Improved the Performance of Load Balancing In Scientific Cloud Environment

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Abstract - The efficiency and utility of cloud computing based on scheduling and balancing of load over cloud computing. The load balancing is important factor regarding the performance of cloud computing. In this paper used particle swarm optimization technique for the balancing of job in cloud environment. The nature of dynamicity of particle of swarm optimization supports the concept of dynamic load balancing technique. The maximum search space gives the more searching capacity of job scheduling process. The particle swarm optimization technique gives the two comparative job allocation processes in terms of local best and global best. The proposed load balancing policy simulated in cloud analyst software. The cloud analyst software is basically extension of cloudsim. The cloudsim simulator gives the all dedicated parameter for the allocation of job and virtual machine.

Keyword: - Cloud computing, Load Balancing, Virtual Machines (VM), PSO.

I. INTRODUCTION

Cloud computing provides much more effective computing by centralized memory, processing, storage and bandwidth. It should make sure that the tasks are not loaded heavily on one VM and also ensure that some VMs do not remains idle and/or under loaded In cloud computing technology the data and applications are maintained using the internet and central remote servers. Over the last few years Cloud Computing has been gaining immense popularity where user can pay (as you use) for software, hardware. To improve the response time of user's submitted applications so that there should be maximum utilization of available resources we use of load balancing algorithms. Load balancing methods aims to speed up the execution of applications by removing tasks from over loaded VMs and assigning them to under loaded VMs and execution of applications of resources whose workload varies at run time in an unpredictable manner.

Load balancing is the process of improving the performance of a parallel and distributed system through a redistribution of load among the processors or nodes As Load Balancing is one of the major issues related to cloud computing, the load may represent a CPU capacity, memory, network load etc. It is necessary to distribute the load equally among the nodes in a network. This results in agile and efficient performance of the system. Thereby it avoids heavily loading or under loading of nodes in a network. Load balancing can affect the overall performance of a system. Load balancing methods can be classified in two different ways Static Load Balancing Algorithms and Dynamic Load Balancing Algorithms [10].

Honey Bee Foraging Algorithm Achieves global load balancing through local server action Honey Bee Behaviour inspired Load Balancing [HBBLB] a technique which helps to achieve even load balancing across virtual machine to maximize throughput [4]. It considers the priority of task waiting in queue for execution in virtual machines. After that work load on VM calculated decides whether the system is overloaded, under loaded or balanced. And based on this VMs are grouped. New according to load on VM the task is scheduled on VMs. Task which is removed earlier. To find the correct low loaded VM for current task, tasks which are removed earlier from over loaded VM are helpful.

Biased Random Sampling In this approach the load on a server is represented as a virtual graph having connectivity with each node. Each server is symbolized as a node in the graph, with each in degree directed to the free resources

of the server. Whenever a node executes a job, it deletes an incoming edge, which indicates a reduction in the availability of free resource. After completion of a job, the node adds on an incoming edge, indicating an increase in the availability of free resource. Random sampling is used for the increment and decrement processes. The last node in the walk is selected for allocation of load instead, any other node based on certain criteria could also be preferred. A node on receiving a job, will execute it only if its current walk length is equal to or greater than the threshold value. Else, the walk length of the job under consideration is incremented and another neighbor node is selected randomly [9]. Again a new directed graph is formed and load balancing is achieved in a fully decentralized manner, thus making it suitable for large network systems like a cloud.

As a social and domestic insect, the bee is native to Europe and Africa. The bees feed on nectar as a source of energy in their lives and use pollen as a source of protein in the rearing larvae. The bee colony contains generally, a single breeding female called Queen, a few thousands of males known as the Drones, a several thousands of sterile females called Workers, and many young bee larvae called Broods. The bees share a communication language of extreme precision, based on two kinds of dances: the round dance when food is very close. They are carried out when bees search food. The bees' reproduction is guaranteed by the queen. It will mate with several males in full flight, until her spermatheca is full. The unfertilized egg will give rise to a drone, while, the fertilized egg gives rise to worker or queen depending on food quality [14].

II. LOAD BALANCING

Load balancing is used to distributing a larger processing load to smaller processing nodes for enhancing the overall performance of system. In cloud computing environment load balancing is required distribute the dynamic local workload evenly between all the nodes [11]. Load balancing helps in fair allocation of computing resource to achieve a high User satisfaction and proper Resource utilization .High resource utilization and Proper load balancing helps in minimizing resource consumption. It helps in implementing fail over, scalability, and avoiding bottlenecks.

Load balancing is a techniques that helped networks and resources by providing a Maximum throughput with minimum response time. Load balancing is dividing the traffic between all servers, so data can be sent and received without any delay with load balancing. In cloud environment many algorithms are available that helps in proper traffic Loaded between all available servers .Most of them can be applied in the cloud environment with suitable verifications. In cloud computing environment load balancing algorithms can be divided into two main groups. first algorithm type is Batch mode heuristic scheduling algorithms (BMHA) and second is online mode heuristic algorithms.

In BMHA Jobs are combined together when they are arriving in the system. The BMHA scheduling algorithm will start after a fixed time period. The examples of BMHA based algorithms are: First Come First Served Scheduling algorithm (FCFS), Round Robin scheduling algorithm (RR), Min Min algorithm and Max Min algorithm. In On-line mode heuristic scheduling algorithm, all Jobs are scheduled when they are arriving in the system. The cloud environment is a heterogeneous system and in this speed of each processor varies quickly and easily. The online mode heuristic scheduling algorithms are more appropriate and better for a cloud environment.

It is very important to estimate proper load , need to do comparison of all load , stability of all different systems, performance of purposed system, interaction between all the nodes and nature of work to be transferred while developing a load balancing algorithm . The most important thing is selecting the nodes and its also include many other ones. CPU load, amount of memory required combine together to calculate the load of machine. In our daily life example of load balancing is websites. Users could experience many Problems without Load balancing like delays, timeouts and long system responses. Load balancing is all about availability, scalability and performance of resources for critical web-based applications. Load balancing is a process of reassigning the total load to the individual nodes of the collective system of the facilitate networks and resources to improve the response time of the job with maximum throughput in the system [7]. The important things which said about load balancing are estimation of load, comparison of load, stability of different system, performance of system, interaction between the nodes, nature of work to be transferred, selecting of nodes and many other ones to consider while developing such algorithm.

III. HONEY BEE ALGORITHM

The bees algorithm is a population based search algorithm that mimics the food foraging behavior of honey bees. This algorithm starts by searching the neighborhood along with random search that is suitable for both combinatorial and functional optimization Honey bees travel over long distances in flocks looking for nectar in flowers in all directions. They coordinate their travel in such a manner that flower patches with large amount nectar will be foraged by large number of bees while the patches with less nectar are foraged by small number of bees (Honey bees are social insects living in large colonies and carry out their jobs with precise coordination with each other by communicating through movements, odor, cues and food exchanges.

At the beginning of the foraging process, scout bees are sent out on search of flower patches. These scout bees search for flower patches randomly moving from one patch to another. When the scout bees return to the hive, the ones those found a flower patch above a certain quality deposit the nectar or pollen and perform the waggle dance. This waggle dance conveys all the information necessary for other bees to explore the flower patches with the highest quality Algorithms based on the behavior of bees have been developed to solve complex optimization problems. Bees algorithm has been used in variety of fields like manufacturing, water management, wood defect classification, solving the travelling salesman problem.

The bee changes its orientation relative to the sun in order to determine distance and direction. Any deviation from this point gives the new foragers the angle towards which they should pursue. This theory of recruitment involves individual foragers indicating their floral resource in the hive by body movements which can be read by other workers which then go out in the proper direction and the proper distance to locate the same floral path. The honey bee behavior load balancing algorithm is completely inspired by the foraging behavior of honey bees. When overloaded virtual machine is found, then the task is to be removed to the under loaded virtual machine to balance the load.

IV. PROPOSED WORK

In this section discuss the proposed algorithm for load balancing in cloud computing. The proposed algorithm based on the concept of dynamic load balancing technique. The dynamic load balancing process accrued the process of scheduling based on task and resource allocation. For the allocation of task and resource used two different technique one is searching of task according to the dedicated job and other is execution of task incorporation of process. For the execution of task used particle of swarm optimization. The particle swarm optimization the load and perform the task.

The particle of swarm optimization selects the input of virtual machine load in terms of M^R theM show the value of domain machine load and R shows that Job component of R real load. The R Job content {r1, r2, r3, r4,…….rn} describe the artificial particle as population. The unique job relation of input load set the velocity of particle. If the job selection value is change then next iteration moves the update of velocity. These terms describe as, the particle's job value, Rid and its near value of particle; Rgd is a velocity value of optimization job space. The random values for job are fet1 and fet2 are used for the local and global value selection of particle, that is, to make the optimal solution. The values of c1 and c2 manage the value of velocity of Rid and Rgd in deciding the particle's next movement velocity. At that each iteration changes the velocity of swarm and creates new job subset for selection of job. The derivation of equation in (c) and (d)

$$V_{id}=W\times V_{id}+C1\times fet1\times\left(R_{id}-x_{id}\right)+C_2\times rand2\times\left(R_{gd}-X_{id}\right) \quad \ldots\ldots\ldots (c)$$

$$X_{id}=x_{id}+V_{id} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (d)$$

where w denotes the value of job matrix; Rid is the position of particle value, Rgd is the position of global value best fitness value, c1 and c2 are constants and are known as acceleration coefficients; d denotes the dimension of the problem space; fet1, fet2 are random values in the range of (0, 1). The finally optimal job is executed to data centre. Here first define the fitness constraints function for the allocation of job corresponding to virtual machine. here define the Mi is the set of virtual machine and Ri is the set of job and Lk is total load over the cloud. The fitness constraints function define as

$$L_k\left(M_{i,R_j}\right)=\frac{\left[\tau\left(M_i,R_j\right)\right]\alpha\left[\rho\left(M_i,R_j\right)\right]\beta}{\sum_{h\in lk}\left(Ml,Rj\right)^{\left[\tau\left(Mi,h\right)\right]\alpha\left[\rho\left(Ri,h\right)\right]\beta}},\ Rl\in Lk\left(Ml,Rl\right) \ldots\ldots\ldots\ldots\ldots (4.6.1)$$

Here $\tau\left(Ml,Rl\right)$ is the partial load and available virtual machine.

Here discuss the step

1. Input R1,R2…….Rn in M1,M2,……..Mn for total population
2. Map(Mi,Ri)
3. Define particle as job and distribute all in Ri
4. Do
5. For each particle do
6. For each Mi do
7. Select next job
8. End for
9. Calculate individual job cost based on formula 4.6.1
10. If estimated value Vi equal to job then
11. Load map (Mi, Ri)
12. Update the velocity of job using formula(c)
13. End if
14. End for
15. Population is empty
16. Terminate the process.

PROPOSED MODEL

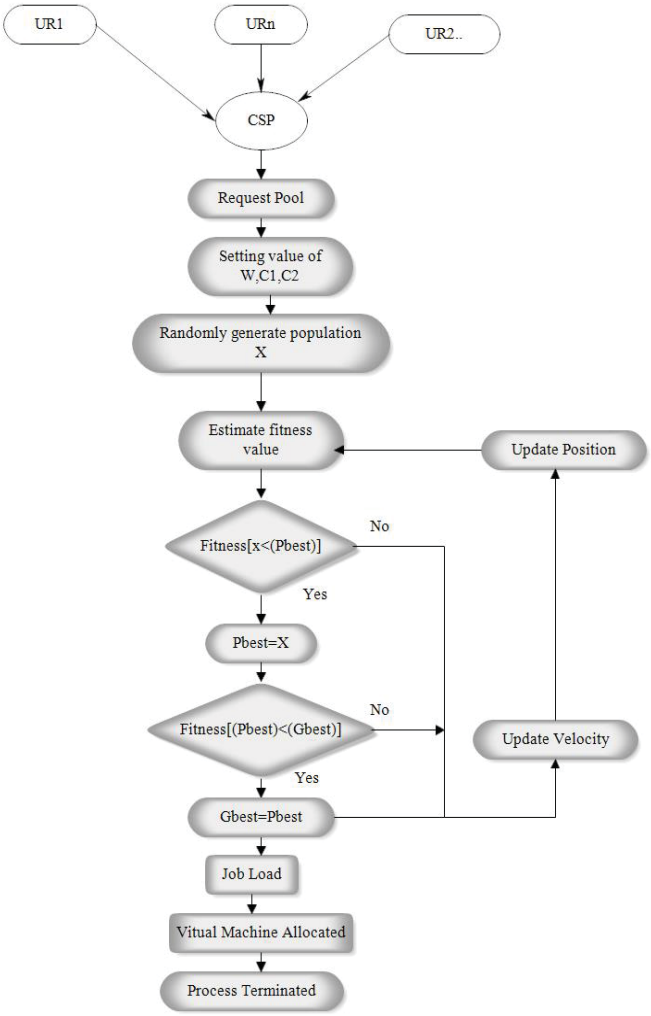

Figure 1: process block diagram of load balancing process based on PSO.

V. EXPERIMENTAL RESULT AND ANALYSIS

In this section we define the experimental results analysis with the various techniques such as RR, GA and PSO.

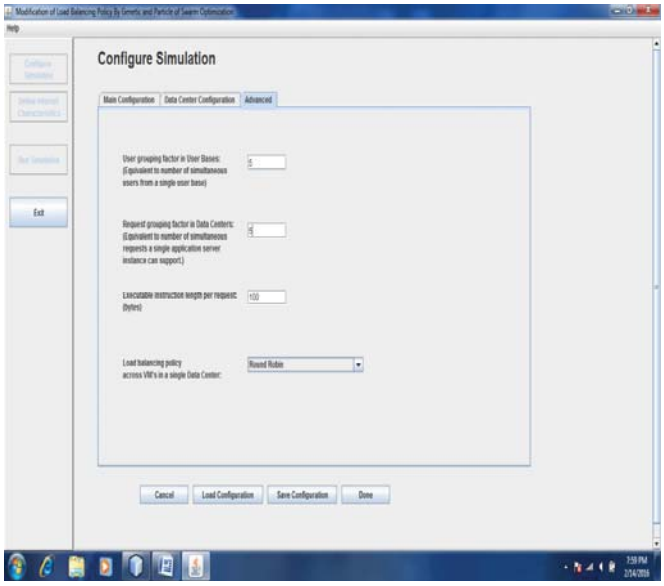

Figure 2: Shows that the Simulation window for cloud computing analyst for Round Robin methods with the input value is 5 for the experimental work.

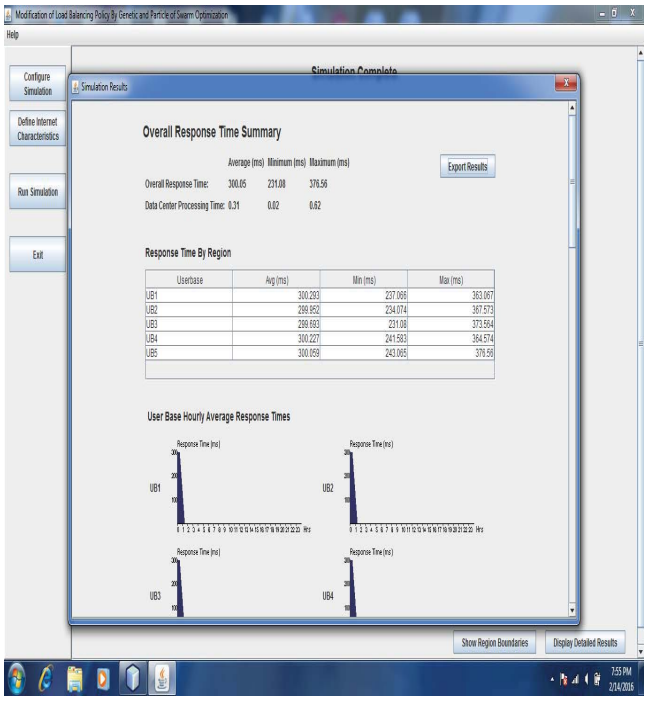

Figure 3: Shows that the result window for cloud computing analyst using Round Robin method with input value is 5.

Number of Input	Method Name	Average Time	Minimum Time	Maximum Time

5	Round Robin	0.31	0.02	0.62
	Genetic Algorithm	0.22	0.01	0.44
	PSO	0.16	0.01	0.31

Table 1: Comparative performance evaluation using Round Robin, Genetic Algorithm and particle of Swarm Optimization methods with the input value is 5.

Number of Input	Method Name	Average Time	Minimum Time	Maximum Time
10	Round Robin	0.36	0.02	0.69
	Genetic Algorithm	0.24	0.01	0.43
	PSO	0.18	0.01	0.34

Table 2: Comparative performance evaluation using Round Robin, Genetic Algorithm and particle of Swarm Optimization methods with the input value is 10.

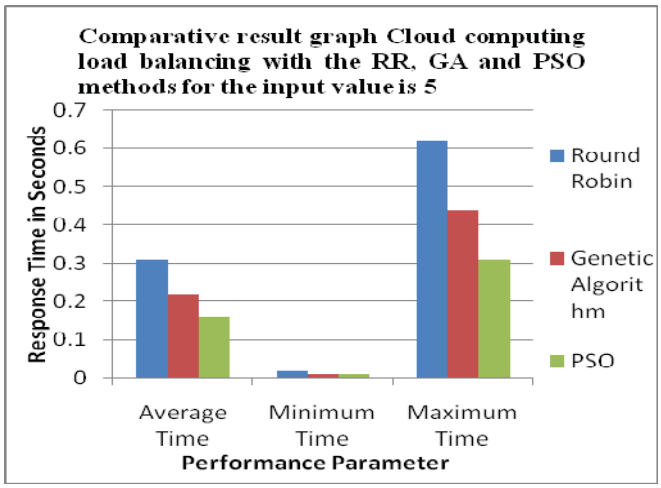

Figure 4: Shows that the comparative performance evaluation for each method with the different number of input value here the input value is 5.

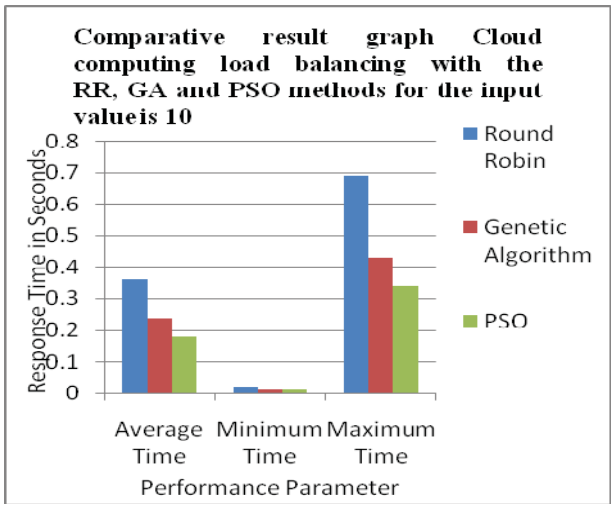

Figure 5: Shows that the comparative performance evaluation for the cloud computing load for each different number of input value here the input value is 10.

VI. Conclusion and Future Work

The efficiency of cloud based infrastructure based on load balancing factor of different component of cloud computing. For the improvement of load efficiency in cloud computing various researcher and cloud designer used swarm based job and task scheduling technique. The swarm based task scheduling technique is very efficient in compassion of old and traditional technique such and FCFS and round robin technique. In this paper used particle swarm optimization algorithm for load balancing policy in cloud environments. The particle swarm optimization set the diverse property of virtual machine and request job. The particle swarm optimization based load balancing policy is very efficient for the proper allocation of job according to dedicated virtual machine. The partial allocation of job allocation policy faced problem of minimum time span. The minimum time span factor effect the efficiency factor of particle swarm optimization policy.

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