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Various Issues & Challenges of Load Balancing Over Cloud: A Survey

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ABSTRACT- An emerging technological trend of computing over internet is, the Cloud Computing. It has various compensations along with certain crucial issues that need to be determined in instruction to improve reliability, scalability, authenticity etc. of cloud computing situation. These matters are in one way or the other related to the load management, fault tolerance and different security subjects in cloud situation. This paper covers the main unease on Load Balancing in Cloud Computing environment. This load could be CPU load, recollection volume, or system load. Load complementary is the procedure of allocating the load between various nodes of a dispersed organization to avoid a condition where some of the nodes are seriously loaded while other nodes are indolent or responsibility very slight effort in order to recover both supply operation and job answer time. Load balancing safeguards that all the mainframes in the organization or every node in the system does roughly the equal quantity of exertion at any instantaneous of time. There are many approaches to determination the tricky of load balancing in cloud environment, hence by investigation of such procedures with their countless returns, restrictions and issues a new and competent practice for Load Balancing is instigated in future.

***Index Terms*—Load Balancing, Cloud Computing, , Distributed System, Ant colony optimization, Scheduling,**

I. INTRODUCTION

1.1 CLOUD COMPUTING

"Cloud is a equivalent and disseminated computing system consisting of a collection of inter-connected and virtualized computers that are dynamically provisioned and obtainable as one or more combined calculating possessions based on service-level agreements (SLA) recognized through cooperation amongst the provision breadwinner and consumers."[2] The US National Institute of Standards and Technology (NIST) [3] symbolizes cloud calculating as " a pay-per-use prototypical for permitting available, expedient, on-demand system admittance to a communal pool of configurable calculating possessions (e.g. networks, servers, stowage, submissions, amenities) that can be quickly provisioned and unconfined with negligible organization exertion or provision earner communication.". Since cloud computing is a new technology .It providing online resources and online storage to the user's .It provide all the data at a lower cost. In cloud computing users can access resources all the time through internet. They need to pay only for those resources as much they use .In Cloud computing cloud provider outsourced all the resources to their client. There are many existing issues in cloud computing. The main tricky is load opposite in cloud calculating. Load harmonizing helps to dispense all loads amongst all the nodes. It also confirms that every calculating reserve is disseminated professionally and honestly. It provides high satisfaction to the users. Load balancing is a comparatively new system that delivers high reserve operation and improved rejoinder time [5, 6, 7, 8].

The Cloud computing consists of several characteristics: [9, 10].

• On demand service- Cloud computing provide services to users on their demand .Users can access the services as they want.

• Broad Network Access- In cloud computing competences are obtainable over the system .All the capabilities are accessed through different mechanisms.

• Resource Pooling- Different models are used to pooled the resources which provide by the providers to their consumers. All the possessions vigorously allocated and reallocated conferring to consumer request.

• Rapid Elasticity- Amount of possessions is upsurge at any time rendering to the purchaser's necessities.

• Measured Service- In cloud computing resource usage can be monitored, controlled for both the provider and consumer of the all service.

There are many challenges in cloud computing:-

- Security
- Efficient load balancing
- Performance Monitoring
- Consistent and Robust Service abstractions
- Resource Scheduling

- Scale and QoS management
- Requires a fast speed Internet connection.

Cloud service delivery is divided into three models. The three service models are [2, 3, 4, 11]:

- Cloud Software as a service (Saas)

The competence delivered to the customer is to use the provider's requests successively on a cloud organization. The customer does not accomplish the fundamental cloud substructure.

- Cloud Platform as a Service (Paas)

The competence delivered to the customer is to deploy onto the cloud infrastructure consumer created or acquired applications created using encoding tongues and tackles supported by the provider. The buyer does not accomplish or regulator the fundamental cloud substructure, but has regulator over the positioned requests and perhaps submission hosting environment configurations.

- Cloud Infrastructure as a Service (Iaas)

The competence delivered to the customer is to provision processing, storage, networks, and other important calculating possessions where the customer is able to organize and run subjective software, which can comprise functioning systems and submissions. The purchaser does not complete or controller the vital cloud infrastructure but has regulator over effective systems, storing, deployed submissions, and perchance incomplete regulator of excellent networking mechanisms.

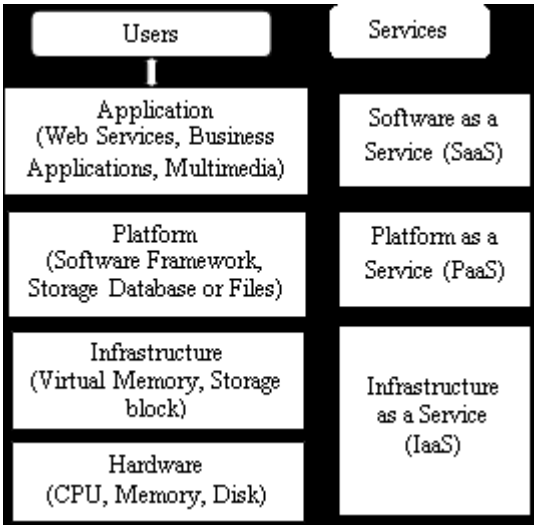

Figure 1: Cloud Computing Architecture

A distinctive cloud figuring system involves of three major components. They are:

- Client: Client is end users, which interact with the clouds to manage information related to the cloud. Clients can be Mobile client, thin client and Thick client.
- Datacenter: Datacenter is the collection of servers hosting different applications and it may exist at a large distance from the clients.
- Distributed Servers: Distributed servers are the part of a cloud which actively checks services of their hosts and available throughout the internet hosting different applications.

1.2 LOAD BALANCING IN CLOUD COMPUTING

Load balancing is used to distribute a larger processing load to smaller processing nodes for enhancing the overall performance of system. In cloud totaling situation load complementary is required distribute the energetic local workload consistently amongst all the nodes. [12, 13, 14, 15] For the appropriate load delivery a load balancer is used which received tasks from different location and then dispersed to the information center. A load balancer is a expedient that acts as a contrary proxy and allocates system or submission load across a quantity of attendants [16].

The metrics for Load Balancing in Clouds includes parameters [16].

- Throughput - it is castoff to estimate the no. of responsibilities whose execution has been completed. It should be high to progress the presentation of the classification.
- Performance – it is used to check the efficiency of the system. It has to be enhanced at a judicious cost e.g. reduce rejoinder time while possession adequate interruptions.
- Resource Utilization – it is used to patterned the application of possessions. It would be augmented for an effective load harmonizing.
- Scalability - it is the capability of an procedure to accomplish load corresponding for a classification with any predetermined numeral of nodes. This metric should be upgraded.
- Response Time – it is the quantity of time taken to retort by a actual load harmonizing procedure in a disseminated arrangement. This limitation should be lessened.
- Fault Tolerance - it is the capability of an procedure to complete unbroken load harmonizing in spite of uninformed node or link catastrophe. The load harmonizing ought be a good burden open-minded procedure.
- Migration time – it is the time to journey the jobs or possessions from one protuberance to other. It would be diminished in command to augment the presentation of the arrangement.
- Overhead Associated - regulates the quantity of upstairs complicated while realizing a load opposite procedure. It is self-possessed of upstairs due to undertaking of responsibilities, inter-processor and inter-process statement. This would be diminished so that a load harmonizing practice can exertion resourcefully.

Load complementary is a system of allocating the total load to the separate nodes of the cooperative organization to the enable networks and capitals to recover the retort time of the job with maximum throughput in the system [17]. The significant belongings which said about load complementary are approximation of load, load judgment, dissimilar organization constancy, organization presentation, communication among the nodes, countryside of exertion to be transported, choosing of nodes and many other ones to deliberate while emergent such procedure.

The Load balancing algorithms could be divided into various kinds. Such a classification is depicted in the figure [12, 13, 16, 17]:

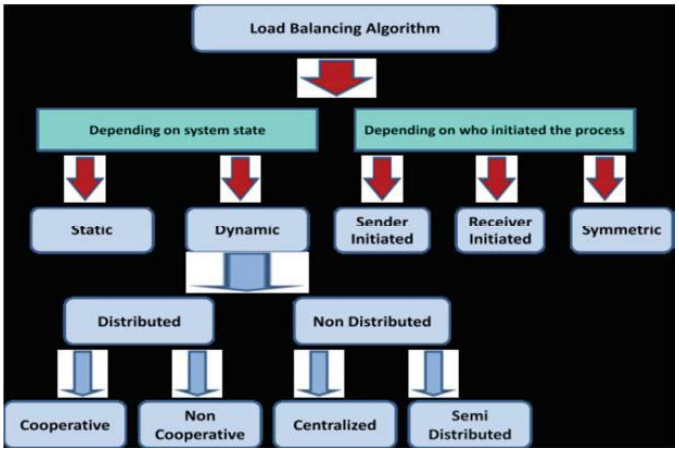

Figure 2 -Types of Load Balancing Algorithm

- Static approach: - This tactic is mainly well-defined in the strategy or employment of the arrangement. Static load harmonizing procedures divide the traffic homogenously amongst all servers.
- Dynamic approach: - This approach considered only the recent state of the organization during load balancing decisions. Dynamic method is more apposite for widely disseminated classifications such as cloud totaling. Lively load harmonizing approaches have two types .They are distributed approach and non-distributed (centralized) approach..In centralized approach, only a single node is responsible for managing and distribution within the whole system. Other all nodes are not responsible for this.

Load balancing solutions usually apply redundant servers which help a better distribution of the communication traffic so that the website availability is conclusively settled. There are other kinds of load complementary procedures contingent on who introduced the procedure, load complementary procedures like:

- Sender Initiated: If the load harmonizing procedure is prepared by the correspondent.
- Receiver Initiated: If the load corresponding process is initiated by the handset.
- Symmetric: It is the recipe of both sender originated and mouthpiece originated.

In the area of cloud computing, the main objective of load balancing techniques is to improve performance of computing in the cloud, stoppage strategy in case of organization failure, preserve steadiness and scalability for cooperative an upsurge in large scale calculating, decreases related costs and answer time for employed in the cloud and also exploits the obtainability of possessions [18]. Load balancing helps in fair allocation of computing resource to accomplish a high User gratification and proper Resource utilization. Load balancing is dividing the circulation between all waitpersons, so information can be sent and established without any postponement with load complementary [19].

The goals of Load Balancing include:

- 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.

The need of Load Balancing in cloud computing environment is to achieve efficient resource scheduling, maximum utilization of resources & a higher user satisfaction, creation sure that no solitary node is overcome, hence we can say that for educating the overall presentation of the organization appropriate load complementary is desirable. It also helps in applying fail-over, avoiding bottlenecks, enabling scalability, over-provisioning and reducing response time. There are certain policies of load balancing algorithms that are:-

- Information policy: It defined that what information is required and how this information is collected.
- Triggering policy: This policy defined that time period when the load balancing operation is starting to manage the load.
- .Resource type policy: This policy defined the all types of resources which are available during the load balancing.
- Location policy: This uses all the results of the resource type policy. It is used to find a partner for a server or receiver.
- Selection policy: This policy is used to find out the task which transfers from overloaded node to free node.

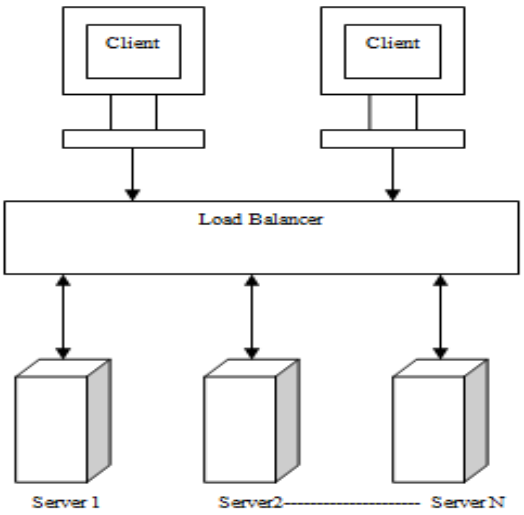

Figure 3 -The Concept of Load Balancing

II. LITERATURE SURVEY

Jio Zhao et.al [1] implemented a heuristic Clustering based Load Balancing in Cloud using Bayes Theorem. Since most of the prevailing load complementary methods have moderately high difficulty, this daily has absorbed on the assortment tricky of corporeal hosts for organizing demanded errands and planned a original experiential approach called Load Balancing based on Bayes and Clustering (LB-BC). LB-BC familiarizes the notion of realizing the complete load harmonizing in a long-term development in dissimilarity to the instantaneous load harmonizing methods in the existing literature. Simulation consequences show that associated with the present works, the planned method has condensed the disappointment quantity of task disposition events perceptibly, improved the throughput, and optimized the external services performance of cloud data centers. This daily has planned a task placement approach LBBC for the long-term load balancing effect and it has employed a heuristic idea based on Bayes theorem and the clustering process. LB-BC first has narrowed down the search scope by comparing performance values. Then, LBBC has utilized Bayes theorem to obtain the posteriori probability values of all candidate physical hosts. Finally, LB-BC has combined probability theorem and the clustering idea to pick out the optimal hosts set, where these physical hosts have the most remaining computing power currently, for deploying and executing tasks by selecting the physical host with the maximum posteriori probability value as the clustering center and thus to achieve the load balancing effect from the long-term perspective.

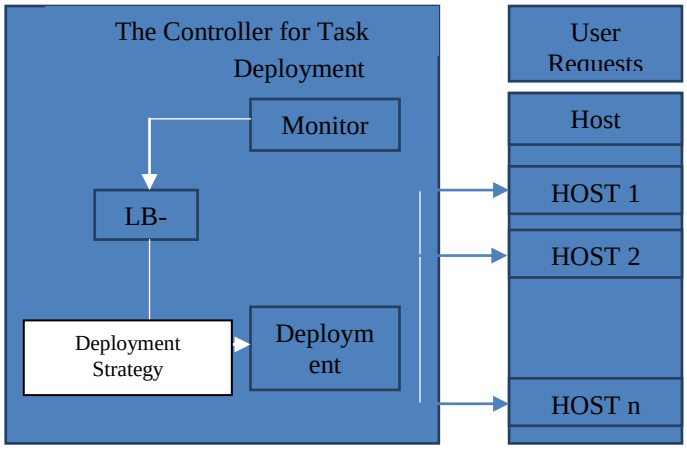

Figure 4: Existing LB-BC's Internal Architecture Model

Below is the literature survey of load balancing techniques that are currently common in clouds like:-

- **Message Oriented Model Load Balancing Approach**:
  Zenon Chaczko et.al [15] proposed a model that uses XMPP for load balancing. This technology provides an open platform for real time communication between various parties. XMPP customers send attendance material to XMPP attendance servers and XML brooks comprising particulars of company material of clients produced by these servers. Using a load balancer on the top of an XMPP server allowed incoming requests to be prioritized and handled by a generic service.

- **Carton Mechanism For Cloud Control:**
  R. Stanojevic et.al [22] planned a instrument CARTON for mist control. It amalgamates the use of load balancing (LB) and distributed rate limiting (DRL). LB is used for equally distributing the occupations to dissimilar waitpersons so that the related costs can be diminished and DRL is used to make undisputable that the incomes are dispersed in a method to keep a fair reserve distribution. With very low calculation and communiqué upstairs, this algorithm is simple and easy to implement.

- **Compare and Balance Load Balancing Algorithm:**
  Zhao et.al [23] proposed his techniques with a reference of the problematic of intra-cloud load harmonizing between corporeal congregations by adaptive live immigration of virtual apparatuses. A consignment harmonizing model is considered and applied in instruction to decrease virtual machines relocation time by communal stowage to balance load between servers rendering to their mainframe or IO usage and to keep simulated machineries zero-downtime in the procedure.

- **Event-driven Load Balancing Algorithm:**
  V. Nae et.al [24] obtainable an event-driven load complementary procedure for real time enormously multiplayer online games (MMOG). This algorithm accepts capacity events as input, examines its machineries in background of the incomes and the international state of the game meeting, thereby producing the game session load balancing actions. This is capable of scaling up and down a game session on multiple resources according to the variable user load but has occasional QoS breaches.

- **Scheduling strategy Load Balancing Algorithm On Virtual Machine resources:**
  Meenakshi Sharma et.al [25] proposed a scheduling approach on load complementary of Virtual Mechanism capitals that uses ancient data and present state of the organization. This approach realizes the best load complementary and summary active immigration by using a genetic procedure. It assistances in determining the subject of load inequity and great cost of immigration thus attaining better reserve utilization.

- **Honeybee Foraging Behavior Load Balancing Approach**:
  M. Randles et.al [26] explored a decentralized honey-bee based load balancing technique that is a nature-inspired algorithm for self- organization. It attains worldwide load complementary finished local server movements. Presentation of the organization is enhanced with increased system diversity but amount is not augmented with an upsurge in organization size. It is best suitable for the circumstances where

the miscellaneous populace of provision types is obligatory.

- M. Randles et.al [26] also examined a dispersed and ascendable load complementary method that uses **Biased Random Sampling** of the organization sphere to accomplish self-organization thus harmonizing the load transversely all nodes of the classification. The presentation of the arrangement is enhanced with high and comparable populace of properties thus consequential in an amplified quantity by effectively employing the enlarged arrangement possessions [26].

- **Open Flow model Load Balancing Approach**:
  Hardeep Uppal et.al [27] presented a model in which uses an open flow switch. Open flow changes are like a typical adjustment with a flow table accomplishment packet lookup and forwarding. The difference lies in how flow rules are inserted and updated inside the switch's flow table.

- **Particle Swarm Optimization Load Balancing Approach**:
  T.R.V. Anandharajan et.al [28] also proposed an efficient Particle Swarm Optimization (PSO) based Virtual Mechanism Reserve Scheduling in Cloud Calculating Environment. Since Cloud Computing enable various Resources to be shared over distributed manner where Scheduling of Resources to be done efficiently and accurately. Here in this newspaper Particle Swarm Optimization (PSO) technique is implemented for the Sharing and Scheduling of Resources. Here the improved particle swarms optimization to obtain the optimal solution in reasonable time. The experiments show that the improved algorithms can provide effective solutions that the original algorithm cannot provide on cloud systems.

- **Ant Colony Optimization Load Balancing Approach**:
  Ratan Mishra et.al [29] has planned a classical in which Separate ants are behaviorally much unsophisticated insects. They have a very limited memory and exhibit individual behavior that appears to have a large random component. Temporary as a cooperative however, ants accomplish to achieve a diversity of complex tasks with great dependability and constancy.

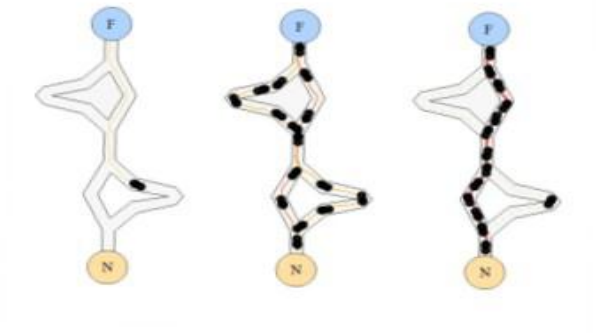

Figure 5: Ant Colony Optimization

- **Efficient Load Balancing Methodology For Future Internet Based On Game Theory:**
  Shaoyi et.al [30] implemented an efficient Load Balancing methodology for Future Internet based on Game Theory. During the survey of Future internet it is observed that Load complementary processes and job distributions are main investigation difficulties in zones of reserve organization of upcoming internet. In this newspaper, we familiarize a load opposite model for forthcoming internet. The compensations of our procedure are healthier scalability to the model, educating system presentation, and low cost on upholding system material.

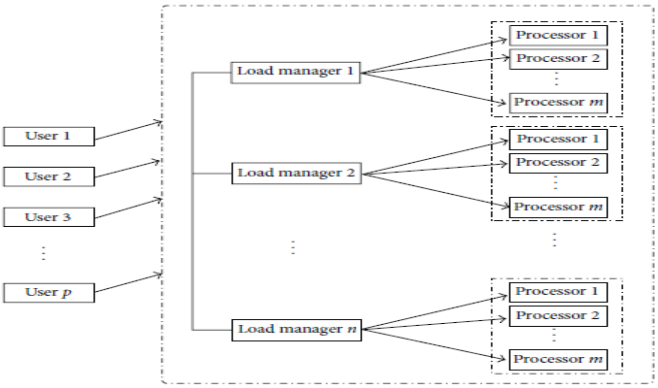

Figure 6: Load Balancing Model implemented for Future Internet

- **Multiple Pheromone Load Balancing Algorithm**:
  Gogulan et.al [31] implemented a Multiple Pheromone procedure for the preparation in Cloud Computing Situation for numerous QoS Requirements .in their paper have discussed that, by monitoring presentation strictures of virtual machineries in real time, the overloaded is easily detected once these parameters exceeded the threshold. Quickly conclusion the adjoining idle protuberance by the ant gathering procedure from the

possessions and preliminary the virtual mechanism can bears part of the weight and encounters these presentation and reserve necessities of the weight. This comprehends the load adaptive self-motivated reserve development in the cloud amenities podium and accomplishes the goal of load harmonizing.

- **Genetic Algorithm Load Balancing Algorithm:**
  Sushil Kumar et.al [32] proposed a soft computing approach, which uses the mechanism of natural selection strategy. A humble Genetic Algorithm is collected of three processes: genetic operation, selection, and replacement operation. The advantage of this technique is that it can handle a vast search space applicable to complex objective function and can avoid being trapped in locally optimal solution. A generation is a collection of artificial creatures (strings). In every new generation, a set of strings is created using information from the previous ones. Occasionally, a new part is effort for good measure. According to Genetic Algorithms are randomized, but they are not simple random walks. They adept adventure ancient material to hazard on new search opinions with predictable development. The effectiveness of the GA depends in appropriate mix of exploration and exploitation.

Divya Rastogi et.al [33] proposed the ranked developments of the information center and multidimensionality of reserve piles transverse servers, system switches, and stowage in a nimble data center that has desegregated server and memory virtualization engineering sciences. Vector.

- **Vector Dot Load Balancing Algorithm:**

S.NO	AUTHOR	TECHNOLOGY USED	ADVANTAGES	ISSUES
1.	Jio Zhao et.al [2016]	Heuristic Clustering Based on Bayes Theorem Implemented.	A very New Concept Implemented.	Highly Complex Methodology.
2.	Sushil Kumar et.al [2015]	Genetic Algorithm For Load Balancing technology.	Natural Selection Strategy	More computation.
3.	Divya Rastogi et.al [2014]	Vector Dot Algorithm For Load Balancing Technology	Multidimensional Storage Over Data Centers.	More Memory Utilization.
4.	Shaoyi et.al [2014]	Future Internet based Load Balancing Technology.	Better Scalability.	Network Contention
5.	Meenakshi Sharma et.al [2013]	Load Balancing Of Virtual Machine Resources	Better Resource Utilization.	Lower Throughput.
6.	Gogulan et.al [2012]	Multiple Pheromone Algorithm For Scheduling	Load Adaptive Scheduling.	Performance degraded.
7.	Ratan Mishra et.al [2012]	Ant Colony Optimization Based Load balancing Technology.	Highly efficient.	More traffic and time utilization.

8.	T.R.V. Anandharajan et.al [2011]	Particle Swarm Optimization based Resource Scheduling.	Increased throughput.	Complex system.
9.	M. Randles et.al [2010]	Honey-bee based load balancing technique	Global load balancing Achieved.	Confined to specific system.
10.	Stanojevic et.al [2009]	Carton For Cloud Control Implemented.	Simple technology.	More iterations.

III. CONCLUSION

Load complementary is one of the main contests in cloud calculating hence it is required to distribute the load evenly at every node. A highly congested provider may fall to provide efficient services to its customers. So, with proper load balancing algorithm system response, service and throughput can be increased. This paper shows a comparison in order to evaluate various existing load balancing techniques. Using this comparison, performance can be improved of any existing techniques by implementing some new ideas as this table provides an idea what is there in algorithm and what is missing.. The Various Load Balancing techniques are analyzed here. Since Load Balancing techniques requires a lot of computational overhead alot of techniques are implemented to solve the issues. Here by analyzing these techniques their various advantages and limitations an efficient technique for Load Balancing can be implemented in future.

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