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Effort of Load Balancing to achieve Green Computing

Lubna Kalam[1*], Ihtiram Raza Khan[2]

[1,2]Dept. of Computer Science and Engineering, School of Engineering Sciences and Technology, JamiaHamdard, New Delhi, India

[*]*Corresponding Author: lubnakalam123@gmail.com, Tel.: +91-9565070420*

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***Abstract*—** In a distributed computing, the serious problem from the starting days is the distribution of load among servers in the commercial internet. Cloud computing faces some challenges in Load balancing and it requires the energetic workload among various nodes and it assure that not a single node get affected. The important aim is the minimization of the load balance from the sources utilization which would be decreased by the release rate of the carbon and energy consumption would be extremely required in cloud computing.

***Keywords*—** Cloud computing, Green computing, Load Balancing, Carbon footprint and Energy efficiency**.**

I. INTRODUCTION

In Cloud computing, computational archetype develop from distributed computing that model lies between super-computing and grid computing. The main asset of cloud computing are there services. These services are further divided into three categories they are following as: SaaS, PaaS, and IaaS. Computing can likely strap WAN with internet to utilize resources which are present remotely, by giving the solution of cost effectiveness to requirements of real time. It also provides extensible Information Technology resources like services and application along with infrastructure on which they work on the internet. The capacity is adjust on the basis of pay-per use easily and quickly. It is beneficial for oblige variation desired and would be helped in the organization that will ignore the capital worth of hardware & software. Basically it is a structure for a relevant network on-demand approach a mutual pool of cloud computing for example- servers, warehouse, services, and implementation with network. This resources could be continued with the discontinued rapidly and the service provider interaction or minimal management effort. There are some major issues like Server Consolidate Load Balancing, and Virtual Machine Migration and many more.

Load Balancing is used to reduce energy consumption by equally load distribution and it will minimize the consumption of resources.

Migration in virtual machines allows virtualization will support in balancing the loads empower excessively providing to avoid hot-spots with in data centre thus, it will reduce energy consumption.
Server Consolidation helps to upgrade the performance of resources by consolidate different VMs consist of different utilization of servers in one servers. The unused servers should be turn off and it will reduce energy consumption.

Green Computing in clouds
Green computing [1] also known as Green IT, is the practice of utilization of computing resource efficiently. It implement on some procedures and policies that upgrade the production of resources in that method it also reduces the usage of energy and impact on environment by their utilization [3][4].

Now, a day's High Performance computing is becoming popular in consumer IT application and commercial. It requires the capability to obtain scalable access directly to the high-end capability of computation that would be implemented within cloud computing by the usage of data centres. It also helps in HPC utilizers to payable access in demand data from the application, anywhere from the cloud [2]. Data centres in cloud computing enables by high speed networks of computer that allows the application to run more aptly on their remote, broadband networks of computers as comparing to local pc. The increases in consumption of energy is not growing in cost of energy but also expanded the released of carbon. Because of high cost of

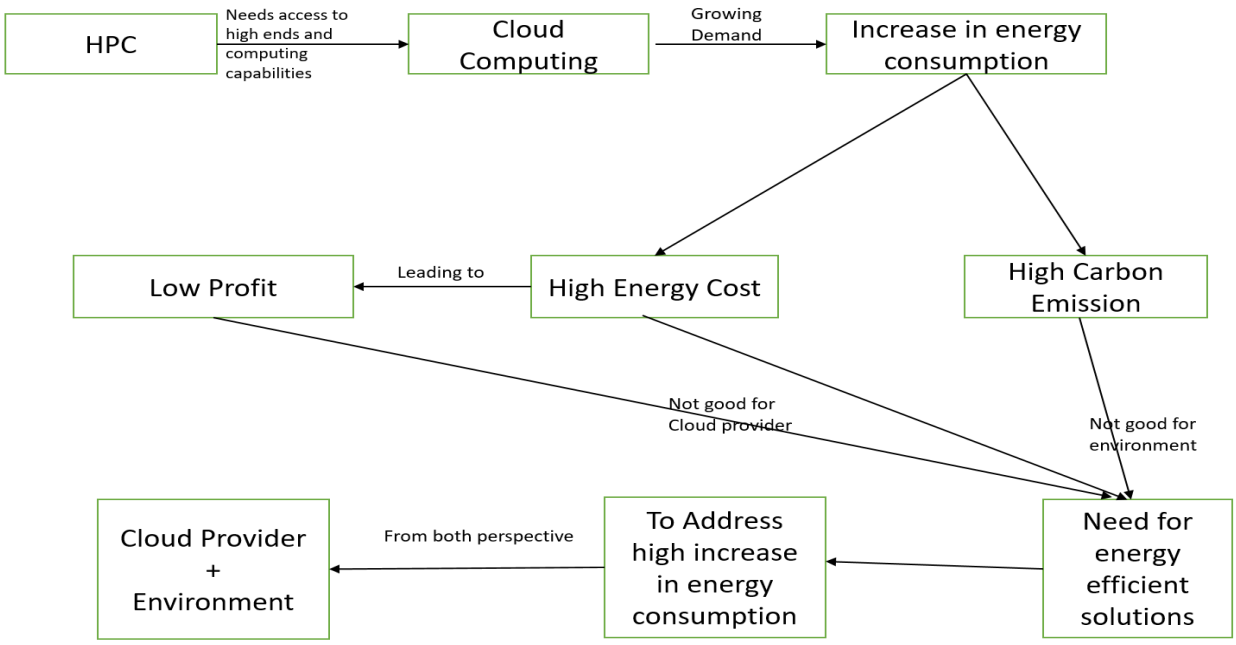

Fig: Green Computing in Clouds

energy results in shortening cloud worker, for environment margin of profit and emission of carbon is high which is not good. So, the solution of power-efficient that may label the excessive consumption of energy, this will require for both perspectives in environment and cloud provider. This is extreme requirement of cloud computing to achieve Green Computing.

II. NEED OF CLOUD COMPUTING IN LOAD BALANCING

There are two more factors which helps to achieve Green Computing and they are as follows –

- **Reducing of Carbon Emission***:* Consuming energy and release of carbon are parallel. The more energy is consumed the higher will be its carbon footprints. As we know Load balancing help to reduce consumption of energy. So, the emission of carbon will help to establish the Green Computing.
- **Reducing Energy Consumption***:* Load balancing is used to avoid over heating by balancing the workload of every nodes present in cloud. This will reduce the amount of consumed energy.

III. RELATED WORK

Some load balancing techniques in clouds are as follows:

- **Scheduling strategy on load balancing :**
  It was proposed by J.Hu et al [5] and it uses current state and historical data of the system. This strategy uses a genetic algorithm to reduce the dynamic migration and it achieves best load balancing. Its help to achieve better utilization of resource by resolving the problem of high cost and load in balance.

- **Task Scheduling on Load Balancing:**

This is discussed by Y Fang et al [6] that load balancing for two level mechanism of scheduling to achieve use of large amount resources it has to fit in vital require of end user. Load balancing is obtain from virtual machine after that from host resource by that it will improve use of resources, function of response time and comprehensive environment of computing performance.

- **Central Load Balancing:**

It was proposed by A Bhadani et al [7]. This policy is used to balance loads evenly in a distributed cloud computing/Virtual machine .It will raise the work of system but it doesn't consider system in fault-tolerance.

- **Honeybee Foraging Behavior-**

It was investigated by M.Randles et al. [8] this technique was inspired by nature and algorithm is used for self-organization. This algorithm was based on working model of Honey bees. It has two function -:

I. Searching of the node.
II. Repeating process.

It obtain global load balancing over local server. When the diversity of system get increased then the performance of system get enhanced but throughput will not increase with the increment in system size.

- **Active Clustering:**

It was investigated by M.Randles. [8] This technique is self-aggregate. This algorithm is used for optimization of job using local rewiring which connect identical services. The action of system get enhanced along large amount of resources. So, increment in throughput through the resources are effective when the system diversity is increase then it will degrade.

- **LBVS (Load Balancing Strategy for Virtual Storage):**

It was proposed by H.Liu et al. [9] it provides a data storage model on a large scale net storage of cloud. Virtualization of storage is obtained by using three-layer architecture while load balancing is obtain by using two modules. It helps to improve the ability of parallel access by the use of replica balance else it reduces the time of response and increases recovery of capacity. This strategy will help to improve the rate of flexibility robustness and storage resources of the system.

- **Server based load balancing for internet distributed services-**

It was proposed by A.M.Nakai et al. [10] for all web servers which can be distributed across the world. Further it will help in reducing time of response by usage of pact that restrict the retraction to nearest distant servers without overloading them.to implement this protocol a middleware is interpreted. To endure overloads it uses search to help all web servers.

- **A Lock free multiprocessing solution for LB-**

It was proposed by X.Liu et al. [11] that is used to avoid shared memory from disparity to other multiprocessing solutions of load balancing to maintain a user session a shared memory and lock are used. By modifying Linux kernel this will be achieved. Further this solution will help to improve all function of load balancer in a environment of multi core by large load balancing in individual load balancer.

- **ACCLB -**

It was proposed by Z. Zhang et al. [12] this theory was open federation of cloud computing. To achieve better load balancing it uses scale free and small world characteristics of a compound network. This techniques conquered heterogeneity to show adaptive nature to dynamic environment, its fault tolerance is excellent and has a good scalability further it will helps to improve system performance.

- **Biased Sampling –**

It was investigated by M.Randles et al. [8] a scalable and distributed load balancing that access random sampling of domain system to obtain self-organization hence it will balance all nodes of load balancing across the system. Thus, the performance of system will improve with similar and high population of resources hence resulting in increased throughput by utilization of effectively increased resources of system. It get degraded when population diversity increases.

IV. COMPARISON

The comparison of all above techniques are as follows:-

Table1: Comparison between load balancing techniques (LBT)

Techniques	Environment	Findings	Description
LBT1 [5]	Cloud Computing	It solves the problem of high migration cost and imbalance of loads	It uses genetic algorithm based on present state and historical data of system degrade dynamic migration, load balancing is achieved.
LBT2 [6]	Cloud Computing	It improves resource utilization and response time.	Firstly maps the task from virtual machine and then to host resources.
LBT3 [7]	Cloud Computing	Up to 20% improvisation in performance. Doesn't acknowledge fault tolerance.	It uses the information of global state to make decision of load balancing.
LBT4 [8]	Large Scale Cloud Systems	Doesn't increases throughput as the size of system increases.	Through local servers actions it achieve global load balancing.
LBT5 [8]	Large Scale Cloud Systems	It get degraded when system population diversity increases.	Optimizes job by using local rewiring which connect similar services.
LBT6 [9]	Cloud Storage	Enhances robustness and flexibility.	It uses writing balancing to restrict data writing in load balancing
LBT7 [10]	Distributed Web Servers	Mean Response time is 31% lesser than smallest latency and 29% lesser than round robin.	To support protocol it uses middleware. To tolerate sudden load changes it uses heuristic.
LBT8 [11]	Multi-core	Improves performance of load balancing	In one load balancer it runs multiple load balancing process.
LBT9 [12]	Open Cloud Computing Federation	Dynamic environment is adaptive. Fault tolerance is excellent and good scalability.	To achieve load balancing it uses scale free and small world characteristics of complex network.
LBT10 [8]	Large Scale Computing System	As population diversity increases it get degrades.	To achieve load balancing it uses random sampling of domain system.

V. RESULTS AND DISCUSSION

In techniques of load balancing there are various parameters like throughput, response time, performance, resource utilization, fault tolerance, scalibilty, migration time, associative overhead. But for energy efficient of load balancing carbon emission and energy consumption is also considered as metrics.

Response Time
In distributed system the amount of time taken to respond by distinct load balancing algorithm. It should be minimized.

Scalability
It has capability to perform load balancing for system by definite no. of nodes. This has to be improve.

Fault tolerance
It has ability to implement homogeneous load balancing despite of link arbitrary or failure node. The load balancing has to be good tolerance.

Resource utilization
The utilization of resources is checked and it has to be optimized by load balancing.

Overhead Associated
It determines the amount of overhead included while implementation of load balancing algorithm. It is composed of overhead because of movement of tasks inter-process communication and inter-processor. The load balancing can work efficiently when it is minimized.

Carbon Emission
It calculate the emission of resources in system. As carbon emission and energy consumption go hand in hand. The more energy is consumed, the carbon footprint get higher. The solution for energy efficient load balancing that it should be reduce.

Energy Consumption
It determines the energy consume by all resources in system. Load balancing will help to avoid overheating by evenly balance of all nodes.

Performance
It checks the efficiency of system. The reasonable cost has to be improved. For e.g. acceptable delays should be kept when response time is reduce.

Throughput
It calculate the complete executed no. of tasks. It improve the system performance.

Table2: Evaluation of load balancing techniques (LBT)

Techniques	Response Time(RT)	Performance(P)	Throughput(T)	Scalibility (S)	Faulttolerance(FT)	Resource Utilization(RU)	Overhead (O)	Migration Time (MT)	Carbon emission (CE)	Energy Consumption (EC)
LBT1 [5]	×	×	×	×	×	✓	✓	×	×	×
LBT2 [6]	✓	✓	×	×	×	✓	×	×	×	×
LBT3 [7]	✓	✓	✓	×	×	✓	×	×	×	×
LBT4 [8]	×	✓	✓	✓	×	×	×	×	×	×
LBT5 [8]	×	✓	✓	✓	×	×	×	×	×	×
LBT6 [9]	✓	✓	×	✓	✓	×	×	×	×	×
LBT7 [10]	✓	✓	×	×	×	×	×	×	×	×
LBT8[11]	×	✓	✓	×	×	×	×	×	×	×
LBT9[12]	×	✓	×	✓	✓	✓	×	×	×	×
LBT10 [8]	×	✓	✓	✓	×	×	×	×	×	×

VI. CONCLUSION AND FUTURE SCOPE

The industry is adopting cloud computing widely these days, though it has lots of existing issues like virtual machine migration, load balancing , energy management , server consolidation etc., which is not been fully addressed. Central issues of load balancing is it require to distribute heavy and dynamic load workload equally to all nodes in clouds to achieve a resource utilization ratio and higher user satisfaction. It also make sure that each and every computing resources should distributed fairly and efficiently. The load balancing techniques have been thoroughly studied, and it mainly focus on services like response time, reducing overhead and improving performance etc., but none of the techniques considered the factors of carbon emission factor

and energy consumption. Hence there is need to develop energy efficient load balancing techniques which can improvise the performance of cloud computing with maximum utilization of resources when reducing in carbon emission and energy consumption to an extent it will help to achieve green computing.

REFERENCES

[1] R.Mata - Toledo, and P. Gupta "*Green Data centers, how green can we perform*", Journal of Technology Research Academic and Business Research Institute, Vol. **3** No. **1**, May **2010** pages **2-8**.

[2] C.S. Yeob , S.K. Garg , R. Buyya, A Anandasivamc, "*Environment-Conscious scheduling of HPC applications on distributed cloud - oriented data centers* " Journal of Parallel and Distributed Computing Elsevier, Vol. **70**, No. **5**, May **2010**, pages **1-18**.

[3] V.Topka ,S.Kabiraj , and R.C Walke , "**Going Green : A holistic Approach to Transform Business** " , International Journal of managing Information Technology Vol. **2** No. **3** , August **2010** , pages **22-31**.

[4] W.A.Ayre , J.Baliga , R.S Tucker and K.Hinton, "*Green cloud computing balancing energy in processing storage, and Transport* " , Proceedings of the IEEE , Vol **99** , No. **1** , January **2011** , pages **149-167**.

[5] J.Gu , J.Hu , T.Zhao and G. Sun , "*A Scheduling Strategy on load balancing of virtual Machine Resource in cloud computing environment*" , Third International Symposium on parallel Architecture , Algorithm and programming **2010** , pages **88-95**.

[6] F. Wang , Y. Fang , and J. Ge , "*A Task Scheduling Algorithm Based on Load Balancing in cloud computing* ", Web Information System and Mining , Lecture notes in Computer science Vol. **6318 2010**, pages **271-277**.

[7] S. Chaudhary and A. Bhadani , "*Performance evaluation of web servers using central load balancing policy over virtual machines on cloud*" ,Proceedings of the Third Annual ACM Bangalore Conference , January **2010.**

[8] M. Randles , A. Taleb - Bendiab and D. Lamb , "*A comparative study into distributed load balancing Algorithms for cloud computing*" , Proceedings of 24th IEEE International Conference on Advanced Information Networking and Application workshops , Perth , Australia , April **2010**, pages **551-555**.

[9] S.Liu , X-Meng , H.liu , Y.Zhang and C.Yang , "*LBVS : A Load Balancing strategy for virtual storage* ", International Conference on Service Sciences , IEEE , **2010** , pages **25-262**

[10] E.Madeira ,A.M.Nakai and L.E. Buzata "Load balancing for internet distributed Services using limited redirection rates" 5th IEEE Latin American Symposium on dependable computing , **2011**, pages **156-165**..

[11] Lei Pan , Xi Lei , chong-jun , jun-yuan , Wang and Xie, "A Lock - Free Solution for load balancing in multicore Environment", 3rd IEEE International Workshop on Intelligent System and Application , **2011**, pages **1-4**.

[12] X. Zhang and Z.Zhang , "A Load Balancing Mechanism Based on Ant Colony and complex network Theory in open cloud computing federation", Proceeding of 2nd International Mechatronics and Automation, Wuhan , China, May **2010**, pages **240-243.**

