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Comparative Analysis of Load Balancing Algorithms in Cloud Computing

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ABSTRACT

Cloud computing, now a days is becoming the most demanding and evolving technology all over the world as cloud computing emphases on increasing the effectiveness of the shared resources as well as cloud resources are generally not only shared by numerous users but as dynamically re-allocated per demand. The use of network services are increased by cloud computing which is an internet based computer technology. The main difficulty associated to cloud computing is the load balancing. The load can be characterized as a memory, CPU storage capacity, a network or delay load. It is always required to segments work load among the dissimilar nodes of the distributed system to advance the resource consumption and for enhanced performance of the system. This can support to evade the condition where nodes in the network are heavily loaded or under loaded. Cloud load balancing helps to enhance the overall cloud performance. This paper emphasize on a new hybrid approach and its comparison with various existing load balancing algorithms such as round robin, throttled, escel, and pso on the basis of overall response time, execution time as well as on the data centre request servicing time.

Keywords: cloud computing, data centres, load balancing, virtual machine.

1. INTRODUCTION

As cloud computing is growing fastly and more services and better results are demanded by the clients, so for the cloud, load balancing has become a very interesting and important research area. Load balancing has a significant influence on the performance in cloud computing as load balancing aims to enhance resource consumption, get the most out of throughput, reduce response time, and avoid overload of any single resource. Better load balancing makes cloud computing more efficient and improves user satisfaction. Therefore, "it is the process of confirming the evenly distribution of work load on the pool of system node or processor so that the running task is accomplished without any disturbance". The objectives of load balancing are to maintain the stability of the system, improves the performance, build the system which is fault tolerance and provide future variation in the system such as security updates, releasing up customers time and resources for further tasks as well. Cloud load balancing is a type of load balancing that is executed in cloud computing which can be completed individually as well as on grouped basis. There are various algorithms designed for balancing the load among different tasks. After completing the literature survey, it can be conclude that most of the load balancing algorithms suggested so far are complex. In Round robin scheduling algorithm method, it considers only current load on each virtual machine. This is static method of load balancing, static load balancing method offer simplest simulation and checking of environment but failed to model heterogeneous nature of cloud. The other algorithm known as throttled is completely based on virtual machine. In this algorithm, "client first ask the load balancer to check the correct virtual machine which access that load simply and execute the operations which is given by the user or client". Escel algorithm says that load balancer is necessary for monitoring of jobs which are requested for execution. The responsibility of load balancer is to queue up these jobs and assign them to different virtual machines. The balancer regularly looks over the queue for fresh jobs and then allots those jobs to the list of free virtual server. The list of tasks that are allotted to virtual servers are also maintain by the balancer, which supports them to recognize that which virtual machines are free and required to be allotted with fresh jobs. The name suggests about this algorithm that "it work on equally spreading the execution load on different virtual machine". According to our research outcome of this algorithm in terms of response time and data center request servicing time is very low in comparison of other two algorithms .Therefore with these issues in mind our paper presents an optimized load balancing system for cloud using PSO and ESCEL algorithms .In our proposed system cloud assign jobs or client request using ESCEL scheduling algorithm but before assign jobs to VMs, these jobs were optimized by cloud server using Particle

Swarm Optimization in an optimized way. Using both these method, system will be less complex and time will be reduce for client request as well as for data center request servicing time.

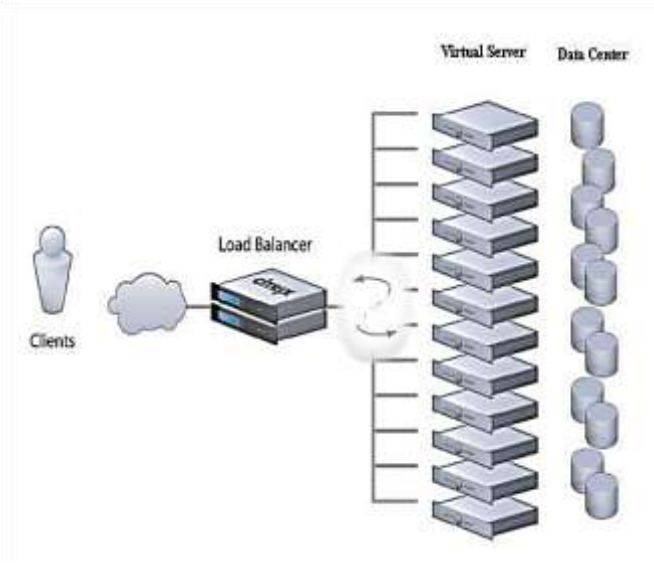

Figure 1: Load Balancing In Cloud Architecture [15]

2. LITERATURE REVIEW*:*

- Shridhar G. Domanal and G. Ram Mohana Reddy et al.[7] developed Modified Throttled algorithm which preserves an index table of virtual machines and also the state of VMs like to the Throttled algorithm. There has been an effort made to recover the response time and attain effective usage of accessible virtual machines. Proposed algorithm employs a method for choosing a VM for processing client's request where, VM at first index is primarily designated depending upon the state of the VM. If the VM is existing, it is assigned with the request and id of VM is reverted to Data Center, else -1 is returned. 3next to already assigned VM is chosen liable on the state of VM and follows the above step, improbable of the Throttled algorithm, where the index table is parsed from the first index every time the Data Center queries Load Balancer for distribution of VM.
- Chaisiri et al.[14] proposed an adaptive resource allocation algorithm for cloud system with pre-empt able tasks but their approach does not pertain to cost and time. Due to the recent emergence of cloud computing research in this area is in the preliminary stage have proposed a resource allocation mechanism with pre-empt able task execution which increases the utilization of clouds.
- Bhathiya et al.[13] considers Cloud Sim-based Visual modeler for analyzing Cloud Computing Environments and Applications all present how Cloud Analyst can be used to model. We have illustrated how the simulator can be used to effectively identify overall usage patterns and how such usage patterns affect data centers hosting the application. Evaluate a real world problem through a case study of a social networking application deployed on the cloud.
- Xiaona Ren et al.[16] considers the unique features of long connectivity applications, which are increasingly popular nowadays in cloud computing. An improved algorithm is proposed based on the weighted least connection algorithm. In the new algorithm, load and processing power are quantified, and single exponential smoothing forecasting mechanism is added. Finally, the article proves by experiments that the new algorithm can reduce the server load tilt, and improve client service quality effectively. But it is Complicated and Prediction algorithm requires existing data and has long processing time.
- Jing Yao et al.[17] presents Load Balancing Strategy of Cloud Computing based on Artificial Bee Algorithm, which is a bionic method based on the gathering behavior of honeybee. Through imitation of behavior of honey bees, it optimizes the amount of nectar (i.e., system throughput) to reach the maximum throughput.

A. Pseudo code: Proposed Hybrid Approach

Begin
Find the next available VM
Checked for every present distribution computation is less than max length of VM assign the list VM
Calculate the load, capacity of a virtual machine
Calculate pbest and gbest for each machine
If existing VM is not assigned generate an original one
Do
Count the active load on each VM

Update load and capacity of virtual machine

Submit the id of those VM which are consisting of minimum load.

The VMLoadBalancer will allocate the request to one of the VM.
If a VM is overloaded then the VMLoadBalancer will distribute some of its work to the VM having least work so that every VM is equally loaded.

Calculate *VM future resource need value of each machine. Update pbest for each machine.*

Update gbest for each machine
Choose the low loaded machine and migrate task from overloaded machine
The datacentre controller receives the response to the request sent and then allocate the waiting requests from the job pool/queue to the available VM & so on.

While
End
Termination criterion is not violated.
End
Termination criterion is not violated.

3. PROTOTYPE DEVELOPED FOR ALREADY DEVELOPED LOAD BALANCING ALGORITHM

A. Equally spread current execution load[4,12]:

The random appearance of load in such a situation can make some server to be heavily loaded while other server is idle or only lightly loaded. By transmitting load from heavily loaded server to low loaded server, the performance is enhanced. "As

the name suggests about this algorithm that it work on equally spreading the execution load on different virtual machine". Load balancer is necessary for monitoring of jobs that are requested for execution. Now, the load balancer queued up these jobs and assign them to different virtual machines. "It also maintains the list of task allotted to virtual servers, which helps them to identify that which virtual machines are free and need to be allotted with new jobs".

B. Throttled Load balancing[4,12]:

The algorithm known as Throttled is entirely based on virtual machine. The algorithm work for assigning a particular job by finding the appropriate virtual machine. All virtual machines list is having by the job manager, using this indexed list, the needed job is allotted to the appropriate machine. "If the job is well suited for a particular machine than that job is assign to the appropriate machine. If no virtual machines are available to accept jobs then the job manager waits for the client request and takes the job in queue for fast processing".

C. Round Robin[4,12]:

Round robin use the time slicing mechanism. As the name suggests the algorithm works in the round manner where each and every node is assigned with a time slice and that node has to pause for their turn. The time is divided and each node is allotted with an interval. They have to perform their task in a time slice they have allotted. It considers only current load on each virtual machine. This is static method of load balancing, this scheme provide simplest simulation and monitoring of environment but not able to model heterogeneous nature of cloud.

D. PSO Algorithm [5, 11]:

In PSO algorithm, task will check all the virtual machines and assign the task to proper virtual machine which will have least memory wastage i.e., task will assign to those virtual machines which will have least memory wastage in best fit manner . User sends their task request to the cloud server. And this cloud server will decide which virtual machine to store that task. Cloud server will select the virtual machine based on the particle swarm optimization algorithm.

4. PROPOSED HYBRID SYSTEM

This paper provides an optimized load balancing system for cloud using PSO (Particle Swarm Optimization) and ESCEL(Equally Spread Current Execution Load) algorithms as using both methods, system will be less complex and time will be reduce for client request as well as data centre request servicing time is also minimized. In our proposed system cloud assign jobs or client request for jobs using ESCEL scheduling algorithm but before assign jobs to VMs, these jobs were sent to the cloud server and cloud server optimized these jobs using Particle Swarm Optimization in an optimized way. Therefore, reducing the request time for client and data centre as well as fast response for completion of time is also delivered.

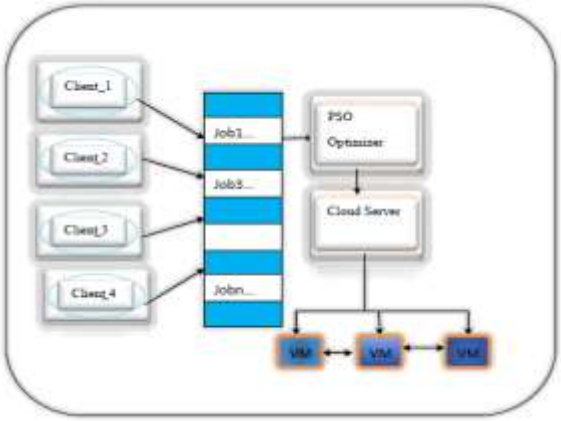

Figure 2: Proposed system Architecture

A. Working Methodology:

In our proposed system client requests for resources to cloud server. These requests take a form of queue of jobs taking time as one of constraints. After queue formation of jobs, PSO (Particle Swarm Optimization) is applied for optimization of these tasks and then these tasks are sent to the cloud server as per computing purpose. Now, cloud server assigns these jobs to VMs after applying ESCEL (Equally Spread Current Execution Load) scheduling algorithm. As a result, Client gets optimized and fast response for completion of task is delivered. [Figure 2] shows the complete working of the proposed system.

5. RESULTS

The Proposed hybrid approach is more efficient and reduces the response time as well as data centre request servicing time compared to ESCEL algorithm. It can be clearly observed that [3, 5, and 6] Particle Swarm Optimization algorithm is more efficient than ESCEL algorithm. In our study it was found that PSO gave better results, so integrate both PSO and ESCEL algorithms for enhance accuracy in load balancing. [Figure 3] shows the overall response time comparison between ESCEL, PSO and Hybrid Approach on a dataset of 5 VMs and 15 VMs respectively from which it is clearly observed that Hybrid approach provides better result as compared to both, on the parameter overall response time.

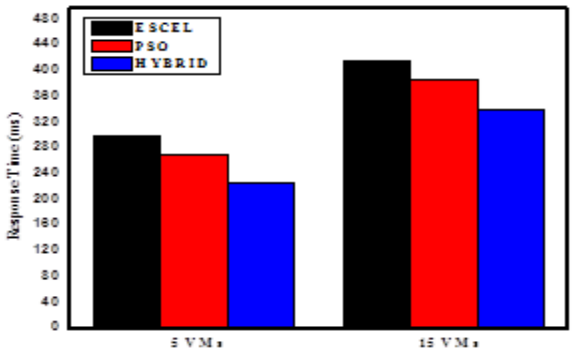

Figure 3: Overall response time comparison between ESCEL, PSO and Hybrid Approach on dataset of 5 VMs and 15 VMs respectively

A. Comparison of Execution Time:

Figure 4: Execution time comparison between ESCEL (Equally Spread Current Execution Load) and Hybrid Approach

B. Overall Response Time:

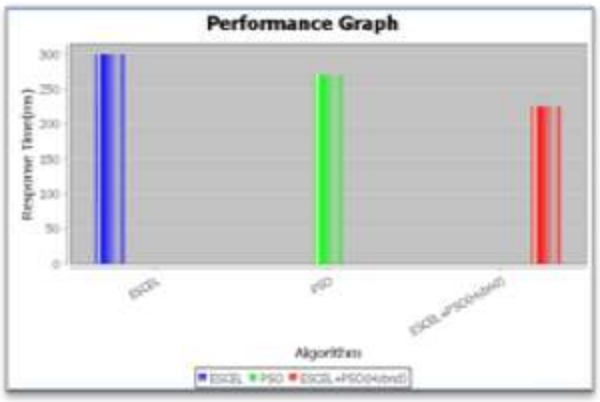

Figure 5: Overall Response Time Comparison between ESCEL, PSO (Particle Swarm Optimization) and Hybrid approach

C. Data Center Request Servicing Time:

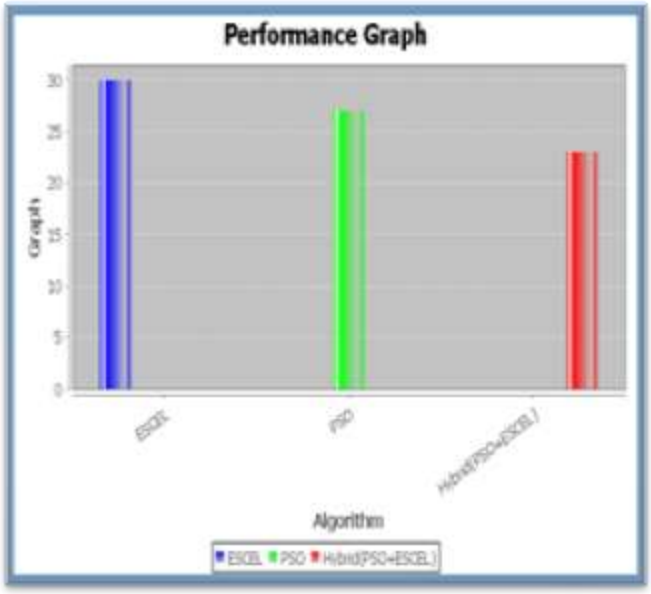

Figure 6: Data Centre Request Servicing Time Comparison between ESCEL, PSO and Hybrid Approach

No. of VMs	Time taken by each algorithm (ms)		
	ESCEL	*PSO*	*Hybrid*
5	300	270	225

No. of VMs	Time taken by each algorithm (ms)		
	ESCEL	*PSO*	*Hybrid*
15	425	390	340

Table 1: Simulation of overall response time for ESCEL, PSO and Hybrid approach

Hybrid approach has many advantages over ESCEL and PSO on the parameters such as overall response time, execution time, data centre request servicing time as well as complexity of the system gets reduced with fast execution of tasks. [Figure 4-6].

6. CONCLUSION AND FUTURE WORK

This paper presented new algorithm for load balancing in cloud computing. Algorithms PSO and ESCEL were integrate on the basis of proposed architecture is done. A study about the working of PSO algorithm in different research areas is also accomplished. In our study it was found that PSO gave better results so our aim is to use it with ESCEL algorithm for enhance accuracy in load balancing. This study makes our vision focus on the aspect that PSO can be used to optimize load balancing in cloud computing. Therefore, In future work, our planning is to optimize PSO to make it appropriate for cloud environments and more efficient or effective in terms of load balancing. Furthermore, this research work can also be exaggerated by implementing the optimization of PSO on different cloud simulators and compare the proposed approach with previously tested soft computing techniques based on some parameters which are fixed.

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