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A Novel Approach to Load Balancing in Cloud Computing Using PSO and ESCEL

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Abstract— From last decade there has been a rapid development in the use of internet and its applications. Cloud computing is also known as internet based computing where we rent the computing resources over the internet. It is a pay per use model where you only pay for the amount of services rented. It provides numerous advantages over the traditional computing. With cloud computing gaining such a huge momentum now a days, the office culture is even changing as many people now even prefer to work from home rather than going every day to office. There are three main services provided by cloud that are SAAS, IAAS and PAAS. Load balancing is a very major issue faced now a days in cloud environment so that the resources are efficiently utilized. There are many load balancing algorithms available that are used to balance the load of the client requests. In this paper we are going to propose a algorithm which is a combination of two algorithms namely PSO and ESCEL.

Keywords: Cloud computing, Load balancing, ESCEL, PSO, Virtual machine, Optimization

I. INTRODUCTION

Cloud computing provides on demand services of software, hardware and infrastructure as per the requirement of the user at a specific time. In this the user pays only for the amount of service he is going to use. For example there are many ERP softwares being used in most of the organizations to manage the functionalities of its different departments. The clients or users generally purchases yearly licences to use ERP softwares and use them. In order to extend the services they need to pay the subscription fees again for the next year. To the users it does not matter where the actual hardware or software is installed, it is somewhere located on some remote server. Fig.1 depicts the general scenario in cloud computing.

In order to provide consistent services, it is very important to address the issue of load balancing among various nodes. As the requests are randomly generated by the users so many a times due to this some nodes become heavily loaded and some are very lightly loaded. In order to improve the overall efficiency of the system the objective of load balancing is to transfer the load from the heavily loaded machine to lightly loaded machine. This will improve the resource utilization as well as the response time of the various client requests and will increase the overall performance of the system.

There are number of load balancing algorithms that are available in the cloud computing to assign the requests to the most efficient VM in such a way that resources are effectively utilized. Cloud computing implements the virtualization technique in which a single system can be virtualized into number of virtual systems. Load balancing of the entire system can be handled dynamically by using virtualization technology where it becomes possible to remap virtual machines (VMs) and physical resources according to the change in the load. A virtual Machine is a software implementation of a computing environment in which an operating system (OS) or program can be installed and run.

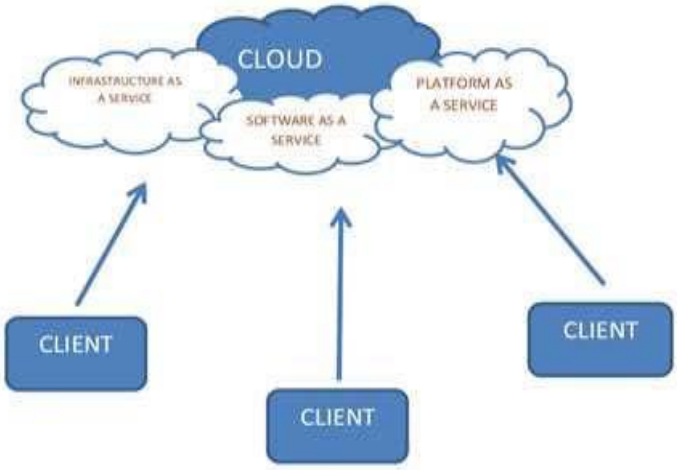

Fig. 1[2]

II. EXISTING LOAD BALANCING ALGORITHMS

There are many algorithms that are available which are used for deciding in which way the coming client requests need to be served ie. to which virtual machine they need to be assigned so that the overall resource utilization is maximum. The load balancing algorithms are broadly classified in two categories: static and dynamic. The static algorithm is based on certain predefined conditions and does not take into account the current state of the system. Whereas Dynamic algorithm take into account the present state of the system. Listed below are some of the existing algorithms.

A. Round Robin Load Balancer

It is a static algorithm which assigns the client requests to the virtual machines as per the round robin scheduling. It does not take into account the previous state of the system. Here the first request is assigned to the VM picked randomly and later requests are assigned to virtual machines on a circular basis where each virtual machine is given a fixed quantum of time.

B. First come First serve

It is simplest of all the scheduling algorithms. It assigns the jobs in the order in which they arrive into the system. The implementation of FCFS algorithm is managed with the help of FCFS queue. The job which enters the system first will be assigned the virtual machine first. See fig.2 below.

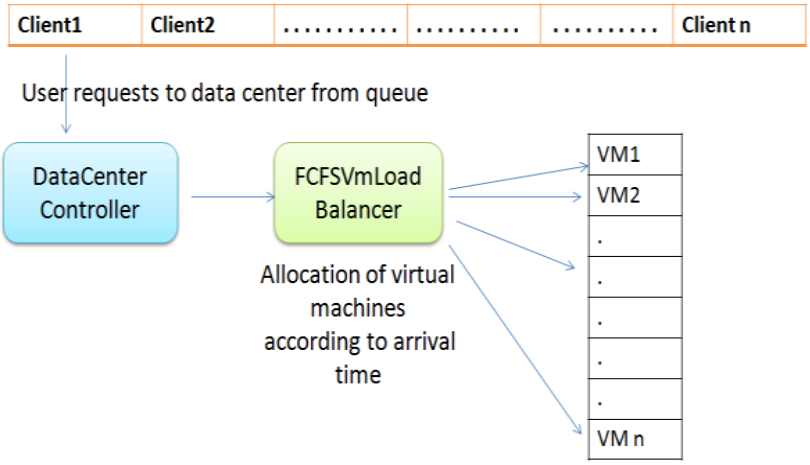

Fig.2 FCFS Load Balancing [1]

C. Throttled Load Balancer

This algorithm is based on the Virtual machine and is dynamic in nature.. It will check the most suitable VM that can serve the client request easily and can handle the operations given by client. If there is no virtual machine which is available, it will wait and for the virtual machine to be free. When the virtual machine is set to free, the next job is assigned to it.

D. ESCEL Algorithm

This algorithm initially assigns the task randomly to the virtual machines. It is based on the concept of current execution load. This algorithm calculates the current load on each virtual machine and then distributes the load from heavily loaded virtual machine to the lightly loaded virtual machine. It is dynamic in nature as it considers the current load condition of each virtual machine.

III. PROPOSED WORK

A. Problem Statement

Now a days cloud computing is used in almost every domain of work and has numerous applications. Effective utilization of resources is very important so as to increase throughput and responsiveness of the system. So we need to have proper load balancing mechanisms. The Round robin is a static approach and thus does not take into account the current state of the system. The first come first serve is easier to implement but does not effectively utilize the given resources. The honey-bee inspired load balancing is based on first come first serve approach and is complex in implementation as each node need to maintain its separate queue and will need to calculate profit every time a client request is assigned to a particular virtual machine. The proposed algorithm is dynamic in nature and assigns the request to most suitable virtual machine and not on the first come first serve basis.

B. Load balancing in cloud computing using PSO and ESCEL

As discussed in previous section there are many algorithms which are available to balance the load in cloud. In a cloud environment there are no of users present which generates the requests, and no of virtual machines which are present and the decision of which client request is assigned to which VM is based on load balancing algorithm. In this paper we will try to carry out the implementation of the algorithm which balances the incoming load present in the cloud. It is a dynamic algorithm that will assign the requests in most efficient way so that resources in the system are properly utilized.

We shall be using particle swarm optimization approach to optimize the user requests so that they are assigned to the most appropriate virtual machine as per the capacity of the virtual machine. Later the load will be further balanced by the ESCEL algorithm. ESCEL algorithm will balance the load of the system by checking the current load on each machine and then migrating the load from a highly loaded virtual machine to a least loaded virtual machine.

IV. SYSTEM MODEL

The cloud consists of a number of nodes which are present in cloud. Our proposed model will consists of the pool of jobs which are created as requests are generated by the clients and there will be a number of virtual machines in the system. The requests are assigned to the virtual machines based upon the particle swarm optimization (PSO) algorithm. PSO is a algorithm which is inspired by the bird flocking behaviour. It is a new computation technique due its high performance and flexibility. Later the load is balanced by migrating load from the highest loaded machine to the lowest loaded machine thus by effectively utilizing the system resources.Fig.3 depicts the system architecture.

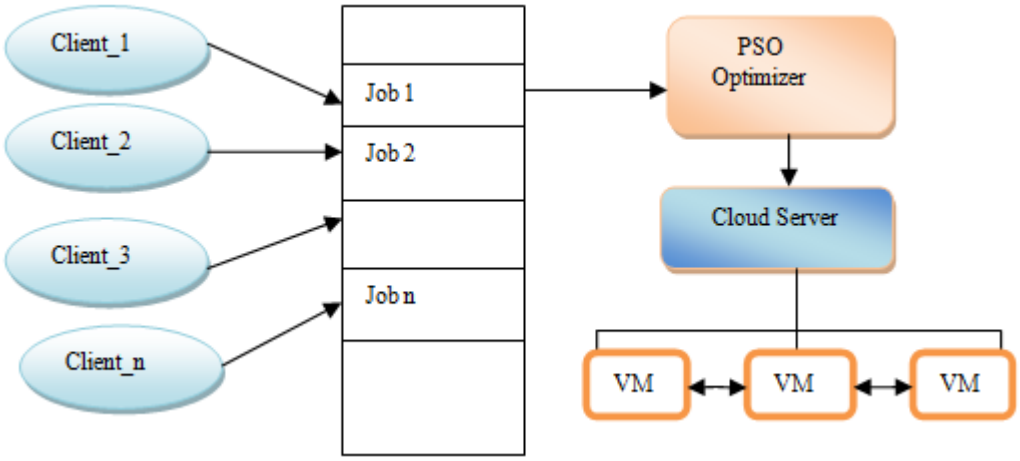

Fig.3 Proposed system Architecture

V. IMPLEMENTATION

The implementation of the proposed work is done by developing a module in java. The complete scenario which consists of a number of clients generating requests and a no of virtual machines to which these requests are to assigned. These requests are queued up and stored in pool. Each job has its associated load and each virtual machine has a maximum load capacity that determines the maximum load that can be assigned to that virtual machine. The client requests are assigned to virtual machine upon being optimized by PSO. The ESCEL load balancer balances the current load on the system thus stabilizing the load on given virtual machines.

VI. RESULTS

The performance of the system is checked by the time spent in execution to assign the request to a suitable virtual machine and comparing it with time spent when ESCEL is used in single. We observed that the time is considerably reduced when our proposed algorithm is used. It can be depicted with the help of a graph which compares the time spent in scheduling jobs when PSO and ESCEL is used hybrid as compared to those used in case of ESCEL only, refer to fig. 4.

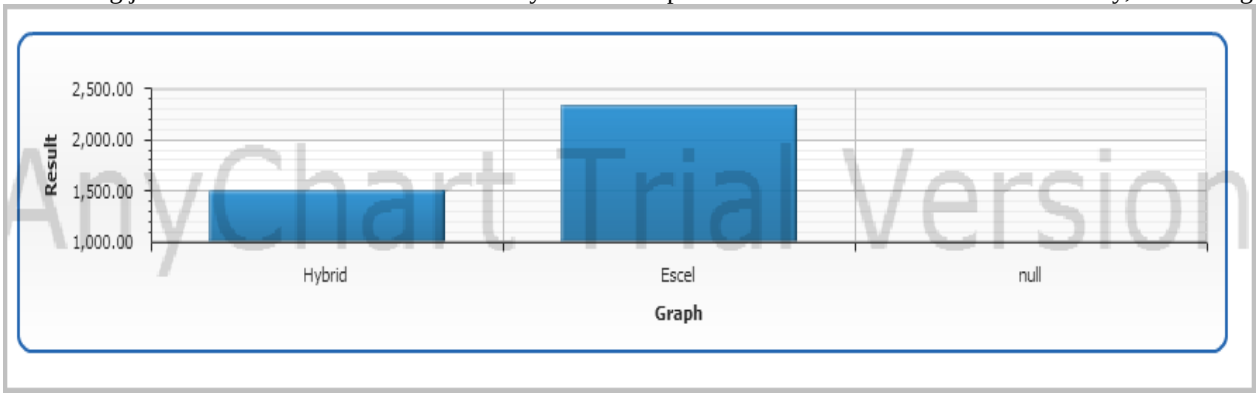

Fig. 4 Execution time comparison (in nano seconds)

VII. CONCLUSION

In present work we proposed a load balancing algorithm which is based on PSO and ESCEL. The implementation of proposed work is carried out by developing a custom module in java. We did the performance comparison of the proposed algorithm with respect to the ESCEL. We found that the performance of the system is improved. In future the results can be further refined by taking into account the different variations of PSO along with existing load balancing algorithm.

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