Review of Various Load Balancing Methods for Cloud Computing

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ABSTRACT

Cloud computing is an innovative technology which is based on virtualization. It is a new name of existing technology. Cloud computing mainly serves computing resources as a service to cloud users. This Computing is not only about the hard drives were storing and accessing can be done but it is latest computing paradigm and it offers tremendous opportunities to solve the large-scale scientific problem. To fully exploit the applications of cloud, various challenges need to be addressed where scheduling is one among them. In cloud computing, optimum utilization of computing resources are always challenging. A cloud service provider ensures to serve computing resources efficiently to cloud user at optimum cost. Load balancing methods play a vital role in the efficient utilization of computing resources. A load balancing algorithm migrates an overloaded VMs task to an under the loaded machine, with disturbing the existing environment. Different load balancing methods are suggested by cloud researchers. Still, an efficient load balancing method is required. This research paper presents a review of various load balancing method in cloud computing. Also, a comparative analysis has been presented based on various performance measuring parameters.

Keywords : Cloud computing, Load balancing, Virtualization, Virtual Machine, Load Balancer

I. INTRODUCTION

Cloud Computing is the future of technology said by various CEO of IT industry. It works on the principle that the user must pay according to the time for which it is using the resources from various cloud providers. It is well known that it is not easy to handle large resources. It is very costly in terms of money as well. So Cloud Computing is the best answer to these challenging problems [7]. Cloud Computing is the answer to almost every problem faced by many Industries which are directly or indirectly related to the Information Technology. This field is growing very fastly as many of the big players in the Information Technology field like Microsoft, Google, Amazon, SAP are investing a lot of money to get improved results. They feel that it is the future of technology.

Cloud computing is a model for enabling on-demand network access to a shared pool of configurable computing machines, which can be provisioned and released with minimal management effort or service provider interaction. In cloud computing, one can store data on remotely placed servers accessible through the internet. It can offer utility-oriented IT services to users based on a pay-as-you-go model [9]. One of its major advantages is that it offers QoS, high computational power, and storage capacity at low cost. According to technology experts, cloud computing can be seen as a game-changing technology that can change the way we access technology.

II. CLOUD COMPUTING & LOAD BALANCING

2.1 Cloud Computing : Cloud Computing Cloud computing is a model for enabling convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort. Cloud computing is based on virtualization. Virtualization is the principal aspect of

the cloud system [3]. Using virtualization technique, cloud computing virtualized a single system into a number of virtual systems. Basically, a virtual machine is a software implementation of the physical resource. A hypervisor (a firmware or low-level program) also called virtual machine monitor is responsible for sharing of a single physical instance of cloud resources among various tenants [5].
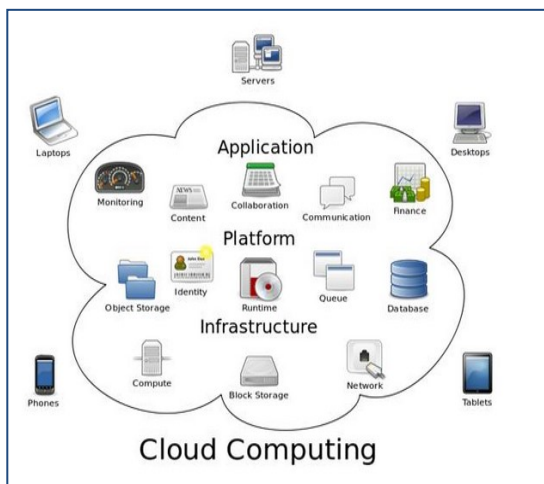

Figure 1. Cloud Computing

The goal of cloud computing is to improve the performance of the system and to achieve optimal resource utilization, maximum throughput, maximum response time, and avoiding overload [7].

2.2 Load Balancing : Cloud computing could be a model for enabling appropriate, on-demand network access to a joint pool of configurable computing resources that may be quickly provisioned and discharged with least management effort. The underlying plan of cloud computing is that the separation of applications from the in operating systems and therefore the hardware on that they run [8,11].
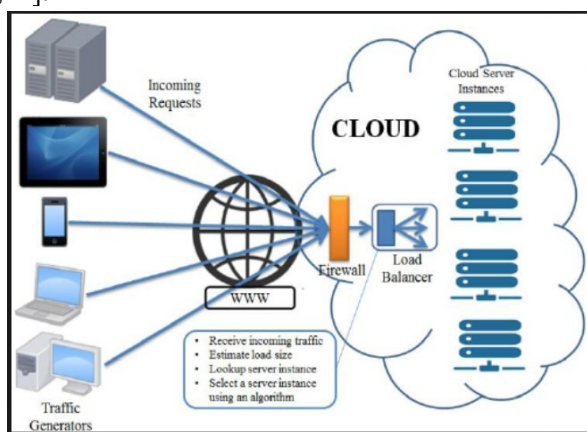

Figure 2. Load Balancing in Cloud

Load balancing is the process of apportioning the load among various working nodes of a distributed system to improve both resource utilization and job response time while avoiding a situation where some of the nodes are heavily loaded while others are underloaded. Load balancing ensures that every node in the system does the approximately equal amount of work as per their capacity at any instant of time [6].

2.2.1 Advantages of Load Balancing

- ✓ To expand the performance significantly.
- ✓ To have a backup plan in case the system fails even partially.
- ✓ To keep the framework stable.
- ✓ To give future improvement in the framework
- ✓ To distribute the workload fairly.

2.2.2 Need of Load Balancing [3]

- ✓ To improve the performance substantially.
- ✓ To have a backup plan in case the system fails even partially.
- ✓ To maintain the system stability.
- ✓ To accommodate future modification in the system.

III. Related work in Load Balancing

Load Balancing is a necessary task in Cloud Computing environment to attain maximum use of resources. If we talk about different load balancing methods, everyone having some pros and cons. Static load balancing method provides simplest simulation and check of the environment but not succeed to the model heterogeneous character of the cloud. Where dynamic load balancing algorithms are hard to simulate but are most excellently suited in a heterogeneous environment of cloud computing.

Round Robin Load Balancing Algorithm : It is a very simple load balancing algorithm that places the newly coming cloudlets on the available virtual machines in a circular manner. The major advantages of these algorithms are its simplicity and easy implementation. The main drawbacks are that it requires the prior knowledge of user tasks and system resources & it does not make use of current state of the system [3, 12].

Throttled Load Balancing Algorithm : It is a dynamic approach. In this, the user submits its request to the Data Center Controller (DCC). Data Center Controller asks the VM Load Balancer to determine the appropriate virtual machine that can handle that much workload easily. Throttled VM Load Balancer keeps a virtual machine list and their status (available/busy). If a suitable VM is found on memory space, cores or availability basis, then throttled VM Load Balancer accept the cloudlet request and allow the cloudlet request over that virtual machine. Otherwise, the client has to wait in the waiting queue until a suitable VM becomes available [11].

FCFS : FCFS (First come back 1st Served), employed in parallel task process, is that the simplest task ordering strategy. It chooses and processes them in keeping with the proper order of jobs moving into the system. With this theme, the user request that comes 1st to the data center controller is allotted the virtual machine for execution 1st. The implementation of FCFS policy is definitely managed with first in first out queue. The data center controller searches for virtual machine that is in idle state or underloaded [9].

ESCE VM load Balancing Algorithm : ESCE stands for Equally Spread Current Execution. It is also called Active VM Load Balancing algorithm. This algorithm is based on spread spectrum technique. As the name indicates, it equally distributes the workload on each VM in the data center [7]. A job queue keeps all the cloudlet requests that need the VM for their execution. ESCE VM Load Balancer (VMLB) also maintains a list of virtual machines. The VM Load Balancer continuously checks the job queue and VM list. If a VM is found free, then cloudlet request will be allotted over that VM.

Ant Colony Optimization : The algorithm works based on the heuristic approach. Whenever a request is initiated, the ants and pheromones are initiated [1, 3]. The ants move towards the head node. The forward movement indicates the ant is moving from the overloaded node to the other by verifying whether the other node is overloaded or not. If the Ant finds under the loaded node, it will continue the forward movement towards the head, else it will take a backward movement to get to the previous node. The Ant commits suicide when it reaches the Target node to avoid further backward movements.

Opportunistic Load Balancing Algorithm : It is also one of the static load balancing algorithms, which do not consider the present workload of the VM. It usually keeps each and every node busy [3, 15]. This deals with the unexecuted tasks quickly and in random order to the current node, where each one of the task is assigned to the node randomly. This algorithm provides a load balancing schedule but does not produce a good result. The tasks are processed in a slow manner, where the current execution time of the node is not calculated.

Honeybee Foraging Load Balancing Algorithm : It is one of the dynamic load balancing algorithms, where they are designed based on the behavior of honey bees. Honey bees have been classified into two types. They are finders and reapers. The finder honeybee helps in finding the honey source. Once the honey source is found, they do the waggle dance to indicate the quality and quantity of available honey. After that, the reapers gather the honey from the sources. Then, again they go for the waggle dance to specify the honey that is left [10].

Greedy Algorithm : The Greedy algorithm is the default algorithm used for scheduling of Virtual Machines in Eucalyptus. The Greedy algorithm [3] is very simple and straightforward. As a matter of fact, it was the only scheduling policy which was in use for a long time. Only after the cloud started evolving, more complex scheduling policies came into effect. The greedy algorithm uses the first node that it finds with suitable resources for running the VM that is to be allocated. The first node that is identified is allocated the VM. This means that the greedy algorithm exhausts a node before it goes on to the next node.

Advantage* The main advantage of the Greedy algorithm is its simplicity.

Comparison of Existing Load balancing method-

Table 1 Comparison of various Load balancing methods

Paper Reference	Load Balancing Algorithm	Static/ Dynamic	Job Allocation	Advantage	Disadvantage
[4]	Round-Robin	Static	Selects the First Node in Random Manner, and allocates other nodes in Round Robin Method	Treats the entire server equally.	Any process is not known in advance.
[7]	Opportunistic Load Balancing Algorithm	Static	Based on the framework of the system.	Keeps every node busy.	The execution time is completed, but the node is still busy.
[9]	Min-Min Load Balancing Algorithm	Static	Identifies and completes the job waiting in queue.	Performs better small execution time.	Leads to Starvation.
[13]	Max-Min Load Balancing Algorithm	Static	Finding the minimum execution time and deals with the maximum execution time.	Improves efficiency by increasing concurrent execution.	Execution that takes maximum time need to wait for long time.
[1] NIE Qing bin	Ant Colony Optimization Based Load Balancing Algorithm	Static	Based on actions of ants and seeking an optimal path in collecting their food.	Distributes the workload among nodes in efficient and optimal job scheduling is achieved	——
[7]	Honeybee Foraging Load Balancing Algorithm	Dynamic	Based on the behaviour of honeybees' and their approach in collecting honey.	The response time and waiting time of the virtual machine are reduced.	There is a decrease in the throughput, when there is an increase in resources.
[5]	Biased Random Sampling Load Balancing Algorithm Active Clustering load balancing Algorithm	Dynamic	Based on Random Sampling Method.	Load balancing is achieved through all the nodes in the system	Corrupts when load increases.
[3]	Active Clustering load balancing Algorithm	Dynamic	Grouping nodes together.	Similar nodes are grouped together.	The performance is poor when there is an increase in variety of nodes.

IV. Conclusions and Future works

Load Balancing is an essential task in Cloud Computing environment to achieve maximum utilization of resources. Cloud Computing is a huge concept and load balancing plays a very important role in Clouds. We have discussed and compared various load balancing algorithms, other load balancing algorithms can also be applied. Balancing the network load equally is one of the significant tasks in cloud computing. The ant colony optimization works better and distributes the workload in an efficient manner when compared to other algorithms. In Future work, we will develop an efficient load balancing method for cloud computing and will compare this proposed with various existing load balancing methods.

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