Hybrid Improved Max Min Ant Algorithm for Load Balancing in Cloud

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***Abstract*—Cloud computing provide unlimited resources to the customers. Cloud also provides many services to the end users. Users can access these resources directly through internet. Users pay only for those resources which they use. In cloud computing environment load balancing is very important concept. Modified max –min used the concept of original max -min. Modified Max-min is based on the execution time not on complete time as a selection basis. This paper proposes hybrid Improved max min Ant Optimization algorithm. The main motive of our work is to balance the total system load .We try to minimizing the total makespan. We simulated results using the Cloud Sim toolkit. Results show the comparison between improved max min and new hybrid improved Max-min ant approach. It mainly focuses on total processing time and processing cost.**

Keywords: Cloud Computing, Load Balancing Algorithms, Improved Max-Min Algorithm, Hybrid Improved Max Min ant Algorithm

I. INTRODUCTION

Cloud Computing is a new technology. Cloud service providers provide many services to end user. All the services are providing on internet with lower cost. Also, there are some applications are provide which users can used through internet. Applications are provide on lower cost in the cloud environment. Users pay only for those resources which they used.[1] They need to pay as much they used. In cloud environment resources are increase quickly. So load balancing is a main problem in cloud computing. In cloud many tasks are executed on available resources at same time. Load balancing is required for proper utilization of all the resources and for better response. Many algorithms are implemented for load balancing in cloud computing. All the algorithms work in different ways. In Cloud computing datacenters are used to collect all the resources; that all resources are shared by many users through the internet.

Cloud computing is a internet based computing service that is provided by infrastructure providers, they provide the services on the users demand. In cloud computing Quality of Service and Load Balance (LB) is very important terms. To improve the performance of resources and for better results many effective task scheduling algorithm are used. Load balancing algorithm is responsible for managing all the jobs that are submitted to cloud environment. Jobs are assigned onto available all resources in such a way that the total response time should minimized. [2][3]. These algorithms also help in manage the makespan. Many of these algorithms try to minimize the total tasks completion time. Max-min, Min-min and RASA are the three well algorithms which used for load controlling. In all these algorithms first calculate the completion and execution time of each task on each available resource in cloud computing. RASA is a combination of other two algorithms. In the RASA algorithm, first completion time of each task is calculated on all available resources then Max min and Min-min algorithms are applied on those tasks. RASA used these algorithms in such a way to take advantage of algorithms and avoids the drawbacks of both algorithms. In Max-min algorithm large tasks to be executed firstly, which means small task delays for long time because they executed after the completion of long tasks. On the other hand, Min-min is executing smaller tasks firstly then large ones that mean long time tasks face delays. [4] [5]

But we used improved max min algorithm. The main idea of an improved Max-min algorithm is that assign task with maximum execution time to resource with minimum complete time at place of original Max-min assign task with maximum completion time to resource with minimum execution time. First we calculate improved max min algorithm result and then we apply improved max min and Ant colony approach together for better results.

A. Metrices for Load Balancing Algorithms

There are many matrices are used in load balancing .These all matrices are helps in measure the performance of algorithms:

1. *Scalability:* It means algorithm is able to perform when numbers of tasked are increased quickly in cloud environment. Any algorithm is good when this metric should be improved as compared to other algorithms.
2. *Resource Utilizations:* It means all the resources are used properly. Better resource utilization It should be better for an efficient load balancing algorithm.
3. *Fault Tolerance:* It means recovery from all types of failure. The load balancing should be a good fault tolerant technique. The main faults which occur are like node failure.
4. *Response Time:* It is the time that is taken by a particular algorithm to respond a task. A good algorithm takes minimum time to respond a task.

5. *Overhead Associated:* It define total amount of overhead involved when implementing a load balancing algorithm in cloud computing environment. Overhead occurs due to the inter process communication between the tasks. If this minimized that load balancing algorithm work properly.

B. *Dynamic Load Balancing*

Types of Load Balancing Algorithms:

a. *Distributed algorithms:* In this all nodes of algorithm execute together, they divide load balancing work between them properly. All the nodes are interacting with each other in two ways: one is cooperative and other is non-cooperative. In the cooperative all the nodes work together but side-by-side to achieve a common goal. .All nodes work together to improve the response time of the system. In Non-Cooperative, all nodes works independently to achieve a common goal for better response time for all tasks.

b. *Non-distributed algorithms:* In this load balancing is done by one or many resources. Non-distributed dynamic load balancing algorithms have two types: one is centralized approach and other is semi-distributed approach. In centralized approach, the load balancing algorithm is executed only by a single node. In this only central node is responsible for all operation and controlling. In semi distributed approach, all nodes of the system are divided into clusters. Then load balancing is done in centralized form in the clusters. A central node controls all the operations of load balancing. That central node is select by choice in each cluster during load balancing operations

II. DYNAMIC COMBINATION OF IMPROVED MAX MIN AND ANT ALGORITHM

A. *Improved Max Min Algorithm*

In Max-min algorithm large tasks have highest priority and smaller tasks have lower priority. It means, when we have one long task, then Max-min algorithm could execute many short tasks concurrently while executing large task. The make span is calculated in this by the execution of long task .It would be similar to the Min-min make span. [6] [7]

We try to minimize waiting time of short jobs through assigning large tasks to be executed by slower resources. On the other hand execute small tasks concurrently on fastest resource to finish large number of tasks during finalizing at least one large task on slower resource.

Where meta-tasks contain tasks with different completion and execution time, we proposed a new Max-min algorithm that helps in increasing the efficiency of max min algorithm. That is known as improved max min load balancing algorithm.

Algorithm 1: Improved max min load balancing algorith

1. For all submitted tasks in meta-task; T_i
2. For all resources; R_j
3. Cij = Eij + rj
4. While meta-task is not empty
5. Find task T_k costs *maximum execution time.*
6. Assign T_k to the resource R_j which gives *minimum completion time.*
7. Remove T_k from meta-tasks set
8. Update r_j for selected R_j
9. Update Cij for all j

Improved max min increases the chances of execution of tasks on resources.

Algorithm 1 represents improved max min approach. It defined how it works. Max-min algorithm is followed to implement improved Max-min. Load balancing algorithms enhances performance in distributed systems. Sometimes these algorithms not help in better makespan.

There are many existing load balancing algorithms in cloud computing which used for load balancing. Some new algorithms are also implemented from existing algorithms, this will helps to researchers to carry out further work in this area. We combine improved max min and ant algorithm as hybrid approach. Improved max min work in different way from original max min algorithm. [8] [9] [10]

In the original max min "Select task with max execution time then assign that task to that resource which take min completion time" but in improved max min we "Select task with max completion time and then assign resource which take min execution time"

B. *Ant Colony Algorithm*

Ant Colony Optimization (ACO) algorithm is inspired from real ant colonies and it work based upon their actual behavior. Ants are live in colonies. They are work for the survival of colony. Ants always travel from their nest and food sources when they searching for food. In the initial stage ants explore the area surrounding their nest in a random way. While moving from one place to another ants deposit special substances called pheromones. Ants can smell pheromones. When choosing their way for food. During the return trip they again follow the pheromones. Value of pheromones depends on the quantity and quality of the food which ant search. The pheromone trails will guide other ants to the food source.

Algorithm 2 represents the ant colony algorithm approach. Basic method of ACO work is as follow: Ant Colony Optimization (ACO) algorithm is inspired from real ant colonies and it work based upon their actual behaviour.

Algorithm 2: Improved max min load balancing algorith

1. begin
2. Initialize the pheromone
3. While stopping criterion not satisfied do Position each ant in a starting VM
4. while (stopping when every ant has build a solution) do
5. for each ant do
6. Chose VM for next task by pheromone trail intensity
7. end for
8. end while
9. Update the pheromone
10. end while
11. end

Ants are live in colonies. They are work for the survival of colony. Ants always travel from their nest and food sources when they searching for food. In the initial stage ants explore the area surrounding their nest in a random way. In the way they drop pheromones, so other ant follow the same shortest root.

III. Basic Principle of Combination of Improved Max Min and Ant Algorithm

Improved max min provides optimal solution during the preliminary stage, but it will significantly reduce after some time. [11] [12] [13] [14]

However, during the starting stage of ant algorithm, the searching speed is very slow for lacking of pheromones, and then after pheromones reach a certain degree, the speed of optimal solution improves quickly.

The basic principle of dynamic combination between max min algorithm and ant colony algorithm is that we can utilize max min algorithm to get advantages in initial stage and then obtain the optimal solution by ant algorithm in last stages. .

IV. Stimulate Result

Cloud computing simulation platform Cloud sim is used for implementation. It was designed by Australia Melbourne University. In Cloud Sim we used Java as discrete event simulation engine.

Figure 1 represents that how the tasks are allocated. It known as task allocation policies.

Cloud Sim helps in simulation of IaaS (Infrastructure as a Service), PaaS (Platform as a Service) and SaaS (Software as a Service). It provides all the basic components such as Hosts, Virtual Machines, and applications that help in to model the three types of services.

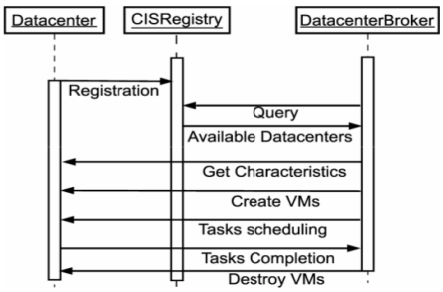

Fig. 1 Model of Tasks Allocation Policies

Figure 2 shows cloudsim workflow model. It defined how cloudsim work in actual. It defined about about different layers.

CIS: It is known as Cloud Information Service. It provides database level match-making services. CIS maps user requests to best suitable cloud providers.

Data centre Broker: it help for mediating between users and service providers. It depending on QoS requirements and the broker deploys service tasks.

Vm Scheduler: Vm scheduler represents the policies. There are two types of policies. One is known as space-shared and second is time-shared. These are required for allocating processing power to all VMs.

Vm Allocation Policy: Vm Allocation Policy is used to select available host in a datacenter. This is mainly focus on the memory, storage, and availability requirement for a VM deployment.

We calculate the result with improved max min that we define as old algorithm and with our hybrid algorithm that is combination of improved max min and ant algorithm. We calculate all the result in cloudsim. We attach the load of planet lab. We calculate result with different number of cloudlets. [15] [16] [17]

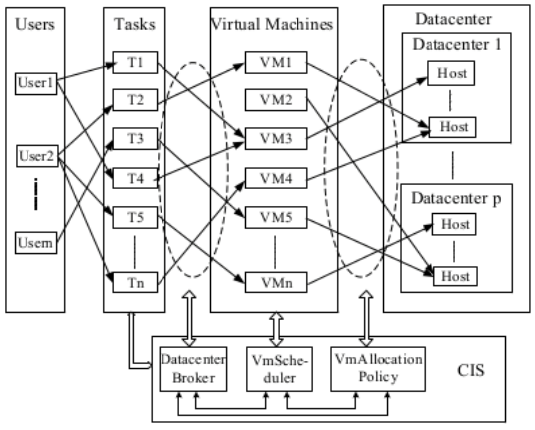

Fig. 2 Cloud Sim Workflow Model

We fix the virtual machine parameter values at the starting.VM parameters are MIPS (millions of instructions per second) and BW (bandwidth). We assign the ID to every VM.

In max min if can't execute tasks concurrently, makes pan become large. To overcome such limitations of improved Max-Min algorithm, a new modification is applied for Max-min scheduling algorithm. To improve the total processing time and cost we applied ant approach on this with improved max min algorithm. Which known as hybrid algorithm. Our approach improve total cost and time factor. This study is only concerned with the number of the resources and the tasks.[18]

Figure 3 shows total processing cost for 1000 tasks (cloudlets).

Figure 4 represents total processing cost for 1000 tasks (cloudlets).We compare the result of old (improved max min algorithm) and hybrid algorithm (combination of improved max min algorithm and ant algorithm)

Figure 5 shows the comparison for different number of tasks. We compare total processing cost

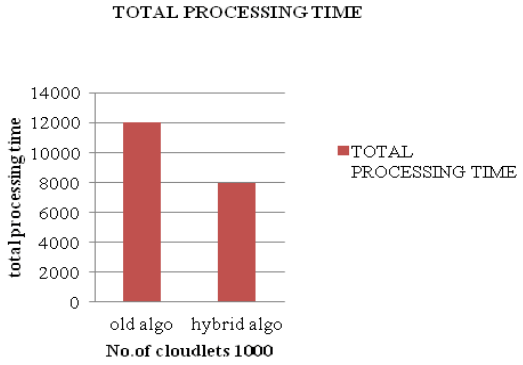

Fig. 3 Total Processing Time for 1000 Cloudlets

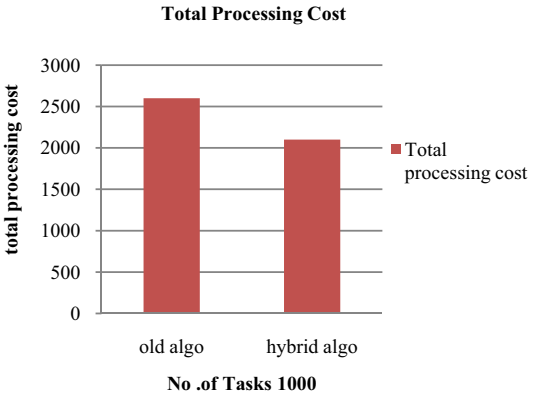

Fig. 4 Total Processing Cost for 1000 Tasks

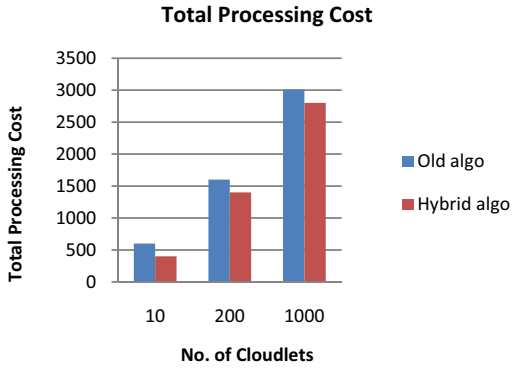

Fig. 5 Comparison for Total Processing Cost with Different No. of Tasks

V. CONCLUSION

We have presented a hybrid improved max min ant approach which is performed by cloud Sim. This helps in better load balancing. It provide better processing time and total processing cost as compared existing algorithms .Load balancing is used to obtain better resource utilization and performance .This study is concentrated only on tasks and resources.

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REFERENCES

[1] Sahu, Yatendra and Pateriya, RK, Cloud Computing Overview with Load Balancing Techniques., International Journal of Computer Applications, Year 2013, Volume 65

[2] Mell, Peter and Grance, Tim, "The NIST definition of cloud computing", National Institute of Standards and Technology, 2009, vol53, pages50, Mell2009

[3] Chaudhari, Anand and Kapadia, Anushka, " Load Balancing Algorithm for Azure Virtualization with Specialized VM", algorithms, vol 1, pages 2, Chaudhari

[4] Nayandeep Sran, Navdeep Kaur, "Comparative Analysis of Existing Load Balancing Techniques in Cloud Computing ", vol 2, jan 2013

[5] Chaczko, Zenon and Mahadevan, Venkatesh and Aslanzadeh, Shahrzad and Mcdermid, Christopher, "Availability and load balancing in cloud computing", International Conference on Computer and Software Modeling, Singapore, chaczko2011availabilit

[6] R. Alonso-Calvo, J. Crespo, M. Garcia-Remesal, A. Anguita, V. Maojo, "On distributing load in cloud computing: A real application for very-large image datasets", Procedia Computer Science 1 (1) (2010) pages 2669–2677.

[7] S.-C.Wang, K.-Q. Yan, S.-S.Wang, C.-W. Chen, "A three-phases scheduling in a hierarchical cloud computing network", in: Communications and Mobile Computing (CMC), 2011 Third International Conference on, IEEE, 2011, pp. 114–117.

[8] Y. Hu, R. Blake, D. Emerson, "An optimal migration algorithm for dynamic load balancing", Concurrency: Practice and Experience 10 (6)(1998) pages 467–483

[9] Etminani, Kobra and Naghibzadeh, M, "A min-min max-min selective algorihtm for grid task scheduling, Internet, 2007. ICI 2007. 3rd IEEE/IFIP International Conference in Central Asia on, 2007.

[10] Liu, Gang and Li, Jing and Xu, Jianchao, " An Improved Min-Min Algorithm in Cloud Computing" page{47--52}, year{2013}, organization Springer

[11] U. Bhoi, P. N. Ramanuj, " Enhanced max-min task scheduling algorithm in cloud computing". pages={2319--4847}

[12] H. Chen, F. Wang, N. Helian, G. Akanmu, "User-priority guided min-min scheduling algorithm for load balancing in cloud computing", pages={1--8}, year={2013}, organization={IEEE}

[13] Buyya, Rajkumar and Ranjan, Rajiv and Calheiros, Rodrigo N, " modeling and simulation of scalable Cloud computing environments and the CloudSim toolkit: Challenges and opportunities", pages{1--11}, year{2009}, {IEEE}

[14] Zhu, Linan and Li, Qingshui and He, Lingna, "Study on Cloud Computing Resource Scheduling Strategy Based on the Ant Colony Optimization Algorithm., International Journal of Computer Science Issues (IJCSI), year 2012, volume 9

[15] Gao, Yongqiang and Guan, Haibing and Qi, Zhengwei and Hou, Yang and Liu, Liang, "A multi-objective ant colony system algorithm for virtual machine placement in cloud computing, Journal of Computer and System Sciences, year 2013, vol79, ppages1230—1242

[16] Mishra, Ratan and Jaiswal, Anant, "Ant colony Optimization: A Solution of Load balancing in Cloud., International Journal of Web \& Semantic Technology, year 2012, vol 3

[17] Li, Kun and Xu, Gaochao and Zhao, Guangyu and Dong, Yushuang and Wang, Dan, "Cloud task scheduling based on load balancing ant colony optimization, Chinagrid Conference (ChinaGrid), 2011 Sixth Annual, year 2011

[18] O. Elzeki, M. Reshad, M. Elsoud, "Improved max-min algorithm in cloud computing, International Journal of Computer Applications"vol 5(12)(2012)pages22–27