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Honey Bee Behavior Based Load Balancing of Tasks in Cloud Computing

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Abstract: ***Cloud computing has recently emerging technology getting popular day by day having wide scope in future. Cloud computing is defined as a large scale distributed computing paradigm that is driven by economics of scale in which a pool of abstracted virtualized energetically. The number of users in cloud computing is growing exponentially. Large number of user requests tries to designate the resources for many applications which along with to high load not far afield off from cloud server. Whenever certain VMs are overloaded then no more tasks should be send to overloaded virtual machine if under loaded virtual machines are available. For optimize solution and better response time the load has to be balanced among overloaded and under loaded virtual machines. In this paper, an algorithm is proposed named honey bee behavior based load balancing (HBB-LB), which targets to achieve well balanced load across virtual machine. The experimental results show that the algorithm has many advantages over existing algorithms. There is improvement in average execution time and reduction in waiting time of tasks. The paper also describes briefly about other existing load balancing approaches.***

Keywords: Honey Bee, Load Balancing, Cloud Computing, Honey Bee Foraging Behavior, Virtual Machine Scheduling.

1. Introduction

Cloud computing is a model for delivering information technology services to the clients in which resources are retrieved from the world wide web (www) through web-based tools and applications. However, cloud computing architecture allows access to information as long as an electronic device has access to the internet. Cloud computing is getting popular day by day because the information and data being accessed is found in the "clouds" i.e. internet, and hence does not require a user to access the data from a specific place.

The cloud has three advance models. In the first model Software as a Service (SaaS) model, the software or the applications are hosted by the clients in the cloud and are made comprehensible to the customers based upon the pay-as-per-use model. Google Apps and Salesforce are examples of this model. The second model, Platform as a Service (PaaS) model provides a hosting atmosphere for the client's application. Examples for PaaS model are Google App Engine and Amazon Web Load balancing [1] difficulty arises in many applications and they produce an effect a crucial role in the operation of distributed and parallel computing systems. Load-balancing [2][3][4] deals in imitation of dividing a program into tiny tasks that can be executed simultaneously and assigning each of these jobs to a computational resource such a processor or a computer. By generating procedures that can assign these jobs to processors in a mannerism that balances out the load, the solution handing out time will be condensed gone greater than before processor utilization.

In Gartners description [5], considered cloud computing as the first accompanied by peak 10 most important technologies and once a bigger prospect in successive years by companies and running and cloud will fine-impression to the IT industry.

The services provided by cloud service providers are available to user in pay-per-use on demand model. Due to its different services it is adopted by all type of user such as organization, industry and institutional etc. There are many existing issues in cloud computing subsequently than load balancing, virtual robot migration, security ,energy government and server consolidation etc. the join up in web traffic and swing bolster are increasing daylight by day making load balancing a immense research subject. in this paper we focus in every second type of load balancing algorithm. Several elements are such as client, datacenters, and distributed server [6].

The number of cloud users has been growing exponentially and apparently scheduling of virtual machines in the cloud becomes an important matter to analyze. Users can accept their jobs into cloud for computational admin or depart their data in cloud for storage. Cloud scheduler must be able to schedule the tasks such a way that cloud provider can profit maximum as well as for his facilitate and QoS requirement of user's job is with satisfied.

Cloud computing provides on demand service that incorporates concepts of parallel and distributed computing. These are emerging distributed systems which is based on "pay as you use" model. The more time the customer use cloud services the more he has to pay Hence customer wants to reduce the overall execution time of tasks on the machines. The processing units in cloud environments are called as virtual machines (VMs). In business point of view, the virtual machines should execute the tasks as early as possible and these virtual machines run in parallel to execute

many tasks in less time. This needs scheduling of the customer tasks within the available resources. The scheduler should do the scheduling method efficiently in order to utilize the available resources fully. More than one task can be allocated to one or more VMs that run the tasks simultaneously. This type of environments should make sure that the loads are well balanced to reduce the makespan time in all virtual machines i.e., it should be noted that no machine gets overloaded and still tasks are being sent to that overloaded virtual machine . Once the machine is overloaded the tasks should be sent to the unloaded machine. In this case, it is the responsibility for the scheduler to balance the loads across the machines. A load balancing algorithm tries to improve the response time of user's submitted applications by ensuring maximal utilization of available resources. The main goal of load balancing algorithms is to speed up the execution of applications on resources whose workload varies at run time in unpredictable way [7].

In cloud computing environments, whenever a virtual machine is heavily loaded or overloaded with multiple tasks, these tasks have to be removed and submitted to the under loaded virtual machine to balance the load among machines of the same data centre[8]. Our approach suggests that load balancing in cloud computing can be achieved by modelling the foraging behaviour of honey bees.

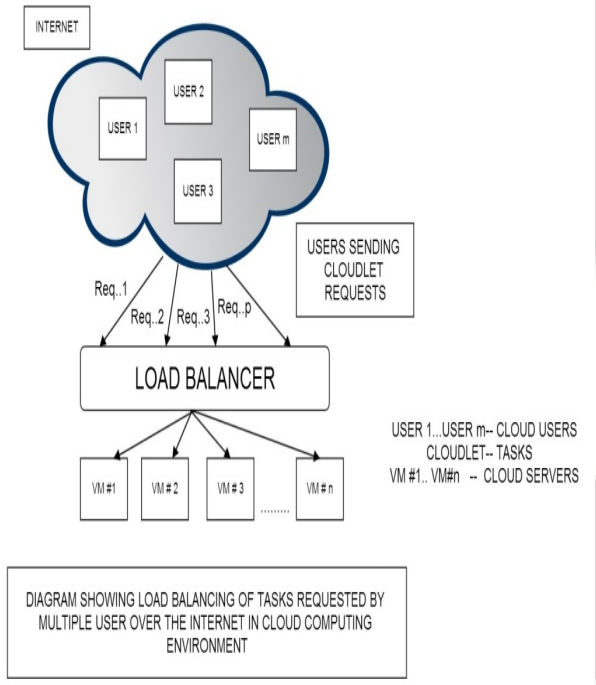


Figure 1: Diagram showing load balancing of tasks requested by multiple user over the internet in cloud computing

2. Key Concept

Load balancing techniques may be applied in homogeneous as adeptly as heterogeneous environments. There are basically two kinds of load balancing techniques. They are (i) Static and (ii) dynamic. Static algorithms leisure shakes up properly single-handedly bearing in mind the variation in the load is not too high. Therefore, these algorithms are not taking over for cloud environments where load will be changing at changing period. Dynamic load balancing algorithms are advantageous beyond static algorithms. But to profit this advantage, we dependence to pay supplementary cost similar subsequent to build up and child support of the load take aspiration, suitably conscious load balancing is beneficial but at the related period expensive with. Dynamic techniques are very animate for load balancing of tasks along in addition to heterogeneous resources. In this paper the proposed load balancing technique is plus functioning techniques which will on your own version the load along between overloaded and numb loaded virtual robot by putting constraints upon agreement of tasks.

3. Existing Load Balancing Approaches in Distributed Systems

3.1 A fast adaptive Load Balancing Method

D. Zhang et al.[9] proposed a binary tree structure that is used to divide the simulation region into various sub-domains .the objective is to balance the load from local areas to global areas. According to the difference of workload, the mechanisms of the cells are obtained. To consider local workload the main workload concentrates on certain cells so that the procedure of adjusting the vertices of the grid can be very long. Load balancing adaptive method is considered to solve this problem. Here the region should be partitioned by using the binary tree mode, the trees consist of three types of nodes, these nodes are leaf nodes, child nodes, parent nodes etc. This algorithm has a faster balancing speed, less elapsed time and less communication time cost of the simulation procedure. Advantages are Relative smaller communication overhead, faster balancing speed, and high efficiency and the demerit is it cannot maintain the topology that is neighbouring cells cannot be maintained.

3.2 An Adaptive and Dynamic Load Balancing Algorithm for Concurrent File System

B. Dong et al.[10] proposed a dynamic file migration load balancing algorithm based on distributed architecture. Dynamic file migration problem arises due to the large file size; the proposed algorithm is based only on centralized system etc. Self acting load balancing algorithms **(SALB) are** used to solve the problem. In the parallel file system the information are transferred between the memory and the storage devices so that the data management plays vital role of the parallel file system. There were various challenges and issues that are faced during load balancing in the parallel file system. These issues are availability of the system and scalability, network transmission and the load migration. Considered the dynamic load balancing algorithms, there is continuous variation in the workload. So there were some decision making algorithms are required. In this decision making system, there were firstly central decision maker, so no other node is decision maker except central node in view of that that if the central node becomes fail, subsequently the total system fails and hence the reliability becomes less. Secondly organization decision maker in which the total system should be not speaking in to groups hence that the

communication cost becomes shortened. But taking decision without considered the mass system load therefore that global optimization explored a major suffering. The advantage of proposed algorithm is efficient load addition mechanism, excited distributed decision maker, migration selection model and full of zip file migration algorithm for a bigger load balancing. The disadvantage is degradation of the amass system due to the migration side effect.

3.3 Heat Diffusion Based Dynamic Load Balancing

Yunhua.et al.[11] proposed an efficient cell selection aspire and two heat diffusion based algorithm called global and local diffusion. Considered the distributed virtual environments there were various numbers of users and the load accessing by the concurrent users can cause shackle. This can be avoided by this algorithm. According to the proposed, the virtual atmosphere is at odds in to large number of square cells and each square cell having objects. The operational of the heat diffusion algorithm is in such a mannerism that all nodes in the cell sends load to its neighbouring nodes in all iteration and the transfer was the difference together amongst the current node to that of neighbouring node. So it was united to heat diffusion process. That is the transfer of heat from tall to low intention, at the forefront they were placed adjacently in local diffusion algorithm, there were local decision making and efficient cell selection schemes are used. Here they usefully compared the neighbouring node large quantity to the adjacent node sufficient. If load is little furthermore the transfer of load becomes doable. There are two stages in global diffusion algorithm first is global scheduling stage and second is local load migration stage. From various experimental results the global diffusion algorithm becomes the augmented one. Advantages are communication overhead is less, tall swiftness and require tiny amount of calculations. Disadvantages are network come to a unventilated is tall and several iterations are taken as a result there was a waste of times.

3.4 Decentralized scale-free network construction and load balancing in massive multiuser virtual environments

Markus et al.[12] addressed the concept of overlay networks for the interconnection of machines that makes the backbone of an online character. Virtual online world creates the opportunities to the world for improved technological advancements and developments. So the proposed network that makes augmented feasibility and load balancing to the operational virtual environments. For the proper hosting of the virtual world the system developed hyper verse architecture. There were self organized load balancing methods by which the world surface is subdivided in to small cells, and it is managed by a public server. In this cells various hotspots appropriately that the absolute enhancement of the endeavor in the cell can be calculated by the public server. Hotspot accuracy is enlarged once increasing the network load. The proposed algorithm cannot avoid the overloaded nodes but locate out the number of links that assigned to each node though joining the network. The advantages are the network becomes reliable; the network becomes resilience, efficient routing, and irregularity tolerant. The demerits are the overload ratio at the coming on is fused as a repercussion that public servers are initially placed randomly so some time is used for balancing the load.

3.5 Load balancing in dynamic structured P2P systems

Brighten et al. [13] proposed an algorithm for load balancing in nimble peer-to-peer system and adding together hybrid environments. In most peer-to-peer system the non uniform of objects in the feel and with the load of the node can be distorted continuously due to the insertion, taking away and subsidiary various operations. This will leads to fall the produce a consequences of the system. So the concept of virtual server can be introduced. The load hint of the peer nodes is stored in inconsistent directories in this proposed load balancing algorithm. These directories in the back to schedule reassignment of the virtual servers to generate a improved relation. Greedy heuristic algorithm used to locate out a bigger resolved for the proper utilization of the nodes. The huge number of virtual servers in the system helps to gathering the utilization. The various load counsel in to the corresponding pool and with the virtual server assignments are to be finished. This proposed algorithm should be applied to every second types of resources associated to storage, bandwidth etc, It was intended to handle the various situations in imitation of changing load of the node, node adroitness, entering and leaving of nodes and in addition to insertion and elimination of the nodes. Advantages are high node utilization and increasing scalability. Disadvantage is the reassignment of the virtual server is hard.

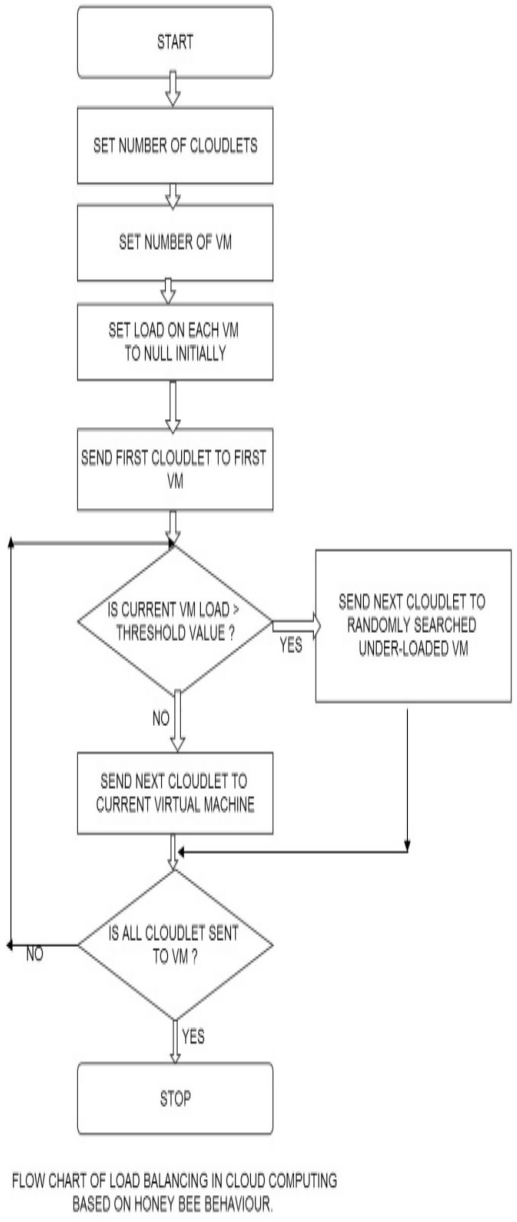
4. Honey Bee Behaviour Inspired Load Balancing (HBB-LB)

4.1 Honey Bees foraging behavior

A colony of honey bee can extend itself over long distances as to find many food sources such as flower patches and then these bees harvests nectar or pollen from these sources. A small fraction of the colony finds the environment looking for new flower patches. When food source is encountered the scout bees go in the field surrounding the hive and check for quality beneficial. When they return to the hive, the scouts collect the food harvested. There is an area in the hive called as the “dance floor”, where waggle dance is performed by the bees that found a very beneficial food. Through the waggle dance a scout bee passes the position of its search to idle spectator, which helps in the using of the flower patch. Here the duration of the dance is according to the scout’s rating of the food source, to harvest the best rated flower patches more foragers get recruited. When dance is done, the scout return to the food source it found to see more food. Till the food is profitable, food sources will be posted by the scouts when they return to their hive. Foragers who are recruited recently may waggle dance as well, which will step-up the recruitment for highly profitable flower patches. This autocatalytic process will go on to find most beneficial flower patches [14].

4.2 Proposed flow chart for load balancing

In this paper our research work proposes a flow chart that describes the mechanism of load balancing among overloaded virtual machines and underloaded virtual machines. The flow chart is inspired by the Honey Bee Behaviour approach to balance the load in cloud computing. The key idea is to submit the tasks to the virtual machine till the machine gets overloaded i.e. load on that virtual machine become more than threshold value .The threshold value may be considered 75. We do not submit tasks to the overloaded machine and we send the remaining tasks to underloaded virtual machines that can be finding by RANDOMLY SEARCH method. Here in flowchart Cloudlets are considered as tasks/jobs that user requests to the Virtual Machine (VM).



FLOW CHART OF LOAD BALANCING IN CLOUD COMPUTING BASED ON HONEY BEE BEHAVIOUR.

Figure 2: Flow chart of load balancing in cloud computing based on Honey Bee Behaviour

4.3 Advantages over Existing Approaches

The experimental results show that the process is effective and more efficient when compared with existing algorithms. Our approach illustrates that there is a significant improvement in average execution time and reduction in waiting time of tasks.

5. Conclusion and Future Work

In this paper, we have proposed a flow chart for load balancing in cloud computing environments based on behavior of honey bee foraging strategy. The tasks are to be send to the underloaded machine and like foraging bee the next tasks are also sent to that virtual machine till the machine gets overloaded as flower patches exploitation is done by scout bees. Honey bee behavior inspired load balancing improves the overall throughput of processing and priority based balancing focuses on reducing the amount of time a task has to wait on a queue of the VM. Thus, it reduces the response of time of VMs. We have compared our proposed algorithm with other existing techniques. Results show that our algorithm stands good without increasing additional overheads. In future, we plan to improve this algorithm by considering other QoS factors of tasks.

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