Enhancement of Dynamic Load Balancing using ANT COLONY in cloud environment

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***Abstract*— Cloud Computing is an emerging trend in IT environment. Load balancing also plays an important part in cloud computing which has large amount of requirements of resources. In this paper the ANT based technique is compared with the existing algorithm and it has stood out in energy consumption, time management as better alternative to the previous algorithm. In current research the improvement of ANT colony algorithm has been done and compared in a tabular form.**

Keywords—Cloud Computing, Resource Scheduling, Load Balancing, Service Level Agreement (SLA), Resource Provisioning

I. INTRODUCTION

A. Cloud computing:-

Cloud computing relies on sharing of resources to achieve coherence and economies of scale similar to a utility over a network. Cloud Computing is getting popular every day. Cloud service providers provide services to large scale cloud environment with cost benefits. Also, there are some popular large scaled applications like social networking and internet commerce. These applications can provide benefit in terms of minimizing the costs using cloud computing. Cloud computing is considered as internet-based computing service provided by various infrastructure providers based on their need, so that cloud is subject to Quality of Service (QoS), Load Balance (LB) and other factors which have direct effect on user consumption of resources controlled by cloud infrastructure [1].

A cloud system is so complex due to its unpredictable environment. It is extremely challenging to obtain accurate information on the state of the system. Moreover, it contains large resources which are shared and require complex policies to manage them. The factors affecting the resource management in cloud are performance, functionality and cost. Resource management in cloud computing is associated with fluctuating workloads which pose a major Challenge to elasticity of cloud computing. The situation for fluctuation can be of two ways [15]. One is a planned spike and the other is an unplanned spike in workloads. For the first case, the situation can be predicted in advance and resource allocation can be done in advance. For the second case, resources have to be allocated on demand and reallocated when needed. This is called Auto-scaling in cloud computing. This shows that the policies for resource management for cloud computing is different from the policies for traditional systems [16]. The general policies to be considered in cloud resource management are Admission control: takes decision whether to admit a job/request to be processed in the cloud, Resource allocation: provisions Virtual Machines (VMs) onto Physical Machines (PMs) and jobs onto VMs, Quality of Service (QoS): refers to metrics like response time, operational cost, throughput, maximization of profit and so on, Workload balancing: load balancing of jobs between the resources so as to improve its utilization, Energy Management: refers to optimized use of energy in the datacenter [2].

B. Features of Cloud

- **Worldwide Access**. Cloud computing increases mobility, as you can access your documents from any device in any part of the world. For businesses, this means that employees can work from home or on business trips, without having to carry around documents. This increases productivity and allows faster exchange of information. Employees can also work on the same document without having to be in the same place.
- **More Storage**. In the past, memory was limited by the particular device in question. If you ran out of memory, you would need a USB drive to backup your current device. Cloud computing provides increased storage, so you won't have to worry about running out of space on your hard drive.
- **Easy Set-Up**. You can set up a cloud computing service in a matter of minutes. Adjusting your individual settings, such as choosing a password or selecting which devices you want to connect to the network, is similarly simple. After that, you can immediately start using the resources, software, or information in question [3,13].
- **Automatic Updates**. The cloud computing provider is responsible for making sure that updates are available – you just have to download them. This saves you time, and furthermore, you don't need to be an expert to update your device; the cloud computing provider will automatically notify you and provide you with instructions.

- **Reduced Cost**. Cloud computing is often inexpensive. The software is already installed online, so you won't need to install it yourself. There are numerous cloud computing applications available for free, such as Drop box, and increasing storage size and memory is affordable. If you need to pay for a cloud computing service, it is paid for incrementally on a monthly or yearly basis. By choosing a plan that has no contract, you can terminate your use of the services at any time; therefore, you only pay for the services when you need them [5].

II. EXISTING LAOD BALANCING TECHNIQUES IN DISTRIBUTED SYSTEMS

A. A fast adaptive load balancing method: D. Zhang et al. [4] proposed a binary tree structure that is used to partition the simulation region into sub-domains. The characteristics of this fast-adaptive balancing method are to be adjusted the workload between the processors from local areas to global areas. According to the difference of workload, the arrangements of the cells are obtained. But the main workload concentrates on certain cells so that the procedure of adjusting the vertices of the grid can be very long because of the local workload can be considered. This problem can be avoided by the fast load balancing adaptive method. Here the region should be partitioned by using the binary tree mode, so that it contains leaf nodes, child nodes, parent nodes etc. There were partition line between the binary tree and the indexes of the cells on the left are smaller that of right and the indexes on the top are smaller than the bottom [8]. Calculate the workload based on the balancing algorithm. 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 relative smaller communication overhead, faster balancing speed, and high efficiency and the disadvantage is it cannot maintain the topology that is neighboring cells cannot be maintained.

B. Decentralized Scale-Free Network Construction and Load Balancing in Massive Multiuser Virtual Environments: The concept of overlay networks that makes backbone of an online environment, which is used for interconnection of machines is addressed by Markus et al. [7]. The features of this network include better feasibility and load balancing to the dynamic virtual environment. The load balancing method was so designed that the surface of the world is to be divided into small cells in a self-organized way. Hotspots were created to calculate the absolute mass by the public servers. The over loaded nodes cannot be avoided or decreased but can be counted in this new algorithm. The disadvantage in this algorithm is that it is a bit time consuming [11].

C. Load Balancing in Dynamic Structured P2P Systems: Load balancing in dynamic peer to peer system was designed in an algorithm by Brighten et. al. which can be used in other hybrid environments. The concept of a virtual server is introduced to decrease the lack of performance of the system [6]. The peer nodes store the load information in different directories with the help of this algorithm and this helps to get better reassignment of the virtual servers in the system. It can be applied to resources such as bandwidth, storage etc. its advantages include increase in scalability and higher utilization of nodes but at the same time disadvantage include difficulty in reassignment.

III. PROBLEM DEFINITION

A. Overload and Underload

Each virtual machine has capacity to take up the load and also max. capacity to buffer the queue. Once this queue will be filled and on each subsequent addition of the request will overload the virtual machine. Underload is the situation when the virtual machine has load less than the max. capacity that machine can undertake [17].

B. Virtual Machine Migration

It is the process of migration of request from one machine to other, so that two objectives can be achieved.

- Saving the system from overloading on few virtual machines. i.e. it should be evenly distributed.
- Saving the power consumption by shifting the load of two or more virtual machines to one or more machines/ so that few machines power can be shut off. In result power will be saved [9,12].

C. Parameter Improved

- Reduction in time required for execution of request due to less waiting time.
- Total power consumption for cloud i.e. energy reduction by request completion.

D. Implementation Parameters

In total cloud we have taken 15 resources. Mainly these resources are sharable file resources. Various clients request for these resources. cloud virtual machine which has less load will look for the available resources and allocate these resources to the client itself. The identification of optimal machine will be based on least load and maximum processing speed.

As the tasks are being submitted to the cloud by the clients. It will be of dynamic nature. Such that there is no fixed no. of client requests. The requests submitted by the client can be fulfilled if the cloudlet has enough resources.

For this cloud we have taken 10 cloudlets. Each cloudlet will be allotted with unique cloudlet id as it runs. Each cloudlet can take up the load of 5 requests. At the start we have taken the load of 1 at each cloudlet [10,14].

When the two virtual machines load is equal to or less than the first machine total capacity, then shifts the second machine load to the first machine. And power off the second machine.

3.1 Flow Chart of Proposed Algorithm

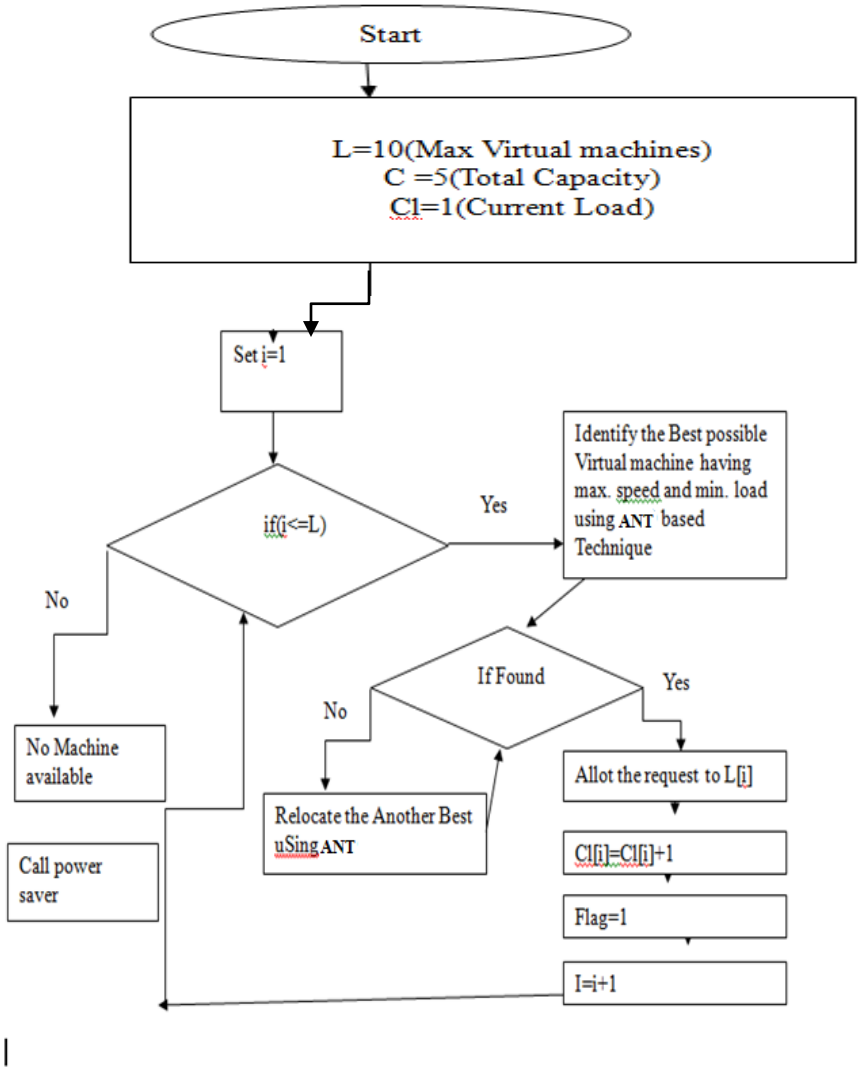


Figure 3: Proposed Flow Chart

IV. Results and Discussion

In current research the improvement of the ANT colony algorithm has been done. In second table there is the comparison of time taken by previous technique and current technique. In this table this time denotes the time taken for load balancing. Such that overloading of the machines can be avoided. In current ANT based technique is an improvement in time.

4.1 Experimental Results

Time Comparison		
Cloudlet ID	Centralized based Time	ANT Based Time
0	320	259
5	320	296
1	320	254

6	320	265
2	320	274
7	320	222
3	320	320
8	320	281
4	320	302
9	320	242
100	320	244
105	320	246
102	320	274
107	320	262
104	320	295
109	320	226
101	320	248
106	320	261
103	320	314
108	320	297
Average	320	269.1

Table 1: Time Comparison

In second table there is the comparison of time taken by previous technique and current technique. In this table this time denotes the time taken for load balancing. Such that overloading of the machines can be avoided. In current ANT based technique is an improvement in time. As this improvement is around 20% to 21%. Such that centralized technique requires more time for load balancing.

4.2 Energy Comparison

Energy Table		
Cloudlet ID	Power Consumption of Centralized	ANT Power consumption
0	17.888544	17.66352
5	17.888544	15.779734
1	17.888544	16.673332
6	17.888544	17.029387
2	17.888544	17
7	17.888544	15.132746
3	17.888544	17.521416
8	17.888544	17.720045
4	17.888544	15.716233
9	17.888544	17.088007
100	17.888544	16.462078
105	17.888544	15.427249
102	17.888544	15.033297
107	17.888544	14.933185
104	17.888544	17.521416
109	17.888544	15.588457
101	17.888544	16.40122

106	17.888544	15.362291
103	17.888544	16.340136
108	17.888544	16.703293
Average	17.888544	16.3548521

Table 2: Enery Comparison

In energy comparison of both the techniques there is ANT based technique shows that less energy is required for load balancing in comparison to the centralized technique. There is an improvement around 18%.

5.3 Throughput

In comparison to the centralized and distributed (ANT) the throughput is better in each iteration. That mean the ANT on average performs in better way.

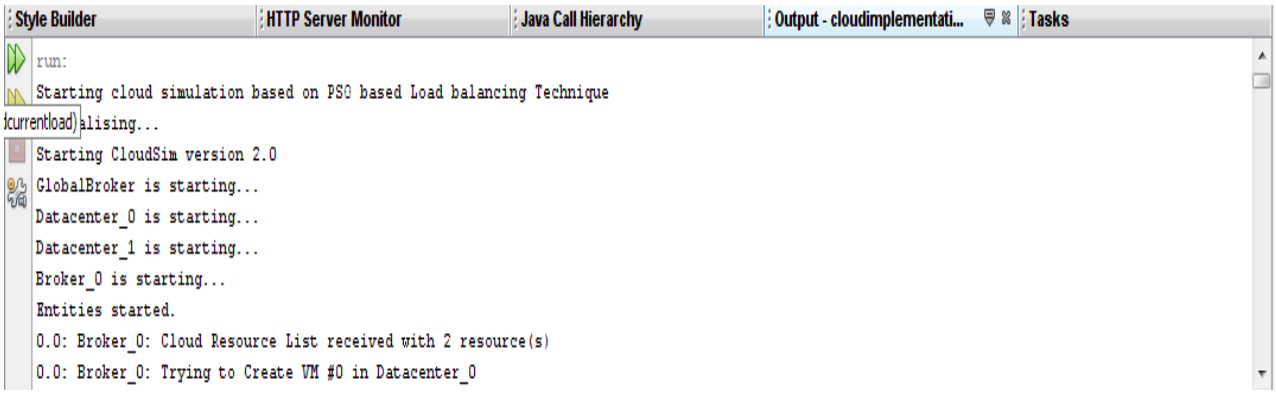
5.4 Processor Utilization

In both the cases the processor utilization is same. But we can say that at same processor utilization the ANT gives better throughput.

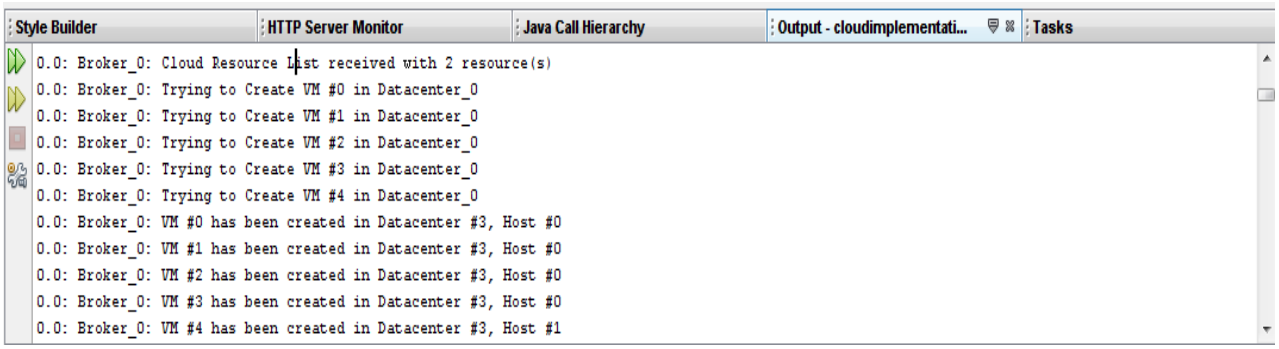
5.5 Virtual Machine migration of centralized

In case of centralized there is no virtual machine migration. Each machine even goes on processing at minimum load. Mean no machine will be shut down to save the power. Because in centralized the machines under the control of the central machine is always check the load not the threshold load.

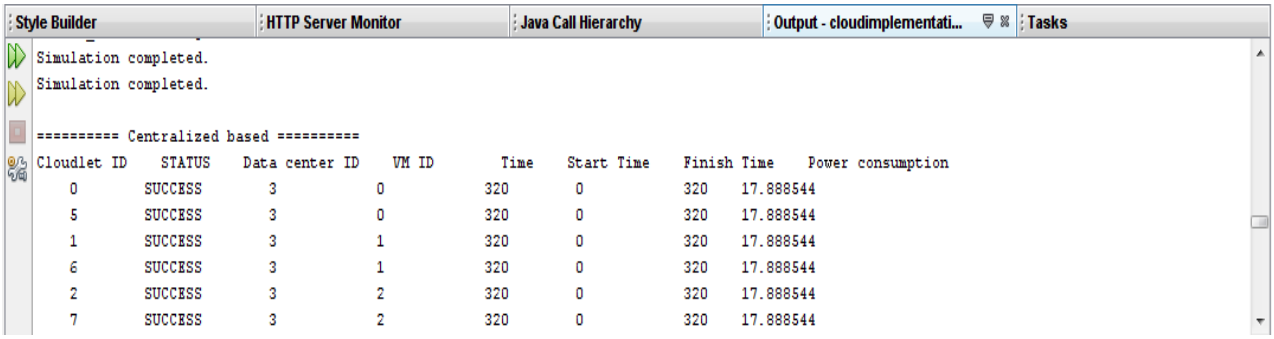
5.6 SNAPSHOTS



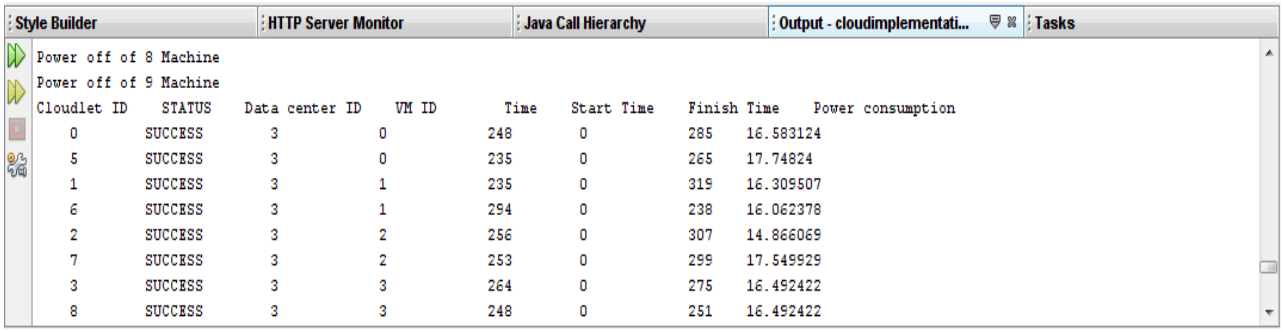
This snap shot shows the start of the cloud. As while starting the cloud all the datacenters and brokers are being started. Each cloud also has specific no. of virtual machines.



In this snapshot each datacenter is creating virtual machines. Each virtual machine has their own unique ids.



This snapshot shows the centralized based cloud scheduling. It shows various parameters like Time, Start Time, Finish Time, and Power Consumption. This snap shot shows the ANT based power management. When there is less load few machines automatically be shut down so that power occupation can be reduced. In result better resource utilization.



This snap shot shows the ANT based scheduling. In this various parameter are being shown like Time, Start Time, Finish Time, Power Consumption.

CONCLUSION AND FUTURE SCOPE

In this time denotes the time taken for load balancing. Such that overloading of the machines can be avoided. In current ANT based technique is an improvement in time. As this improvement is around 20% to 21%. Such that centralized technique requires more time for load balancing. In energy comparison of both the techniques there is ANT based technique shows that less energy is required for load balancing in comparison to the centralized technique. There is an improvement around 18%. In comparison to the centralized and distributed (ANT) the throughput is better in each iteration. That mean the ANT on average performs in better way.

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