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Improvement of Cluster Based Approach for Secure Loadbalancing over Cloud

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ABSTRACT

It is a process of distributing the total load among the system to improve system performance when there is a condition arrive Cloud Computing is the technique of dynamic virtual provisioning of computing resources like processing power, storage, networking and Information Technology infrastructure through the Internet on pay per use basis from service providers. Customers can request for resources on the cloud from anywhere on the planet, by sending request through Internet to cloud service provider. Cloud Computing uses the concept of the virtual machines and store data on virtual machines, instead of physical machines. Load balancing is the major aspect of cloud computing atmosphere. where several nodes are heavily loaded and the others are idle. This paper will present several techniques of load balancing in different cloud environment, existing load balancing technique and also discuss various parameters like scalability, performance, resource utilization, fault tolerance, associative overhead.

Keywords : Cloud Computing, Load Balancing, Resource Utilization, Static load balancing, Dynamic load balancing.

I. INTRODUCTION

Cloud computing is made up of two basic terms in the latest telecommunication technology field. First term is “Cloud”. It is a pool of the heterogeneous resources which provide services as per requirement. “Computing” is done by the criteria provided by service level agreement specified in SLA. Cloud computing is the technique of dynamic virtual provisioning of computing resources like processing, power storage, networking and information. It is also commoditized which means the outcome is a utility registering model, similar to power in which you pay for what you would need. There are some basic characteristics of cloud computing such as on demand self services, broad network access, rapid elasticity, resource pooling, measured service, virtualization, service orientation, geographic distribution, resilient computing. However, by using any kind of method, the complete potential of the cloud cannot be get without understanding its vulnerabilities, capabilities, trade-offs and advantages.

Cloud computing has characteristics of all these technologies which share certain aspects of cloud computing

a. Grid Computing
b. Utility Computing
c. Virtualization
d. Autonomic Computing

A quick review of these technologies is defined here:

a. Grid computing:

Grid Computing is a type of distributed computing that coordinate network resources to achieve their objectives. Here server, storage and network are combined to form computing nodes that can be dynamically provisioned as needed.

b. Utility Computing:

The utility computing ensures the utility based pricing schemes for economic reasons which also help to maximize resource utilization and minimizing the operating cost.

c. Virtualization:

Virtualization is an abstraction in which a physical machine is converted into a virtual machine and that virtual machine is provided to customer& customer feels that he is actually using the physical machine

d. Autonomic Computing:

Autonomic Computing ensures that the computer has complex and critical functions present without using any major interventions through a user.

II. TYPES OF CLOUDS

A. Public cloud

The infrastructure of cloud is solely operated for an organization. It may be managed through the organization or another party and may exists on premise and off premise [1].

B. Private Cloud

The infrastructure cloud is shared through various organizations and also through a particular community that has shared concerns. It may be managed by the organization or a third party and may exist on premise or off premise.

C. Community Cloud

The infrastructure of cloud is made presentable to a large industry group or common public and is owned through an organization selling cloud features.

D. Hybrid Cloud

The infrastructure of cloud is a composition of two or more clouds (community, public, private) that remain unique entities but are bound together through proprietary or standardized methodology that enables information and application portability.

III. TYPES OF SERVICE MODELS

A. Infrastructure as a service (IaaS):

Cloud provider offers computers as virtual machines and other resources as per user's request. Virtual machines run as hypervisors such as xen, kvm. Infrastructure as a service cloud providers supply these resources as per demand for their data centers. Cloud provides a hosting environment that does not restrict an application to Specific resources. [2]

B. Platform as a Service (PaaS)

Cloud suppliers give a processing stage normally including working framework, programming dialect execution environment such as java, python, database, web servers. NIST describes PaaS as follows:

"The provided capability to consumer is to deploy onto the infrastructure of consumer-created cloud or acquired applications created by applying programming languages and other tools. The customer does not control or manage the underlying infrastructure of cloud which includes storage, network servers, operating system, or servers, but has control over the deployed applications and also possible application hosting atmosphere configurations".

C. Software as services (Saas)

Software as services is a model of software development where an application is hosted as services provided to customer across the internet. NIST describes SaaS as follows "The provided capability to the client is to use provider's applications running on infrastructure of cloud. The applications are accessible from several customer devices by a thin client interface such as a web browser (e.g., web-based e- mail)".

IV. LOAD BALANCING

Load Balancing-Load Balancing is a mechanism for distributing a larger processing node to smaller processing nodes for enhancing the full performance of a system, without disturbing the other running task. Load Balancing is mainly used for performing two basic tasks one is resource allocation and other is scheduling. An ideal load balancing technique should avoid overloading and under loading of a individual node, but in cloud computing environment case the right selection of the load balancing algorithm is not easy because it involves various factors like reliability, throughput, security etc. Some other factors are also described

a. Resource is easily presentable on demand
b. Performance will substantially improved
c. cost of using resource is less
d. Resources are effectively used
e. Ensures system stability

For measuring the adequacy of load balancing algorithms re-enactment environment are needed and Cloudsim [3] is the efficient tool that can be used for measuring the efficiency and effectiveness of cloud. Cloudsim [3] contains four basic entities which are Datacenter, Virtual Machine, Hosts and Software (Application and System software) Datacenter entity provide the infrastructure level services to the cloud users. Virtual Machine allows development and deployment of application service models. Software is executed on a virtual machine on- demand [4].

V. TECHNIQUES FOR LOAD BALANCING IN CLOUD COMPUTING

A. Decentralized content aware

Define abbreviations and acronyms the first time they are used in the text, even after they have been defined in the abstract. Abbreviations such as IEEE, SI, MKS, CGS, sc, dc, and rms do not have to be defined. Do not use abbreviations in the title or heads unless they are unavoidable.

B. CARTON

According to this mechanism, it uses two parameters named as LB and DRL. With the help of LB (Load Balancing) equal jobs are distributed to different server and DRL (Distribute Rate lining) is used to improve the performance level of the server as it is used in the capacities of dynamic workload.

C. Compare and Balance

This algorithm is based on sampling, unlike traditional server optimization strategies which consider load balancing and scheduling of resources for RAM,

BW and CPU usage in physical servers. Dynamic Compare and Balance minimizes the number of host machines, thus reduces cost of cloud services.

D. Event-driven

This algorithm based on the concept of Massively Multiplayer's Online Games (MMOG). After receiving all its events as input

it will analyzes its entire component in the context of the resources and its capacity.

E. Task scheduling based on Load Balancing

Task scheduling based on LB is a two level scheduling, which is used to meet the dynamic requirement of the users and will also achieve high resource utilization, by mapping task to virtual machine and then virtual machine to host resource

F. Load Balancing Virtual Storage Strategy

(LBVS): Load Balancing Virtual Storage Strategy provides storage on a cloud as a service model of cloud storage. In this algorithm Load Balancing is achieved by using two modules of load balancing and provides better storage rate and robustness of the system.

G. Central Load Balancing Virtual Machine:

CLBVM is used to improve the major drawback of fault tolerance in the system as the whole selection policy is based on the central node.

H. Honeybee Foraging Behavior:

Honeybee Foraging Behavior is a self organizing and natured inspired algorithm. In this algorithm performance is achieved by increasing the system size but the overall throughput will not increase with a system size increase.

I.. Biased Random Sampling:

It is a distributed and also scalable method that uses system domain random sampling to achieve the self organization for balancing the load across complete system.

J. Active Clustering:

It is a self aggregation load balancing algorithm to optimize job assignments by connecting similar service using local re-wiring.

K. Ant Colony and Complex Network Theory (ACCLB):

ACCLB (Ant Colony and Complex Network Theory) uses fully distributed approach in which information is dynamically updated at each ant movement. The benefit of this algorithm is that it is better fault tolerant and improves the overall performance of the system.

L. Opportunistic Load Balancing and Load Balancing Min- Min (OLB+LBMM):

Opportunistic Load Balancing and Load Balancing Min- Min (LBMM) scheduling algorithm keeps the updated working status of the overall system and minimizes the execution time for the better performance.

Cloud is made up of several resources and to Manage these resources it require systematic planning and layout while designing algorithm on cloud for resource provisioning. The developer must be aware of the issues and scenarios of the atmosphere of cloud therefore various algorithms were made to match up those entire requirements and it is being classified in to various categories. On the basis of cloud environment- Depending upon the load balancing system present state algorithms can either be dynamic or static. Static Environment

In the static load balancing, the cloud require prior knowledge of nodes capacity, processing speed, performance capability, memory storage and other statistical information about the system. At the same time as it is static algorithm, the user requirement will not change at run time, and the changes occured in run time in the load will not be accepted. Static load balancing policy is much easier to simulate and also suitable for

heterogeneous cloud environment . C o m m u n i c a t i o n delay can be easily minimized and system execution time is also reduced by using static load balancing algorithm.

Table 1. Comparison of Various types of Load Balancing Techniques in Cloud Computing Environment

Types o	Knowledge status	Usage	Drawback
Static	Prior knowledge is required	Used in homogeneous	Not flexible Not
Dynamic	Run time changes	Used in heterogene	Compl ex
Centralized	Single node is responsible for	Used in small network with low	Not fault Tolerant
Distributed	Multiple node is responsible for	Used in large heterogeneous	Complex algorithm Communication
Hierarchical	Nodes at different level of	Used in large homogen	Less fault Toler

A. Round Robin and Randomized Algorithms

In this algorithm, resources are assigned to the task on FCFS basics i.e. the job that arrived first will be first allocated the resources. It is one of the simplest algorithms which pass each new request to the next server. Thus this algorithm does not have status record of each connection. With identical work load, round robin algorithm works properly. In this algorithm each node will have equal opportunity, however in public cloud the configuration and performance of each node is not same. Thus there is slight change in Round Robin algorithm which is called Round Robin based on load degree evaluation. Randomized schemes work well when the process is more and processor is less. This algorithm attains the best performance as compared to other load balancing algorithms for particular special purpose applications.

B. Central Manager Algorithm

In this algorithm, a central processor or channel agent selects the new process. The minimum loaded processor is selected from all the processors, when a process is created. Then the load manager selects the host for new processor and then central load manager calculates the overall load.

C. Threshold Algorithm

In the threshold algorithm the host is selected locally without sending remote message and each processor must contain the private copy of the system load. In the threshold algorithm the level of the load can be defined as

Under loaded-load<Tunder Medium-Tunder ≤ load Tupper Overloaded-load > Tupper

Initially the process is assumed as under loaded but when the processor exceeds the load limit then it start sending messages at remote level. It contain copy of all the messages and keep updating the entire load of the processor to get the actual status of the load on the processor.

Dynamic Environment

In dynamic atmosphere, the installation of heterogeneous resources of cloud provider is done and these are flexible resources. In this dynamic environment, load changes in the run time can be easily adapted by proposed algorithm. Dynamic environment can be highly adaptale in cloud computing whereas it is very hard to simulate. Based on Weighted Least connection a load balancing method in dynamic atmosphere is called ESWLC, it allocates resources with the minimum task weight according to its node capability. Based

on weight and the capability of node, task is assigned to a node.

Load Balancing Based On Spatial Distribution of Nodes

There can be three basic kind of algorithm that distinguishes which node is responsible for cloud computing atmosphere load balancing.

A. Centralized Load Balancing

In the Centralized Load Balancing technique the central load is the main factor which is responsible for storing knowledge of overall cloud network and then makes decision to apply static or dynamic approach for load balancing. Hence all the decisions are made by the central node. This load balancing reduces the overall time and is free from analyzing whole cloud resources, but it is not fault tolerant for longer time and also creates overhead for centralized node. In this technique the chances of failure for the centralized node is very high and the recovery is also not easy in case of node failure.

B. Distributed Load Balancing

In the Distributed Load Balancing technique there is no single node responsible for monitoring the cloud network instead multiple nodes monitors the network to make accurate load balancing decisions. Every node in the network is equally responsible for maintaining the knowledge table to ensure efficient distribution of task in static environment and re-distribution in dynamic environment. In distributed scenario, failure intensity of a node is less. Hence the system is reliable and fault tolerant and none of the particular node is overloaded. [6]

C. Hierarchical Load Balancing

Hierarchical Load Balancing involves different levels of the cloud in load balancing decisions. This type of balancing is done by master slave model and it can be modeled as a tree data structure where every node is managed or balanced by its parent node[7]. Based on the information collected by the parent node, allocation and scheduling can be done. In this algorithm the root node is responsible for distributing the load to all its sub nodes.

VI. LITERATURE REVIEW

Some virtual machine placement and migration methods are discussed here with their anomalies. Authors [9] proposed a threshold based VM provisioning method to improve the profit and SLA violation of cloud service provider. Authors [10] proposed a threshold based dynamic compare and balance algorithm for cloud data center optimization. Authors [11] proposed a Modification Best Fit Decreasing (MBFD) algorithm for energy-efficient resource allocation to provide server consolidation, in which VM allocation problem is divided into two parts, the first part consider the creation of new VMs for user requests and assigning them on to the physical machines while on the other hand second part optimize the current allocation of VMs. Authors [12] proposed Dynamic virtual machine migration algorithm by using enhanced version of energy consumption model for green cloud datacenters. Authors [13] proposed Energy-aware VM consolidation approach using combination of heuristics and migration control for reducing energy consumption as well as minimize number of VM migrations. Authors [14] proposed an Optimized Control Strategy for Load Balancing based on Live Migration of Virtual Machine that combines multi-strategy mechanism with the prediction mechanism.

VII. OBJECTIVES

The main goal of this work is:-

i. Study of existing VM consolidation algorithms.
ii. Develop the concept of new energy efficient VM Consolidation algorithm using Inter quartile Range (IQR) based on VM migration and maintaining low level of SLA.
iii. Compare the newly developed algorithm with the standard algorithm and performance analysis.

VIII. PROPOSED METHDOLOGY

Cloudsim is the most appropriate tool that can be used for modeling cloud. Cloudsim allows VM to be managed by the hosts, which in turn are managed by data centers. To measure the efficiency and effectiveness of simulation balancing algorithms load environment are required. In this work, we have used eclipse tool for simulation. We are using energy efficient VM Consolidation algorithm in cloud environment.

We are using inter quartile range (IQR) method for finding dynamic threshold. The proposed algorithm will find the over loaded host first and then choose the virtual machine for migration from overloaded hosts and place this VM using VM placement algorithm for Overloaded Host. After load balancing, finds an under loaded host and select all the virtual machines from that host. Place these VMs over least loaded host by using VM placement algorithm for under loaded Host. For performance evaluation and simulations we are using Cloudsim in our work. Thus an Energy Efficient Dynamic VM Consolidation algorithm for reducing energy consumption and minimizes number of VM migration while keeping SLA violation at low level is proposed.

We have analyzed different scenarios by taking 10 hosts, 20 virtual machines and various numbers of tasks (cloudlets) i.e. load to evaluate the performance of proposed algorithm. It is essential to use workload traces from real system. In this simulation we have taken different work load. We have plotted different graphs based on different work load between two strategies, proposed method and the existing method (Static threshold based VM provisioning). The performance of the proposed approach is evaluated for various parameters (i.e. Energy Consumption, Number of VM migrations, Number of SLA violation and Average SLA violation). These results can vary according to the different environment setups.

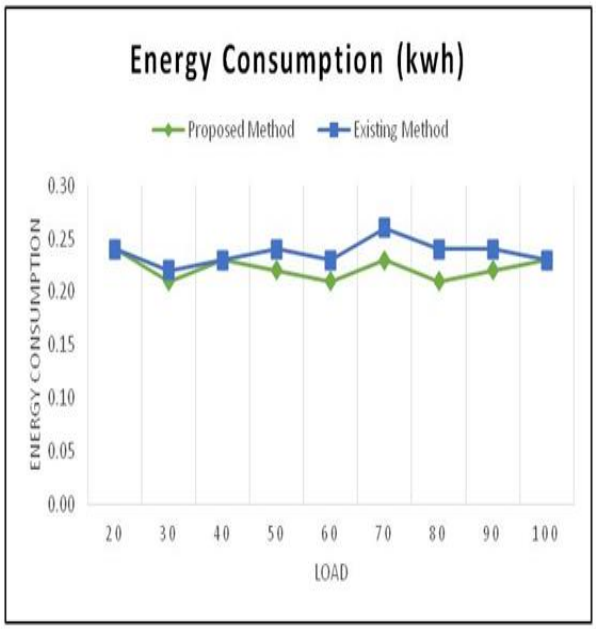

Figure 1. Energy Consumption comparisons between Proposed and Existing method

Table 2. Experimental Results For Various Parameters

Load	Energy Consumption		Number of VM migrations		Number of SLA violation		Average SLA violation	
	Proposed Method	Existing Method	Proposed Method	Existing Method	Proposed Method	Existing Method	Proposed Method	Existing Method
20	0.24	0.24	31	44	2099	2709	10.02	10.05
30	0.21	0.22	31	45	2150	2713	10.04	10.06
40	0.23	0,23	33	45	2217	2739	10.02	10.08
50	0.22	0,24	32	43	2193	2725	10	10.07
60	0,21	0.23	34	45	2185	2737	10.03	10.08
70	0.23	0.26	33	44	2218	2776	10.03	10.09
80	0.21	0.24	31	44	2054	2738	10.01	10.08
90	0.22	0.24	35	43	2229	2695	10.04	10.05
100	0.23	0.23	32	45	2111	2735	10.01	10.08

Energy consumption is compared for proposed method and existing method as shown in figure 1. From graph we have analyzed that proposed method; consumes less energy than existing method.Number of VM migrations is compared for proposed method and existing method in figure 2. From graph we have analyzed that proposed method; incurs less number of VM migrations than existing method.

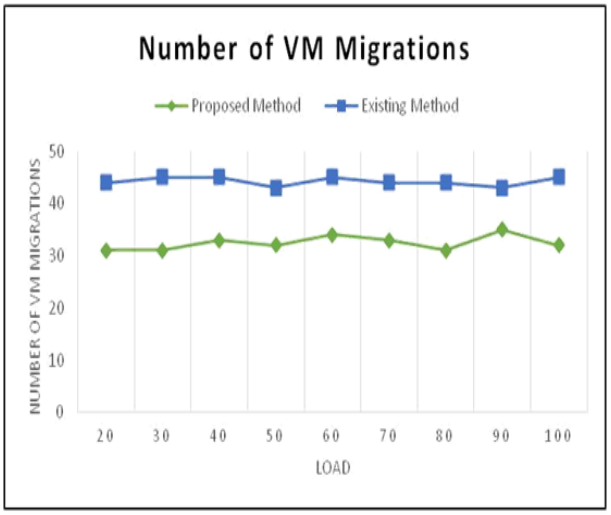

Figure 2. Number of VM Migration comparisons between Proposed and Existing method

Figure 3. SLA Violation comparison between Proposed and Existing method

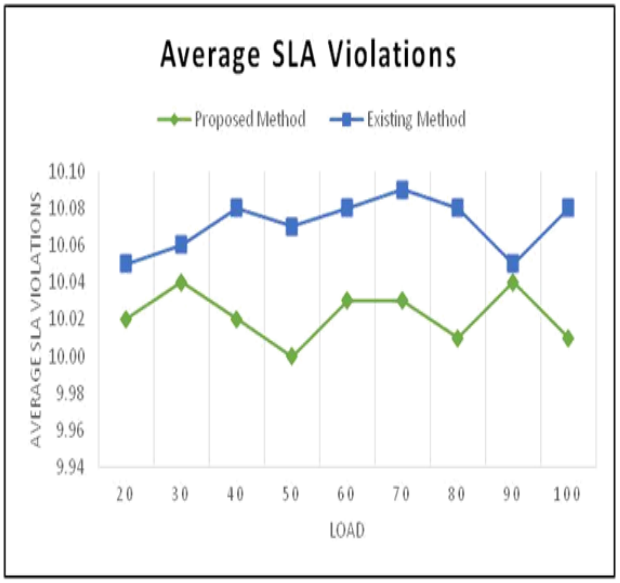

Figure 4. Average SLA Violation comparisons between Proposed and Existing method

Number of SLA violation is compared for proposed method and existing method figure 3. From graph we have analyzed that proposed method; incurs less number of SLA violations than the existing method. Average SLA violation is compared for proposed method and existing method in figure 4. From graph we have analyzed that proposed method; incurs less Average SLA violations than the existing method.

IX. CONCLUSION

Load Balancing is a very major issue in cloud computing environment and with the rapid growth of cloud users it has been noticed that the demand of load balancing has increased. In this paper, numerous load balancing techniques have been discussed all having few advantages and disadvantages. Basically there are two basic kinds of load balancing techniques static and dynamic. Static load balancing has an advantage of monitoring and simulation with a drawback that it fails to model heterogeneous nature of the cloud. on other hand dynamic load balancing has the advantage that it easily models in the heterogeneous nature of cloud with a drawback that it is very difficult to simulate a n d also that load on each node define the algorithm effectiveness. Unlike centralized and distributed algorithm nature, it provides better fault tolerance but it requires high degree of replication. On the other hand, different hierarchical algorithms divide load at various level with upper level node in a balanced manner. The study also compares various distributed algorithms with their parameters having some pros and cons. As it is known that cloud computing is a very enormous area but it is now understood that the above algorithm will satisfy the criteria with some conditions. However, cloud computing environment performance can be improved if dependencies between tasks are modeled by information.

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