. It uses three strategies: one is transfer. That decides on which tasks are eligible for transfer to other node for processing. Second is location. This strategy nominates a remote node to execute a transferred task. Third is

information. This is an information center for load balancing algorithm. This is responsible for providing location and transfer strategies to each node. Dynamic load balancing algorithm distributes work among processor during execution of algorithm. Its behaviour is unpredictable. It has better resource utilization. It is more reliable than static. It is easy to estimate execution time and more efficient. It has higher run time complexity.

B. Virtual Machine(VM) :

Virtual Machine (VM) is based on computer architectures and provides functionality of a physical computer. In computing, a VM is an emulation of a computer system. Their implementations may involve specialized hardware, software, or a combination. Every VM has virtual devices that provide the same functionality as physical hardware and have additional benefits in terms of portability, manageability, and security. In VM world OS actually running on your computer is called host and any OS running inside VM is called guest. Two types of VM are present in cloud computing: System VM, Process VM. System VM provide substitute for a real machine and provide functionality needed to execute entire OS. Process VM designed to execute computer programs in a platform-independent environment.

III. RELATED WORK

There have been many papers published by the researchers across on load balancing in cloud. Here, we have considered some of the papers of interest to understand and exploit their findings and the success.

Jitendra Bhatia et. al [1] have proposed load balancing scheme named HTV algorithm. Steps for this algorithm are: Node information queue contain information about node like free space, performance detail etc. these information would be gathered by sending request on cloud node queue would be updated dynamically from available response. For better performance HTV algorithm consider two parameters: one is load on server in that node having more free resources will able to handle more requests easily without decreasing its performance. Another is current performance of server in that request send to node at regular interval and in response, performance parameter is measured.

R. Sundar Rajan et.al [2] developed fire fly algorithm for load balancing in cloud computing. This algorithm serves better purpose of workflow scheduling than other swarm based algorithm. This algorithm is mainly based on execution time while other algorithm care only about execution cost. This algorithm stands on the point that they reduce execution time which in turn reduces execution cost.

Er. Sahil Sharma et.al [3] developed PSO for load balancing in cloud computing. They compare proposed algorithm with shortest job first in homogeneous environment of VM. Total execution time is decreased by varying communication between resources and execution time of compute resource using priority scheduling technique. PSO is responsible for balance load on compute resource by distributing task to resources which are available.

Madhurima Rana et.al [4] developed GA that focus on balanced load, QOS requirement, energy consumption, task scheduling depends on homogeneous system, minimal cost, find best fit solution. By using historical information GA exploits the best solution. GA uses to repeat three steps: selection, crossover and mutation. This algorithm solves execution time and cost parameter.

Madhurima Rana et.al [4] developed ACO that focus on minimize make span, balance load, highly efficient, improve ability to balance load. Ants perform different difficult tasks reliably and consistently. This algorithm solves issue of balance load of system and schedule tasks.

Kumar Nishant et. al [5] developed a modified loading balancing scheme based on Ant Colony Optimization (ACO) with the intention to improve the efficiency. In their approach they have considered both the forward and the backward movements of ants along with measures to limit the number of ants to improve the performance. They performed pheromone updating using foraging pheromone and trailing pheromone in order to achieve better load balancing on the nodes. This algorithm provided similar results in normal Conditions but proved to be more efficient in special situations since the ants continuously update a single set rather than updating their own set.

Randles et al. [6] proposed Biased Random Sampling, Foraging Behaviour and Active Clustering load balancing, inspired by the honeybee load balancing technique. Their proposed algorithm was developed for a cloud environment with heterogeneous nodes, but simulated on a small scale system.

Round robin and throttling based load balancing was proposed by Wickremasinghe et al. [7]. In their approach, they studied application behaviour in a

large scale distributed cloud computing environment by the use of simulations.

Babu Kr et.al[8] developed BCO that focus on VM gets overloaded when too many request are come to the data center. So at that time it needs to be migrating. Algorithm solves improvement of QOS, reduce makespan, reduce migration and good performance.

Pooja Samal et al (2013) [9] proposed R-R (round-robin) algorithm for balancing the load of cloud service provider. Here the author has analyzed various policies utilized with different algorithm for load balancing using a tool (cloud analyst) for improving the server's performance.

Comparison Table for Static and Dynamic load balancing algorithm:

Algorithm	Merits	Demerits
Static load balancing	Load balancing decision made at compile time, Less complex.	Do not have ability to handle load changes at runtime.
Round - Robin	Easy to understand	Larger task take long time
Min-Min	Small task gives best result	Machine & task variation can't be predicted
Max-Min	Better work	It takes long time to complete task
Dynamic load balancing	Distribute work at run time	Need constant check of node, More complicated.
Honey Bee	Increases throughput, Minimize response time	High priority task can't work without virtual machine
Ant colony	Independent task perform	Take longer time to complete task

Table 1: comparison table for load balancing algorithm

IV. PROBLEM DESCRIPTION

A. Honey bee algorithm:

Honey bee algorithm had been initially proposed for numerical optimization. It employs only 3 control parameters (Population size, Maximum cycle number, Limit) that are to be determined by user. Population size is number of food source in population. Maximum cycle number (MCN) is maximum number of generation. Limit determines number of allowable generation. It provides good solution for MR brain image classification and estimation of face pose. It also provides simplicity, flexibility, robustness. It is also used for decision making process like image processing, for scheduling, in pattern recognition, in engineering design to solve environmental or economics problems.

Group decision making process used by bees for searching out best food sources among various solutions is example of swarm based decision method. Bee use waggle dance to communicate and dance performed by scout bees to inform other foraging bees about nectar site. Scout bee is a navigator and foraging bee is a collector of food. Waggle dance is a communication method used by bees to inform other bees about food resources and location of nest site. Waggle dance gives precise information about quality, distance, direction of flower patch. Numbers of runs indicate distance and angle of run indicate direction. It is assumed that there is only one artificial employed bee or queen bee for each food source. Number of employed bee in colony is equal to number of food sources around the hive. Queen bee observed the execution process and performance of all bees. As per order of queen bee all scout bees are started to finding honey source and after finding source they do waggle dance. By showing dance, foraging bee started to run on that way for collecting honey. If quality of honey is high than capacity of foraging bee to collect honey than queen bee decide to send extra bees on that source.

In cloud computing environment servers are bees, web applications are flower patches, advert board is used to simulate a waggle dance. Each server is either scout or forager. Advert board is where servers successfully fulfilling a request or may place adverts. I used honey bee algorithm for improving load balancing schema than existing system.

B. Round Robin Algorithm:

Round-robin load balancing is one of the simplest methods for distributing client requests across a group of servers. Going down the list of servers in the group, the round-robin load balancer forwards a client request to each server in turn. When it reaches the end of the list, the load balancer loops back and goes down the list again. The main benefit of round-robin load balancing is that it is extremely simple to implement.

The user is always sure that the request processing will be simpler and faster when round robin is working for the Load Balancing goal. Because of these feature there has been lot of research carried out to improve performance of this algorithm. Processors are assigned to each process in a circular order without any sort of priority and hence there is no starvation. This serves the advantage of fast response in the case of equal workload distribution amongst processes. Throughput is low as the large process is holding up the Central processing unit for execution. The main advantage of Round robin is to remove starvation. Queuing is done without using any prioritization of the processes.

I will use hybrid algorithm that is combination of evolutionary and swarm based algorithm. I will use round robin algorithm that is evolutionary and honey bee algorithm that is swarm based algorithm. I will use basic steps of round robin algorithm and to solve fuzzy technique problem of round robin algorithm I will combine modified honey bee algorithm with it. Basic honey bee algorithm does not provide priority task that problem I will try to solve in hybrid algorithm.

V. CONCLUSION

I have read & reviewed many papers to understand different load balancing algorithm in cloud computing. There are approaches that supposed my research for better results. I will try to combine evolutionary and swarm based algorithm for balancing proper work load in cloud computing environment. I will try to make hybrid algorithm which is combination of round robin and honey bee algorithm. Hybrid algorithm gives better expected outcome than existing system.

REFERENCES

[1] Jitendra Bhatia,Tirth Patel, Harshal Trivedi,Vishrut Majmudar, ”HTV Dynamic Load Balancing Algorithm for Virtual Instances in Cloud”, Proceedings of IEEE International Symposium on Cloud and Services computing. 2012

[2] R. Sundar Rajan, V. Vasudevan, S.Mithya,” Workflow Scheduling in Cloud Computing Environment Using FireFly Algorithm” Proceedings of IEEE 2016

[3] Er. Sahil Sharma, Er. Manoj Agnihotri,”Execution Analysis of Load Balancing Particle Swarm Optimization Algorithm in Cloud Data Center” IEEE 2016

[4] Madhurima Rana, Saurabh Bilgaiyan, Ustav Kar,”A Study on Load Balancing in Cloud Computing Environment Using Evolutionary & Swarm Based Algorithms” IEEE 2014

[5] Kumar Nishant, Pratik Sharma, Vishal Krishna, Chhavi Gupta, Kuwar Pratap Singh, Nitin and Ravi Rastogi, “Load Balancing of Nodes in Cloud Using Ant Colony Optimization”, Proceedings of 14th IEEE International Conference on Modelling and Simulation, pp. 3-8, 2012.

[6] M. Randles, D. Lamb, and A. Taleb-Bendiab, “A comparative study into distributed load balancing algorithms for cloud computing,” in Advanced Information Networking and Applications Workshops (WAINA), 2010 IEEE 24th International Conference on, 2010, pp. 551-556.

[7] Wickremasinghe, R.N. Calheiros, and R. Buyya, “Cloudanalyst: A cloudsim-based visual modeller for analysing cloud computing environments and applications,” in Advanced Information Networking and Applications (AINA), 2010 24th IEEE International Conference on, 2010, pp. 446-452.

[8] Babu Kr, Joy Aa, Samuel P,”Load Balancing of Tasks in Cloud Computing Environment Based on Bee Colony Algorithm”In 2015 Fifth International Conference On Advances In Computing And Communications(Icacc)2015 Sep 2(Pp. 89-93).IEEE.

[9] Pooja Samal and Pranat i Mishra , " Analysis of variant s in Round Robin Algorithms for load balancing in Cloud Computing " , International Journal of Computer Science and Information Technologies, Vol. 4 (3) , 2013, 416-419 .

[10] Klait hem Al Nuaimi, Nader Mohamed, Mariam Al Nuaimi and Jameela Al-Jaroodi, "A Survey of Load Balancing in Cloud Comput ing: Challenges and Algorithms", Second IEEE Symposium on Net work Cloud Computing and Applications, 2012, pp. 137-142

[11] Dhinesh Babu L. D. and P. Venkata Krishna, "Honey bee behaviour inspired load balancing of t asks in cloud comput ing environment s", Applied Soft Computing, Elsevier, Vol. 13, No. 5, 2013, pp. 2292–230.3

[12] Wang Xiaochuan,Ye Chaoqun, Jin Shiyao, "A new cluster architecture based on distributed schedule mechanism" [J]. Computer Engineering, 2002, 28 (3): 131~ 133

[13] Chan-Ik Park,Tee-Young Choe,"An optimal scheduling algorithm based on task duplication",IEEE Trans.on Computers,v01.51, no.4,Apr.2002,PP.444-448.

[14] LiuYuanYuan, a., GaoQing, "the load equilibrium method of virtual resource in virtual computing environment" [J]. Computer engineering. 2010,36 (16) : 30-32

[15] www.informationq.com/wp-content/uploads/2015/04/cloud-computing-layout-diagram.jpg

[16] image.slidesharecdn.com/cloudreviewin-111201094644-phpapp01/95/cloud-computing-overview-iaas-saas-paas-and-its-benefits-8-638.jpg?cb=1361444159

[17] www.devteam.space/blog/wpcontent/uploads/2017/07/Cloud-Models.jpg

[18] cdn.ttgtmedia.com/ITKE/uploads/blogs.dir/113/files/2013/07/Cloud-service-consumers.jpg