ISSN: 2278 – 7798
International Journal of Science, Engineering and Technology Research (IJSETR)
Volume 5, Issue 7, July 2016

Load Balancing Algorithm in Cloud Computing

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Abstract: **Cloud computing is a fast developing field in computing research and industry today. Three significant facilities offered by the cloud are IaaS, SaaS, and PaaS. With the development of the Cloud, there are novel possibilities opening up on how applications can be made and how different facilities can be provided to the end subscriber by using Virtualization, on the internet. There are the cloud service suppliers who offers large scaled computing infrastructure described on usage, and offer the infrastructure facilities in a very reliable way. The establishment of an efficient load balancing algorithm and how to utilize Cloud computing resources effectively for efficient and effective cloud computing is one of the Cloud computing service suppliers ultimate objectives.. Other vital techniques i.e. virtualization and scalability by generating virtual machines in cloud computing. In cloud computing web service and traffic provisioning is increasing day by day so load balancing becomes a major research problem in cloud computing. Cloud Computing is a new propensity evolving in IT atmosphere with in large needs of resources and infrastructure. Load Balancing technology for cloud computing is a critical aspect of cloud computing atmosphere. Adept load balancing policy assures adept resource usage by provisioning resources to cloud subscribers on-demand facilities basis in pay-as-you-use way. Load Balancing may further support prioritizing subscribers by using suitable scheduling standard. In this review paper shows several load balancing techniques in different cloud computing atmosphere basis on needs mentioned in Service Level Agreement (SLA) process and Load balancers are utilized for allocating load to several virtual machines in such a manner that none of the nodes gets loaded lightly or heavily. The load balancing requires performing properly because failure in any one of the node can yield to un-existence of data.**

Keywords: cloud computing, SLA, load balancing, load balancing algorithm, virtual machine.

I. INTRODUCTION

Because of the biggest success of internet in last some years, computing resources is now more everywhere existed and it enabled accomplishment of a novel computing concept known as Cloud Computing. Cloud Computing atmosphere require the conventional service suppliers to have two various ways. These are infrastructure and service providers. Infrastructure suppliers arrangement of cloud platforms and lease resources according to utilization. Service suppliers offer resources from infrastructure providers to support end subscribers. Cloud Computing has lured the giant companies, i.e. Amazon, Google and Microsoft considered as a great impact in today's Information Technology companies. Cloud computing is an on demand facility in which platform, infrastructure and software are offered on demand according to the client's need at particular time. It's a term normally utilized in the case of internet. One can see entire internet as a cloud. Hence the all the above specified facilities are access by a subscriber as a client to the cloud. Now as the basic concept of cloud computing is to offer resources i.e. VMs as services on demand. Assigning effective VM on demand is being conducted with the support of the load balancing algorithms in the cloud computing. As the load balancing algorithm plays a significant part while choosing which VM is to be assigned on demand of the subscriber. While offering facilities it is possible to have a no. of requests at a time and because of that some requestors require to remain in queue though they have probability to forward request to other service supplier. Hence with the support of the load balancing algorithm subscriber will capable to decide whether they require to remain in the queue or get facility from the other service supplier. No. of the algorithms for the load balancing in the cloud computing are existed for assigning the effective VMs. Among such existed algorithm which is to be utilized is the main decision is to be considered. Some of those algorithms have been explained in this paper. Hence for having accurate utilization of resources and being Faithfull with all the resources, idea of load balancing is being conducted.

II. CLOUD COMPUTING OVERVIEW

Cloud computing employ a technique for the internet and central remote servers to manage data and applications. Cloud computing permits businesses and consumers to utilize applications without access and installation their personal files at any computer with internet access. This technique permits for much more ineffective computing by centralizing storage, processing, memory and bandwidth. Cloud computing is a model of network computing where an application or program operates on a linked server or servers instead of on a local computing device i.e. a PC, smart phone or tablet. Like the traditional client server model or chronic mainframe computing, a client links with a server to execution a task. The difference with cloud computing is that the computing process may operate on one or several linked computers can be, using idea of virtualization. With virtualization is one or more physical servers can be configured and divides into several unconnected "virtual servers, all working independently and appear to the client to be a single physical device. These virtual servers do not physically consist and can thus be moved in all directions and flaky up or down on the fly without influencing the end subscriber. The computing resources have become "grainy ", which endow end subscriber and operator avail involving wide access across several devices, on demand service, resource pooling, Fast elasticity and service reviewing capability. Cloud computing is a technique of distributed computing that concentrates on confer a broad range of subscribers with distributed access to virtualized software and hardware infrastructure over the internet. It includes networking, distributed computing virtualization, web software and web services. Concept of cloud computing has concentrated on interest of subscribers towards of distributed, parallel and virtualization computing systems today. It has seemed as famous solution to offer easy and cheap access to externalized IT resources. Through virtualization, cloud computing is capable to approach with the same physical infrastructure a huge client base with various computational requirements. The frequent development in the area of cloud computing also increases critical security concerns. Lack of security is the only problem in broad adoption of cloud computing.

III. TYPES OF CLOUD

Public cloud In Public cloud is existed for public use alternatively for a huge industry and is owned by an organization selling cloud facilities. Customer has no visibility and control Excess where the computing infrastructure is hosted. The computing infrastructure is shared between any organizations**.**

Private cloud The computing infrastructure run for the exclusive utilize of an organization. The cloud possibly maintained by the organization or third party. Private clouds are more secure and more costly in comparison of public clouds. Private clouds may be either off or on premises. Externally hosted private clouds are also only utilized by one organization, but are hosted by third party specializing in cloud infrastructure. Externally hosted private clouds are not costly as compared to On-premise private clouds.

Hybrid cloud integrates various clouds (private community of public) where those clouds retain their specialized identities, but are bound together as a unit. . An associated term is Cloud Bursting. In Cloud bursting organization is utilize their own computing infrastructure for common utilization, but access the cloud for high load needs. This assures that a random increment in computing necessity is managed gracefully. Hybrid cloud may provide proprietary or standardized access to applications or data, as well as a application portability.

Community cloud a community cloud is one where the cloud has been organized to support a common function or aim. For example one organization or for various organization, but they share conman concerns i.e. their mission, policies, security, regulatory compliance requirements and so on.

IV. CLASSIFICATION BASED UPON SERVICE PROVIDER

4.1 Infrastructure as a service (IaaS)

Infrastructure as a service (IaaS) include providing hardware related facilities utilizing the principles of cloud computing. IaaS offers a virtual storage, virtual-machine; virtual infrastructure, disk image library, file or object storage, raw block storage, IP addresses, load balancer, firewalls, virtual local area networks and software supplier provide these resources on-demand from their large pools installed in data centers bundles. The IaaS service supplier maintains the entire infrastructure. [10]

4.2 Platform as a Service (PaaS)

In the PaaS models, cloud suppliers provide a computing platform, basically inclusive of programming language execution atmosphere, database, operating system and web server. Application developers can emerge and operate their software solutions on a cloud platform without the insolubility and cost of buying and handling the basic software and hardware layers. The service supplier maintains the cloud infrastructure, the enabling software and the operating systems.

4.3. Software as a service (SaaS)

Involves complete software providing at the cloud. Clients can access a software application hosted by the cloud providers on pay-per-use basis. In the business model utilizing software as a service, clients are offered access to databases and application software. SaaS is a complete operating atmosphere with management, applications and the user interface .Cloud suppliers maintain the infrastructure and platforms that operate the applications. SaaS is sometimes targeted to as "on-demand software" and is generally priced on a pay-per-use backbone. SaaS suppliers normally price applications utilizing a subscription fee.

V. LOAD BANCING In CLOUD COMPUTING

Load balancing is the technology of disseminating the load among several resources in any system. Hence load needs to be disseminated over the resources in cloud-based architecture, so that every resource does almost the same amount of work at any point of time. Basic need is to offer some methods to balance requests to offer the solution of fast reply for request. Cloud Load Balancers maintain online traffic by disseminating workloads among multiple servers and resources automatically. They increase throughput, decrease response time, and avoid overload. In this paper, an overall survey of the new load balancing methods in the Cloud Computing atmosphere is submitted. The concepts of each algorithm are talked about and finally sum up as an overview. There are various issues while handling with load balancing in a cloud computing atmosphere. Each load balancing algorithm must be such as to instate the needed target.

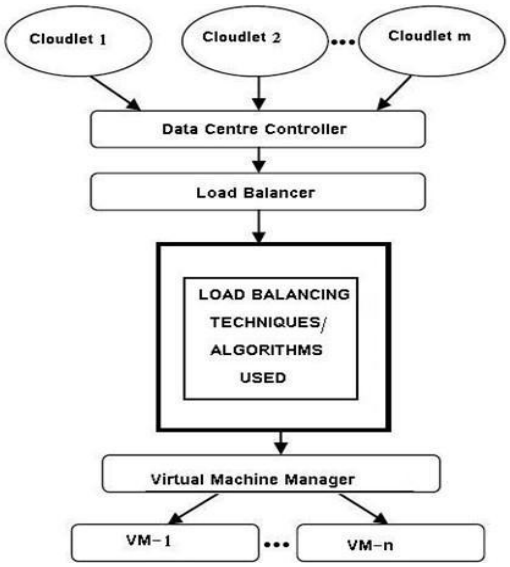

Fig 1: Load Balancing Algorithms Execution

Some algorithms destined at obtain maximum throughput, some target at obtain least response time, some other target to obtain maximum resource usage while some target at obtain a trade-off among all these metrics. Fig1 shows a framework underneath which several load balancing algorithms work in a cloud computing atmosphere.

VI. EXISTING LOAD BALANCING ALGORITHMS

A. Round Robin Load Balancer

This algorithm operates on random selection of the virtual machines. The datacenter controller allocates the requests to a list of Virtual machines on a rotating basis. The first request is assigned to a VM picked arbitrarily from the group and then the Data Center controller allocates the requests in a circular way. Once the VM is allocated the request, the VM is moved to the list end. One more manner to describe round robin algorithm is a better allocation idea called as Weighted Round Robin Allocation in which one can allocate a weight to every VM so that if one VM is able of managing twice as much load as the other, the potential server obtains a weight of 2. In these cases, the Data Center Controller will allocate two requests to the powerful VM for every request allocated to a weaker one. The large issue in this assignment is this that it does not assume the advanced load balancing needs i.e. processing times for every individual requests.

B. Equally Spread Current Execution Algorithm

Equally spread current execution algorithm process manages with priorities. it disseminate the load arbitrarily by examining the size and transfer the load to that VM which is lightly loaded or manage that task easy and consume less time , and provide highest throughput. It is spread spectrum method in which the load balancer distributes the job load in hand into several virtual machines [5].

C. Active Monitoring Load Balancer

Active VM Load Balancer manages information about every VMs and the no. of requests currently assigned to which VM. When a request to assign a new VM reaches, it determines the minimum loaded VM. If there are more than one, the first determined is chosen. Active VM Load Balancer returns the VM id to the Data Center Controller the data Center Controller forwards the request to the VM identified by that id. Data Center Controller realizes the Active VM Load Balancer of the new allocation [8].

D. Throttled Load Balancer

Throttled algorithm is entirely based on virtual machine. In this client first requesting the load balancer to examine the right VM which access that load easily and perform the operations which is provided by the client or subscriber. In this algorithm

the client first requests the load balancer to determine an appropriate VM to perform the needed operation [8

V ISSUE EFFECTING LOAD BALANCING In CLOUD COMPUTING

There are various types of load balancing methods which are presented for cloud computing. These load balancing methods are: geographical distribution, static and dynamic.[12]

5.1 The geographical distribution

The geographical distribution of the nodes matters a lot in the collective performance of any real time cloud computing systems, particularly in case of the large scaled applications i.e. face book, Twitter etc. A well-distributed nodes system in cloud atmosphere is helpful in dealing with fault tolerance and managing the system efficiency. Geographical load balancing (GLB) can be described as a series of decisions about online assignment and/or migration of virtual machines (VMs) or computational tasks to geographically distributed datacenters for meeting the service level agreements (SLAs) or service deadlines for VMs/tasks and to reduce the operational cost of the cloud system.[12]

5.2Static Load Balancing Algorithm [12]

In static load balancing algorithms, the execution of the processors is detected at the starting of the execution it does not based on system current state. The objective of static load balancing is to reduce the total execution time of a synchronous program whereas decreasing the communication delays.[12] These algorithms are mostly appropriate for stable and homogeneous atmosphere and can generate better results .Some of the instances of static load balancing algorithms are: Round Robin algorithm, Randomized algorithm and Threshold algorithm.

5.3 Dynamic Load Balancing Algorithm

In dynamic load balancing algorithm, the decisions in load balancing depend on the system current state, no previous knowledge is required. The major benefit of dynamic load balancing is that if someone node fails, it will not cease the system, it will only influence the system performance. [12] These algorithms are more resilient as compared to static algorithms, can easily follow to alteration and offer better results in dynamic and heterogeneous atmosphere. Dynamic load balancer utilizes morality for holding the track of updated information. There are four schemes for dynamic load balancers: transfer policy, selection policy, information policy and location policy. The task of load balancing is shared between disseminated nodes. In a distributed system, dynamic load balancing can be performed in two different manners: distributed and non-distributed.

5.3.1 Distributed Dynamic Load Balancing Algorithm In the distributed one, the dynamic load balancing algorithm is executed by all nodes available in the system and the scheduling task is shared between them. The communication among the nodes to obtain load balancing can take two forms: cooperative and non-cooperative.[12]

5.3.2 Non-Distributed Load Balancing Algorithm In the undistributed or non-distributed, the nodes work personal for instating a common purpose. Non-distributed dynamic load balancing algorithms are ahead categorized into two: centralized and semi-centralized.[12]

5.3.2.1 Semi-distributed Dynamic Load Balancing In semi-distributed dynamic load balancing, the system nodes are partitioned into clusters, where the load balancing in every cluster is of centralized form. A central node is chosen in each cluster by suitable election method which takes attention of load balancing inside that cluster. Thus, the load balancing of all system is performed through the central nodes of every cluster. [12]

5.3.2.2 Centralized Dynamic Load Balancing

In centralized dynamic load balancing, the algorithm is only executed by a single node in the entire system such as central node. This node has responsibility for load balancing of the entire system and remaining nodes communicates only with the central node.[12] The rest part of this paper are presented as section 6 defines related work about several load balancing method utilized recently in soft computing, artificial antigens(AI) and other associated subjects we conclude our paper and also offer direction for future improvements.

6. RELATED WORK

This paper showed brief discussion about several Load Balancing methods utilized in cloud architectures. In these methods for Load Balancing of specifying server load, main objective to ensure that every computing resource is distributed efficiently, ultimately to enhance resource usage. This paper is reviewed as:-

6.1 Stochastic Hill Climbing this paper [6][8], a soft computing based load balancing technique has been introduced. A local optimization technique Stochastic Hill climbing is utilized for assignment of incoming jobs to the virtual machines (VMs) or servers. There are two significant families of processes for solving a optimization issue. Complete methods which ensure either to determine a valid allocation of values to variables or prove that no such allocation available. These techniques frequently have good performance, and ensure an optimal and correct answer for all inputs. Unluckily, they need exponential time in the worst case, which is not appropriate in the cloud

computing domain. The other incomplete techniques may not ensure correct answers for all inputs. Rather these techniques determine satisfying assignments for solvable issues with high possibility. A version of Hill Climbing algorithm Stochastic Hill Climbing (SHC) is one of the incomplete techniques for solving these optimization issues. A local and stochastic Optimization algorithm is simply a loop that seamlessly moves in the direction of increasing value, which is uphill. It ceases when it arrives a maximum where no neighbor has a maximum value. This variant selects arbitrarily from among the uphill moves and the possibility of selection can change with the steepness of the uphill move. Hence it maps assignments to a set of assignments by building small changes to the original assignment. Every element of the set is measured according to some standard designed to move nearer to a valid assignment to enhance the state evaluation score.

6.2 Particle Swarm Optimization (PSO)

Algorithm [2] Particle Swarm Optimization (PSO) as a meta-heuristics technique is a self-adaptive global search based optimization method proposed by Kennedy and Eberhart . The PSO algorithm is similar to other population-based algorithms i.e. genetic algorithms (GA) but, there is no direct recombination of individuals of the population. The PSO algorithm concentrates on decreasing the overall cost of computation of an application workflow. As a performance evaluation, writers utilized cost for whole execution of application as a metric. The aim is to decrease the overall execution cost of application workflows on Cloud computing atmosphere. Results represent that PSO based task-resource mapping can obtain minimum three times cost savings in comparison of Best Resource Selection (BRS) based mapping for our application workflow. Additionally, PSO balances the load to compute resources by disseminating tasks to existed resources.[1]

6.3 Genetic Algorithm

Genetic Algorithm (GA)[9] has been utilized as a soft computing technique, which utilizes the method of natural selection scheme. A simple GA is composed of three operations: genetic operation, selection, and replacement. The benefit of this method is that it can manage a vast search space suitable to complicated objective function and can avoid being trapping into local optimum solution. A generation is a set of artificial creatures (strings). [5]In each novel generation, a set of strings is generated utilizing information from the prior ones. Occasionally, a new part is attempted for good measure. GAs is randomized, but they are not simple random walks. They adept exploit historical information to speculate on novel search points with required enhancement. The mechanics of a simple GA are amazingly simple, including nothing much complicated as compared to swapping partial strings and copying strings. Easier of operation and effect power is two main attractions of the GA technique. [3] The effectiveness of the GA is based on in suitable mix of exploitation and exploration. Three operators to obtain this are: crossover, selection, and mutation But this method depends on local search optimization method and fetcher improvement use in some global search optimization algorithm is usage.

6.4 Ant Colony Optimization

They introduced an algorithm for load distribution of workloads between cloud nodes by the usage of Ant Colony Optimization (ACO). This is a changed technique of ant colony optimization that has been used from the point of view of grid or cloud network systems with the main objective of load balancing of nodes. This enhancing algorithm has an edge over the original technique in which every ant make their own individual result set and it is later on make into a complete solution. [5][11] since, in their technique the ants consecutive update a single result set instead of the updating their own result set. Moreover, as they know that a cloud is the group of several nodes, which can support many kinds of application that is utilized by the clients based on pay per use. So, the system which is incurring a cost for the client should function gracefully and should have algorithms that can proceed the appropriate system functioning even at pinnacle us hours. ACO is motivated from the ant colonies that work together into foraging nature. In fact the real ants have motivated various researchers for their work, and the ant technique has been utilized by several researchers for problem solving in different fields. [6]This method is used on the name of its inspiration ACO.[1] The ants work completely in search of new foods sources and at the same time utilize the available food sources to migrate the food back to the nest. The technique objectives at effectively load distribution between the nodes and such that the ants never encounter a dead end for nodes movements for making an optimal solution set. In our algorithm, first a Regional load balancing node is selected in CCSP, which will behave as a head node.

6.5 Active Clustering

Active clustering is an improved approach of random sampling, where this algorithm operates on the principle of combining same nodes together and begins working on these group nodes [12]. This approach utilizes the resources effectively thus increases the throughput and system performance by utilizing high resources. In this method a technique called match-maker is proposed. When an execution begins in a network, the process achieves and

searches for the next matching node said to be matchmaker which should meet the standard that it should be the different one from the previous one. Once the matchmaker is determined the process gets started and as soon as the procedure gets over the match-maker gets disconnected from the network. Hence this is a repetitive process in the network to balance the load effectively.

6.6 Honeybee Foraging Behavior Algorithm

[6] Optimization algorithms are search techniques where the objective is to determine an optimum solution to a problem, for satisfying more objective functions, possibly subject to a group of restraints. Perusal of social insects and social animals has resulted in a no. of computational models of swarm intelligence. In this review paper [2] it is a decentralized honeybee-based load balancing approach that is a nature-inspired algorithm for self-organization. It obtains global load balancing through local server actions. System performance is increased with increased system diversity but system throughput is not increased with an increment in system size. It is best favorable for the situations where the diverse population of service types is needed.

6.7 Equally Spread Current Execution Algorithm

Equally spread current execution algorithm process manages with priorities. it disseminate the load arbitrarily by analyzing the size and transfer the load to that VM which is slightly loaded or handle that task easy and consume less time [4], and provide highest throughput. It is spread spectrum method in which the load balancer distributes the load of the job in hand into several virtual machines.

6.8 Throttled Load Balancing Algorithm [4]

Throttled algorithm is fully depends on virtual machine. In this client at first requesting the load balancer to examine the right VM which access that load easily and perform the operations which is provided by the user or client. In this algorithm the client at first requests the load balancer to determine an appropriate VM to perform the needed operation.

IV. SIMULATORS

The primary objective of simulator is to examine the implementation work in the unavailability of the needed atmosphere. Hence in the cloud atmosphere two simulators are utilized CloudSim and Vcloud. CloudSim is the open source. Some simulators present for the distributed field i.e. GridSim, SimGrid etc such simulators are not suitable for the cloud computing as the cloud atmosphere having several layers while GridSim and SimGrid are built for the single layer atmosphere.

A. CloudSim

CloudSim is a novel generalized and extensible simulation framework that enables continuous modeling, simulation, experimentation of evolving Cloud computing infrastructures and management facilities. The simulation framework has the following new characteristics: (i) support for modeling and instantiation of large scale Cloud computing infrastructure, involving data centers on a single physical computing node and java virtual machine; (ii) a self-contained platform for modeling data centers, scheduling, service brokers and allocations schemes; (iii) existence of virtualization engine, which aids in generation and management of several, independent, and co-hosted virtualized facilities on a data center node; and (iv) reliability to switch between time-shared and space-shared allocation of processing cores to virtualized facilities.

B. Virtual Cloud

Cloud computing offers chance to dynamically scale the computing resources for applications. These Resources are shared between customers utilizing virtualization technique. Utilizing these resources effectively is an open challenge. However, cloud computing contains huge no. of resources, examining these new schemes on real world is difficult and time consuming. To ease the issue of modeling and testing schemes, Virtual Cloud is being introduced, for cloud computing atmosphere. Virtual Cloud supports developers to model and examine their schemes to use the cloud computing resources effectively. Developed as multi-layered architecture, this modeler helps to test new techniques, find the problems before implementing in real world cloud computing atmosphere. We can utilize cloudsim for the implementation work as it is open source and much advantageous for our research work

CONCLUSION AND FUTURE WORK

This paper is based on cloud computing technique which has a very vast power and is still unexplored. The abilities of cloud computing are Interminable. Cloud computing offers everything to the client as a service which involves platform as a service, application as a service, infrastructure as a service. One of the significant issues of cloud computing is load balancing because system overloading may yield to poor performance which can build the technology unsuccessful. So there is eternally a need of effective load balancing algorithm for effective usage of resources. Our paper concentrates on the several load balancing algorithms and their applicability in cloud computing atmosphere. In our future work we will talk about Simulated- Annealing for global search optimization in cloud load balancing and simulation. Some extra algorithms which can support in solving some sub-problems in load balancing which are applicable to cloud computing.

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