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A Hybrid ACHBDF Load Balancing Method for Optimum Resource Utilization In Cloud Computing

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ABSTRACT

Cloud computing provides computing resources to the cloud on demand based and the concept is pay per use". Cloud computing mainly focused on optimistic resource utilization in fewer cost efforts. Now, these days cloud computing technology are utilized by most of the IT companies and business organizations. It increases number cloud users as well as computing resources which creates challenges for cloud service providers to maintain optimum utilization of computing resources. Task scheduling methods play an important role in cloud computing. A scheduling machine helps in allocation of the virtual machine to a user task and to maintain the balancing between machine capacity and total task load. Different task scheduling methods are suggested by cloud researchers. In this research work, we are presenting a hybrid ACHBDF (Ant colony, Honey bee with dynamic feedback) load balancing method for optimum resource utilization in cloud computing. The proposed ACHBDF method uses the combined strategy of two dynamic scheduling methods with a dynamic time step feedback method. Proposed ACHBDF utilizes the quality of ant colony method and Honeybee method inefficient task scheduling. Here feedback strategy helps to check system load after each phenomenon in dynamic feedback table. This helps in migration of task more efficiently in less time. An experimental analysis in between existing ant colony optimization, honey bee method and Proposed ACHBDF clearly shows that proposed ACHBDF performs outstanding over existing method.

Keywords : Cloud Computing, Task Scheduling, Load balancing, Honeybee optimization, Ant colony and ACHBDF.

I. INTRODUCTION

Cloud computing is catching a lot of attention as a result of it is the just one of its kind, and it's several distinctive deserves that can be used to ease services execution. Measurability of cloud resources lets a versatile provisioning of resources and provides on-demand computing infrastructure for applications. The propagation of cloud as an all-purpose computing wakes up awareness of the necessity for versatile management methods. So, the success of cloud services relies on the power of cloud management algorithms. On one hand, cloud computing permits users to access services that remain in an exceedingly remote knowledge centers, on the other hand, native computers. Data-centers are the most computing infrastructures that offer several styles of services via scaling capability [3]. This research paper mainly focused on efficient scheduling in cloud computing. This paper mainly discussed the working of proposed ACHBDF method. The complete paper is organized in chapter's introduction, Task Scheduling in cloud computing, related work, problem statement and expected outcome, proposed ACHBDF method, result in analysis and finally covers conclusions of the entire research and future scope for improvements.

II. TASK SCHEDULING IN CLOUD COMPUTING

It is a technique of re-assigning the complete task load to the individual nodes of the shared system to create resource utilization economically and to induce higher latency of the duty, at the same time removing a state during which a couple of the nodes are overloaded wherever as a variety of different node are underneath

loaded. A dynamic task scheduling algorithmic rule doesn't take into account the sooner performance of the system, that is, it depends on the present behavior of the system. the most things to have faith in whereas mounting such algorithmic rule are: analysis and comparison of load, the stability of the various system, the performance of the system, communication between the nodes, nature of the job to be transferred and choice of nodes. This load will be thought about in terms of Network hundreds, CPU load, the quantity of memory utilized.

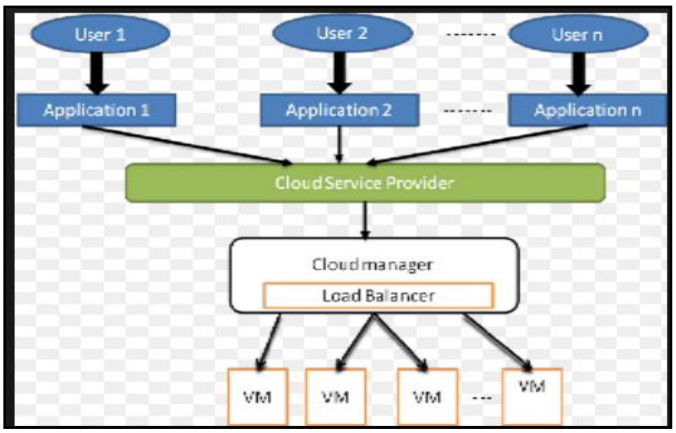


Figure 1.1 Task Scheduling in cloud

III. EXISTING WORKS

Scheduling methods in cloud computing have mainly three types

Table 1.1 Scheduling methods

TYPES OF TASK SCHEDULING METHODS IN CLOUD		
Process initiations based methods	System current States based methods	Decision making based methods
Sender Initiated	Static LB	Centralized LB
Receiver-Initiated	Dynamic Load Balancing	Dynamic LB
Symmetric		Hierarchical LB

NIE Qingbin [1] et al. worked on "An Improved Ant Colony Optimization Algorithm for Improving Cloud Resource Utilization". As indicated by NIE Qingbin et al. propose how to enhance cloud execution by utilizing upgrades in Ant state streamlining existing planning technique. Keeping in mind the end goal to enhance the cloud computing use, an Improved Ant Colony Optimization (IACO) is proposed. The proposed IACO calculation enhances pheromone factors and enlivened factors inventively in view of the existent calculations. Awatif Ragmaniet [2] et al. worked on "A Performed Task Scheduling for Public Cloud Computing Using Ant Colony Optimization". As indicated by Awatif Ragmaniet et al. In the space of a couple of years, Cloud registering has encountered astounding development. In reality, its financial model in light of interest of equipment and programming as indicated by specialized criteria (CPU use, memory, data transfer capacity and so on) or bundle has firmly added to the progression of figuring assets on the planet.

Fatemeh Rastkhadiv [3] et al. worked on "Task Scheduling Based On Load Balancing Using Artificial Bee Colony in Cloud Computing Environment". As indicated by Fatemeh Rastkhadiv et al. Cloud computing is an advancement of conveyed figuring, parallel registering and framework processing. The point of cloud computing is giving dynamic renting of server abilities as versatile, virtualized administrations to end clients. Asset administration as an imperative issue of distributed computing. Load adjusting is an issue of asset administration.

Monika Rathore [4] et al. worked on "Load Balancing of Virtual Machine Using Honey Bee Galvanizing Algorithm in Cloud". As indicated by Monika Rathore et al. Load adjusting is a most critical undertaking of distributed computing. With a specific end goal to achieve best machine use, undertakings from over-burden virtual machines should be exchanged for under stacked virtual machines. Planning of assets is an extremely monstrous issue on the cloud. Planning of the models, cost, nature of administration, time, and states of the demand for access to administrations are factors is to be engaged in the cloud.

Existing methods have following issues such as-

- In ACO ant's phenomena is a locally not globally works dynamically from everywhere. After initialization the pheromone of ants by moving through a neighbor node of the construction in the path.
- A bee colony is not properly working for the allocating the path in collective some wrong information.

- High waiting time -Due to poor allocation in queue jobs takes more time.
- Poor throughput- Total throughput of the system is less.
- High migration degree. Migration degree of the task is high.
- Higher execution time and poor performance.

IV. PROBLEM STATEMENTS

Cloud computing provides computing resources to the cloud on demand based and the concept is pay per use". Cloud computing mainly focused on optimistic resource utilization in fewer cost efforts. Now, these days cloud computing technologies are utilized by most of the IT companies and business organizations. It increases number cloud users as well as computing resources which creates challenges for cloud service providers to maintain optimum utilization of computing resources. Task scheduling methods play an important role in cloud computing. A scheduling machine helps in allocation of the virtual machine to a user task and to maintain the balancing between machine capacity and total task load. Different task scheduling methods are suggested by cloud researchers. This work mainly overcomes the limitation of following methods-

4.1 Ant colony algorithm- The ants work together in search of new sources of food and simultaneously use the existing food sources to shift the food back to the nest. It is a random search algorithm. It takes the behavior of real ant colonies in nature to search the food and connect to each other by pheromone laid down on path optimization algorithm.

Limitations- In ACO there are several limitations like slow convergence, the tendency to stagnancy.

-In ACO ant's pheromone is a locally not globally works dynamically in everywhere.

-Sometimes Bee colony is not properly working for the allocating the path in collective some wrong information.

-There is only one kind of pheromone in ACO and the path and path weight is stable, and cannot fit for dynamic task balancing.

-Dynamically here Ant follows the instruction of Pheromone but not finding the best-laid path for searching thus dynamic ACO works behind on the find best path or shortest path to finding the source.

4.2 The Artificial bee colony algorithm- It is an optimization algorithm based on the intelligent foraging behavior of honey bee swarm and was proposed by Karaboga in 2005. This algorithm is completely inspired by natural foraging behavior.

Limitations- Bee colony algorithm obtains the solution only particular distance because bee provides an optimal solution based on the small path. Slow conversion and poor performance.

V. PROPOSED ACHBDF

The proposed method utilizes the quality of ant colony method and Honeybee method for an efficient task scheduling. Here feedback strategy helps to check system load after each phenomenon in dynamic feedback table. This helps in migration of task more efficiently in less time. Task scheduling is a methodology to distribute workload across multiple computers or a computer cluster, network links, central processing units, disk drives, or other resources, to achieve optimal resource utilization, maximize throughput, minimize response time, and avoid overload.

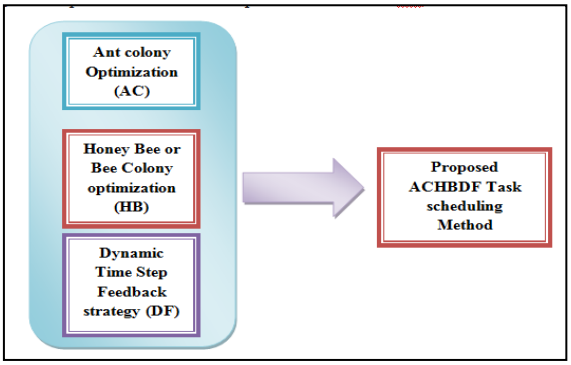


Figure 2. Proposed ACHBDF Method

5.1 Main module of proposed ACHBDF-

Proposed ACHBDF method has following modules-

-A load measurement rule- An index of the status of processor taking on a zero value if the processor is idle, and positive values as the load increases.

-Time step feedback- It typically uses a dynamic, adaptive time step control strategy in order to minimize the calculations performed during inactive portions.

-An information exchange rule - It defines how to collect and maintain the workload information of processors necessary for making load balancing decisions.

-Location Strategy- Selection of a destination node for a transfer task in job scheduling algorithm is referred as location policy or location strategy.

-Load estimation Policy- Total amount of workload on a processor or machine is estimated by this policy.

5.2 Working on Proposed Method

The proposed ACHBDF method uses the combined strategy of two dynamic scheduling methods with a dynamic time step feedback method. Proposed hybrid ACHBDF task load balancing and scheduling method for optimum resource utilization in cloud computing.

Role of Ants (Ant colony optimization)-

-The ants in our proposed algorithm will continuously originate from the Head node. These ants traverse the width and length of the network in such a way that they know about the location of underloaded or overloaded nodes in the network.

-These Ants along with their traversal will be updating a pheromone table, which will keep a tab on the resources utilization by each node.

Roles of Honey Bee Method-

-A bee colony is used for finding the bee with best fitness value, which will help the task to be allocated to that particular virtual machine based on best fitness value.

-Employed bees will be carrying the information about the virtual machines capacity in terms of HDD, RAM, Processor, and Bandwidth.

-The knowledge acquired by the employed bees is shared with onlooker bees in the hive, and then the onlooker bees decide the bee with the best fitness value or a virtual machine with similar capacity as that of task length to be executed.

-A job works as a honey bee and the VMs with low load are considered as the food sources for honey bees.

-Finally, the task is allocated to that virtual machine found with the help of BCO using ACO.

Role of Dynamic time step feedback method-

-The idea of dynamic time step feedback originally comes from molecular dynamic simulation to improved simulation quality and flexibility. It typically uses a dynamic, adaptive time step control strategy in order to minimize the calculations performed during inactive portions, while maintaining adequate time resolution during active portions.

-These algorithms use a dynamically changing time step to reduce the simulation time and increase the accuracy of simulation and by varying the value of the time step.

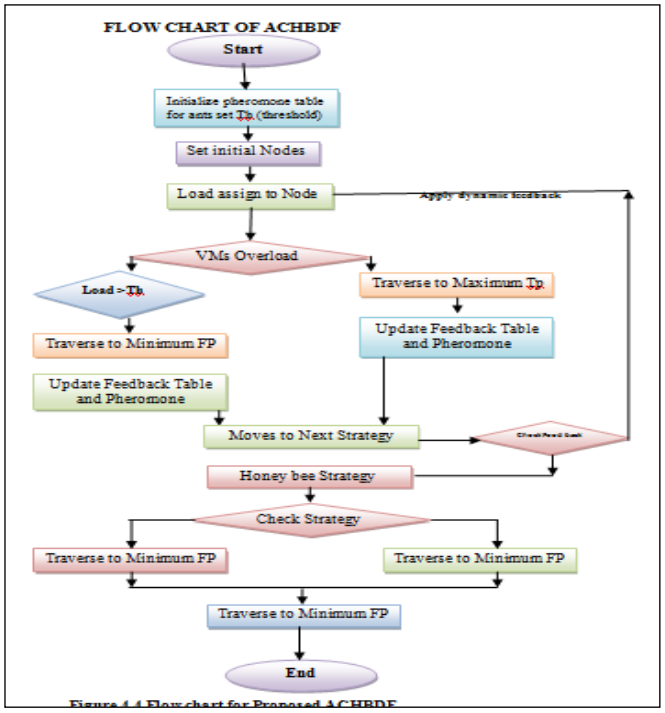


Figure 3 Flow Chart of Proposed MEthod

5.3 ALGORITHM FOR PROPOSED ACHBDF-

The proposed ACHBDF method uses the combined strategy of two dynamic scheduling methods with a dynamic time step feedback method. Proposed ACHBDF method uses following steps for efficient task scheduling in cloud computing.

ACHBDF Algorithm for task scheduling in cloud computing

Input-Set of user requests, Cloud lets, Number of VMs

Output- Efficient task scheduling and optimum utilization of computing resources

Step-1 (Create Initial Cloud Setup)-

Initialize number of VMs, Cloud lets, data center and broker policy

Set threshold value for each VMs

Calculate capacity of VMs

Set initially all the VMs UVM (Under loaded)

Step-2 (Execution of task)

Find number of running or pending task

Number of Task in Queue = Number of running task / Number of Waiting Tasks ---- (2.1)

Find pending jobs length-

Pending Jobs Length = ∑ Length of [Jobs Remaining in running List + Jobs Remaining in Waiting List + Jobs Remaining in Pause List]

Step-3 (Initialize population (N bees)

3.1 Evaluate fitness of bees

If the fittest bees are fitter than the queen then replace the queen for the next generation

Choose D best bees among D fittest following bees and drones of current population (Forming next-generation drones)

Choose W best bees among W fittest remaining bees and workers of current population (to ensure food foraging)

Step-4 check food foraging behavior -

k. Search of food source in W regions by W workers

Recruit bees for each region for neighborhood search m.

Select the fittest bee from each region.

Assign remaining bees to search randomly and evaluate their fitness's.

Step-5 Initialize parameters and pheromone trails.

While stopping criteria are not satisfied.

Do

Make all Ants Construct their Solutions.

Update pheromone trails

Calculate forward strategy $\propto_{jd}^{k} = p_{jd}^{k} \cdot \div \sum p_{jd}^{k}$

Calculate repulsion strategy $\beta_{jd}^{k} = p_{jd}^{'k} \cdot \div \sum p'^{k}_{jd}$

End Do

Step-6 (Mapping between task and VMs by Honey bee)

FOR each employed bee {

Produce new solution vi(new VM)

Calculate the value fi

Apply greedy selection process}

Calculate the probability values pi for the solutions (VMI)

FOR each onlooker bee {

Select the solution VMI depending on pi

Produce new solution vi

Calculate the value fi

Apply greedy selection process}

If there is an abandoned solution for the scout then replace it with a new solution which will be randomly produce

Update feedback

Step-7 Assigning Task and update feedback table- (Remove a task from the higher pending time VM, which contains more than one task and assign this task to the lower pending time VM, which has no task to process.

While (true)

Set OverLoadedVM = VMMap.get(VM_Map.size())

Set feedback level== low

Set LowLoadedVM = VM_Map.get(0)

Varlower position = 1 ; Load_Indiacator indicates VMs status

Var upper posit ion = 1 ;

While (true)

If (OverLoadedVM.taskSize()>1 && Low_LoadedVM.taskSize()<1) Break;

Else if (OverLoadedVM.taskSize()>1)

LowLoadedVM = VMMap.get(lowerposition)

Lowerposition++

Set feedback level== high

Else if (LowLoadedVM.taskSize()<1)

OverLoadedVM=VMMap.get(VMMap.size()-upperposition) Upperposition++

Update feedback;

Else Break The Outer While Loop

End While

Set migratable_Task = Over_Loaded_VM.get_Migratable_Task()

Low_Loaded_VM.assign(migratableTask)

Break

End While

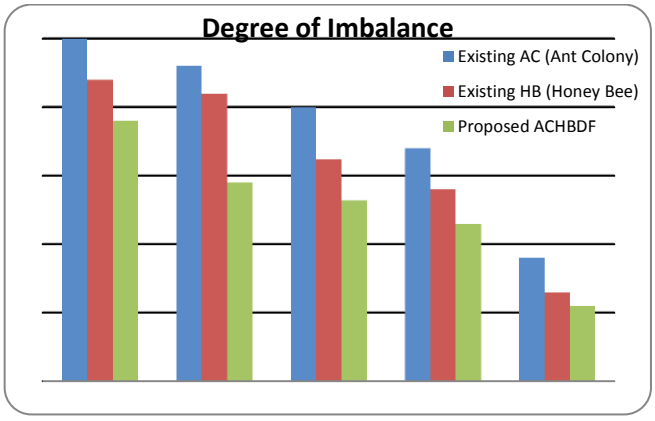
VI. RESULT ANALYSIS

Proposed ACHBDF (Ant colony, Honey bee with dynamic feedback), Ant colony (AB) and Honey Bee (HB) Scheduling methods are implemented over cloud sim simulator 3.1 and JAVA is used as a programming language.

6.1 Degree of Imbalance - The degree of imbalance measures the imbalance among VMs. The small value of DoI tells that the load of the system is more balanced and efficient.

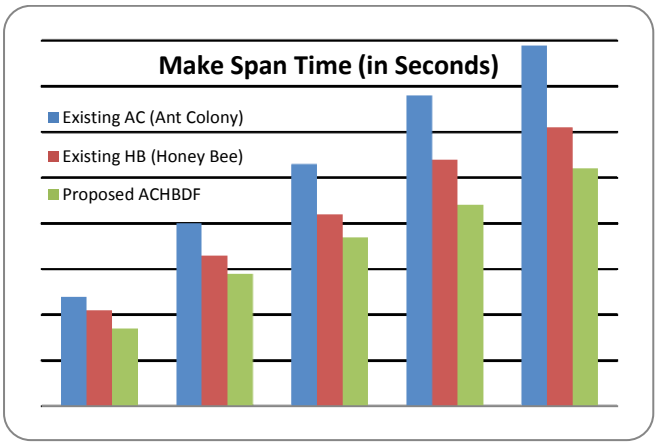
Degree of Imbalance= [T_{max} - T_{min}] / T_{avg}

Where, Tmax, Tmin, and Tavg are the maximum, minimum and average completion time of VMs respectively



Graph 6.1 Degree of imbalance

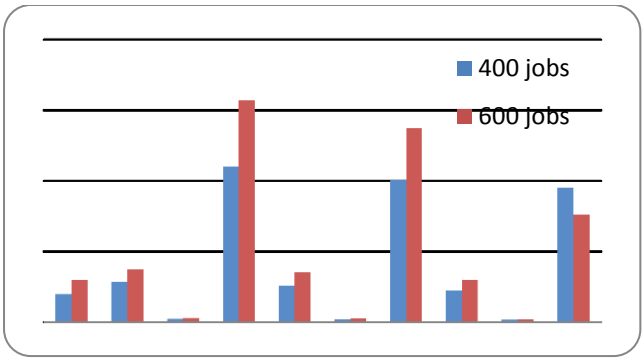
6.2 Make Span Time- The total time that elapses from the beginning to the end. Less makespan time shows better performance.



Graph 6.2 Make Span Time

6.3 Average Response Time- The elapsed time between an inquiry on a system and the response to that inquiry. Used as a measurement of system performance, response time may refer to service requests in a variety of technologies. Low response times may be critical to successful computing.

Average Response Time (in ms)									
Number of Jobs	Existing AC (Ant Colony)			Existing HB(Honey Bee)			Proposed ACHBDF		
	Average (ms)	Min (ms)	Max (ms)	Average (ms)	Min (ms)	Max (ms)	Average (ms)	Min (ms)	Max (ms)
400	576.02	47.89	2202.9	512.3	41.78	2011.9	445.78	34.85	1899.66
600	744.78	59.99	3144.72	703.56	51.22	2744.69	601.48	42.33	1521.76



Graph 6.3 Average Response Time

The above results clearly show Proposed ACHBDF scheduling method performs outstandingly in terms of degree of imbalance; Makespan time and Average response time over existing AC and HB methods.

VII. Conclusions & Future works

Proposed ACHBDF utilizes the quality of ant colony method and Honeybee method for efficient task scheduling. Here feedback strategy helps to check system load after each phenomenon in dynamic feedback table. This helps in migration of task more efficiently in less time. The experimental analysis clearly shows that Proposed ACHBDF scheduling method performs outstandingly in terms of degree of imbalance; Makespan time and Average response time over existing AC and HB methods. ACHBDF improves the overall cloud performance by optimum utilization of computing response. In future work proposed ACHBDF can be implemented in real time environment instead of a simulator and compared with more methods.

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