Load Balancing of Tasks in Cloud Computing Environment Using Honey Bee Behavior

V. Ramya, S. Ranjitha, A. Sathya Sofia and P. Ganesh Kumar

Abstract--- *A cloud is built up of numerous physical machines and stores the data and disseminated resources in the open environment. Every physical machine runs multiple virtual machines for providing services to end users .Load balancing is one of the main challenges in cloud computing which is required to distribute the dynamic workload across multiple virtual machines(VMs) to ensure that no single virtual machine is overloaded and no single virtual machine is under loaded. The load has to be balanced to achieve optimal utilization .In this paper we proposed a method to achieve well balanced load across virtual machines for maximizing the throughput using honey bee foraging behavior. The experimental results show that our approach illustrates that there is a significant improvement in average execution time and reduction time in waiting time of tasks in queue.*

Keywords--- *Cloud Computing, Virtualization, Load Balancing*

I. INTRODUCTION

CLOUD computing is an emerging computing paradigm .This phrase is used in reference to network based services which appear to be provided by real hardware and are in fact served by virtual hardware simulated by software running on one or more machines. such virtual machines(VMs) do not physically exist and can therefore be moved around and scaled up and down without affecting the end user. cloud computing encompasses any subscription-based or pay –per-use service . Virtualization is one of the fundamental technologies that makes cloud computing work. This is a software implementation of computer on which different programs can be executed as in the real machine.

Virtualization is a part of cloud computing, because different services of cloud can be used by user. All these different services are provided to end user by remote data centers with full virtualization or partial virtualization manner.

Load balancing is one of the central issues in cloud computing [2] . Applications run inside VMs and VMs run on physical or virtual hosts. After the initial provisioning ,when a VM runs it consumes computational resources. This requirement could change with time. Therefore at run time we may need to move VMs around to other hosts so that no VMs would starve for Computational resources. It also ensures that every computing resource is distributed efficiently and fairly. Hence, improving resource utility and the performance of a distributed system in such a way will reduce the energy consumption. This problem is Dynamic Load Balancing of Virtual Machines where a technique is required to identify an under-utilized or over utilized VMs to recommend a migration plan based on the priority of VM to maintain a balance and to reduce energy consumption.

Our approach suggests that load balancing in cloud computing can be achieved by modeling the foraging behavior of honey bees [1]. This algorithm is derived from a detailed analysis of the behavior that honey bees adopt to find and reap food. In bee hives, the scout bees which forage for food sources, upon finding one, advertise this using dance called waggle/tremble/vibration dance. The display of this dance, gives the idea of the quality and/or quantity of food and also its distance from the beehive. In the same manner, the removed tasks from over loaded VMs are considered as the honey bees. Upon submission to the under loaded VM, the task will update the number of various priority tasks and load of that particular VM to all other waiting tasks. This will be helpful for other tasks in choosing their virtual machine based on load and priorities. Whenever a high priority task has to be submitted to other VMs, it should consider the VM that has minimum number of high priority tasks so that the particular task will be executed at the earliest. Since all VMs will be sorted in ascending order based on load, the task removed will be submitted to under loaded VM. In essence, the tasks are the honey bees and the VMs are the food sources. Loading of a task to a VM is similar to a honeybee foraging a food source (a flower or a patch of flowers). This updating will give a clear idea in deciding which task should be assigned to which VM based on the availability and load of the VMs similar to which honey bees should visit which food source based on whether honey is available at a flower patch or not. The proposed technique works well for load balancing of tasks in cloud computing environments. The specific contributions of this paper include An algorithm for scheduling and load balancing of non preemptive independent tasks in cloud computing environments inspired by honey bee behavior.

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II. Related Works

A. Existing Algorithms in Load Balancing in Cloud Computing Environment

There are mainly two types of Load balancing Algorithms [3],[4]

- Static Algorithms
- Dynamic Algorithms

a. Static Algorithms

In static algorithm the traffic is divided evenly among the servers. This algorithm requires a prior knowledge of system resources, so that the decision of shifting of the load does not depend on the current state of system. Static algorithm is proper in the system which has low variation in load. so that the decision of shifting of the load does not depend on the current state of system. Static algorithm is proper in the system which has low variation in load.

Following are some of the static algorithms:

Round Robin: The allocation order of processes is maintained locally which is independent of the allocation from the remote processor. In this technique, the request is sent to the node having least number of connections, and because of this at some point of time, some node may be heavily loaded and other remain idle

Central Load Balancing Decision Model: CLBDM is an enhancement of the Round Robin technique. This is based on session switching at application layer. In round robin, request is sent to the node having least number of connections. RR is enhanced and in CLBDM, the calculation of the connection time between the client and the node is done and if the connection time goes above the threshold then problem is raised. If a problem is arises, then the connection between the client and the node is terminated and the Task is forwarded to the further node using Round Robin law.

Static scheduling strategy of load balancing on virtual machine resource: This technique considers the historical data and also the current state of system. Here, central scheduler and resource monitor is used. The scheduling controller checks the availability of resources to perform a task and assigns the same. Resource availability details are collected by resource monitor.

Ant Colony Optimization: In this technique, an ant starts the movement as the request is initiated. This technique uses the Ants behavior to collect information of cloud node to assign task to the particular node. In this technique, once the request is initiated, the ant and the pheromone starts the forward movement in the pathway from the "head" node. The ant moves in forward direction from an overloaded node looking for next node to check whether it is an overloaded node or not. Now if ant find under loaded node still it move in forward direction in the path. And if it finds the overloaded node then it starts the backward movement to the last under loaded node it found previously.

b. Dynamic Algorithms

In dynamic algorithm the lightest server in the whole network or system is searched and preferred for balancing a load. For this real time communication with network is needed which can increase the traffic in the system. Here current state of the system is used to make decisions to manage the load.

Following are some of the dynamic algorithms

Load balancing Min-Min (LBMM): This technique uses Opportunistic Load Balancing algorithm which keep each node busy in the cloud without considering execution time of node. Because of this it causes bottle neck in system. This problem is solved by LBMM three layer architecture. First layer request manager which is responsible for receiving task and assigning it to one service manager to second level. On receiving the request service manager divide it into subtasks. After that service manager will assign subtask to service node to execute task.

Map Reduced based Entity Resolution load balancing: For mapping task, the PART method is executed where the request entity is partitioned into parts. And then COMP method is used to compare the parts and finally similar entities are grouped by GROUP method and by using Reduce task. Map task reads the entities in parallel and process them, so that overloading of the task is reduced.

DDFTP (Duel Direction Downloading Algorithm from FTP server): In DDFTP, file of size m is divided into m/2 partition and each node starts processing the task. For example if one server starts from 0 to incremental order than other will start from m to detrimental order independently from each other. As on downloading two consecutive blocks the task is considered as finished and assigned next task to server.

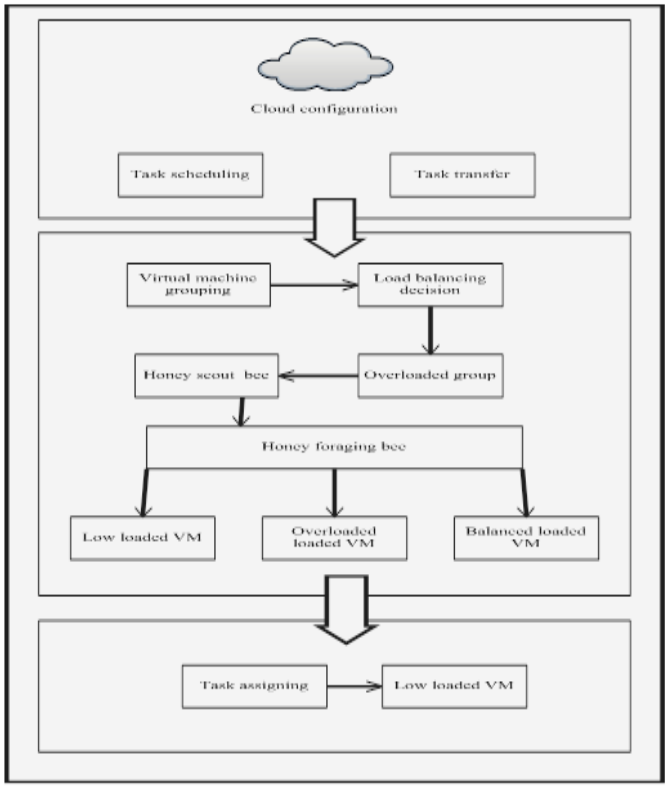
Index Name Server: This technique works on integration of de duplication and access point optimization. To calculate optimum selection point some parameter are defined: hash code of data block to be downloaded, position of server having target block of data, transition quality and maximum bandwidth. Another calculation parameter to find weather connection can handle additional node or is at busy level B(a), B(b) or B(c). B(a) denote connection is very busy to handle new connection , B(b) denotes connection is not busy and B(c) denotes connection is limited and additional study needed to know more about connection.

III. Honey Bee Foraging Behavior

Our proposed Load Balancing of tasks in cloud computing environment using honey bee behavior is based on the following method [5]. A task removed from overloaded VM has to find suitable under loaded VMs it can be allocated to. It has two possibilities i.e., either it finds the VM set (Positive signal) or it may not find the suitable VM (negative signal). There could be more than one VM (a set of VMs for allocation) which can accept this task. Now the task has to find best among these VMs based on the QoS criteria called task priority i.e., task finds the VM which has a less number of tasks with same kind of priority (high priority tasks finds the VM which has less number of high priority tasks). We call it as fight for the VM among tasks. When this fight is over, the winning task is allocated to the respective VM found and the details are updated. If a task does not find a suitable VM, it goes for delay in allocation, during which it gets experience and it will start listening the information updates by other tasks (similar to honey bees listening various dances). Once it confirms the information, the process starts from finding the

VM sets and after successful VM set identification, it will fight with other competing tasks to find it's most suitable VM and gets allocated to it. Information is updated once it ends its fight with other tasks (whether it loses or wins). As newer tasks arrive, the cycle starts until all tasks are allocated to VMs and the scheduling system is well balanced based on load as well as priorities.

IV. Architecture Diagram



V. Design

A. Modules

- Cloud configuration
- Scheduling and Load balancing
- VM grouping
- Honey bee behavior inspired load balancing

Cloud configuration: In this module the VM, cloudlet, datacenter and cloud broker are initialized. Next the VM bandwidth, ram size and VM Size are initialized.

Scheduling and Load balancing: The service requests from the clients for diverse applications can be routed at any data center to any end server in the cloud.

VM Grouping: The virtual machines will be grouped based on their loads. The groups are Overloaded VMs, under loaded VMs and balanced VMs.

Honey bee inspired load balancing of task: Tasks which are removed earlier (Scout bee) from over loaded VMs are helpful in finding the correct low loaded VM for current task (Forager bee). This Forager bee then becomes Scout bee for next task.

VI. Implementation

A cloud computing system has to handle several hurdles like network flow, load balancing on virtual machines, federation of clouds, scalability and trust management and so on. Research in cloud computing generally focus on these issues with varying importance. In this section, we have analyzed the performance of our algorithm based on the results of application done using VMware workstation7.1 and JFree chart.

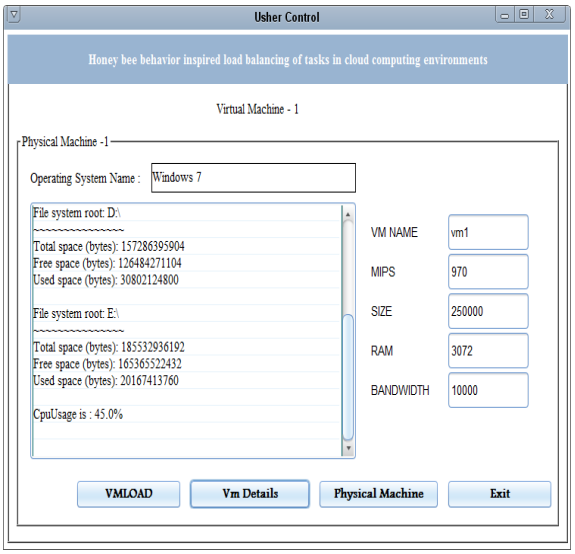


Figure 1: Cloud Configuration

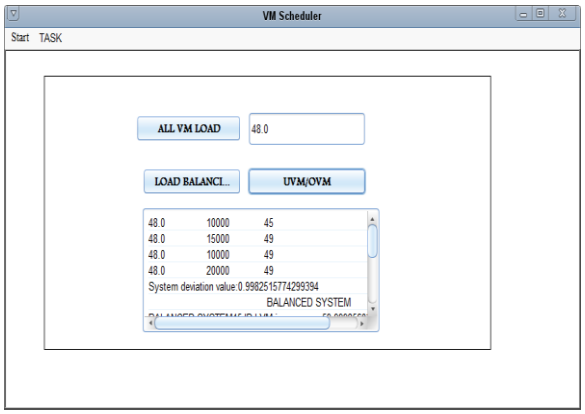


Figure 2: Load Calculation

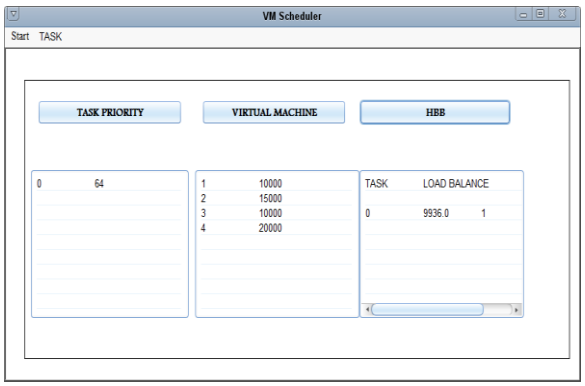


Figure 3: VM Scheduling

VII. CONCLUSION

The load balancing technique for cloud computing environments based on behavior of honey bee foraging strategy not only balances the load, but also takes into consideration the priorities of tasks that have been removed from heavily loaded Virtual Machines. The tasks removed from these VMs are treated as honey bees, which are the information updaters globally. This technique considerably reduces the average waiting time of tasks in queue. In future we plan to improve this technique by focus on *energy consumption and carbon emission* factors.This can improve the performance of cloud computing along with maximum resource utilization, in turn reducing energy consumption as well as carbon emission to an extent that will help achieve *Green Computing.*

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