A Study of Fuzzy Based Dynamic Load Balancing for Cell Networks

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Abstract— Load balancing is usually a technique used for enhancing the performance of a parallel as well as distributed system. The performance from the systems might be enhanced by means of redistribution regarding load over the different cell phone networks. As a result, load balancing plays a significant role pertaining to increasing your efficiency regarding distributed program, but this is a very challenging and difficult task inside large scale distributed system as the global condition of spread systems is usually changes dynamically. Regarding various factors like greatest throughput, outage possibility, availability along with scalability your distributed program needs productive load evening out. In this paper various load balancing techniques have been studied and out of these dynamic load balancing techniques are seem to be good for load balancing. Also, the present load balancing algorithms are reviewed along with the comparative analysis is usually performed.

Keywords— Load Balancing, Cell Networks, Fuzzy Logic, fuzzy based dynamic load balancing algorithm

I. INTRODUCTION

Cloud [16] is described as, which exists at remote location i.e. it refers to a network or internet. Cloud provides various services over network, i.e., on private networks and on public networks, i.e., WAN, LAN. This includes various apps like internet conferencing, e-mail, customer relationship management (CRM), these all are manage in cloud. Also Cloud Computing defines as being a process of manipulating, being able to access and configuring the applications online. In addition, it delivers many services like online storage of data, commercial infrastructure and application. It provide certain services and models that are working behind to make the cloud computing accessible to end users and feasible. The working models for cloud computing are as follows:
a.) Deployment Models
b.) Service Models

Deployment Models
Deployment models refers to in what way the cloud might be accessed. Over the network the Cloud Computing provides four types of accesses these are: Public, Private, Hybrid and Community.
i.)Public Cloud
The Public Cloud can provide easy access of services and systems to the general public. It is less secure because it provides open access, e.g., e-mail.
ii.)Private Cloud
The Private Cloud can provide easy access of systems and services within an organization. It enhances the security level of cloud because it has private nature.
iii.)Community Cloud

The Community Cloud can provide easy access of systems and services to a network associated with organizations.
iv.)Hybrid Cloud
The Hybrid Cloud is combination of both clouds i.e. public and private cloud. However, the analytical activities need to be performed employed private cloud while the non-analytical activities need to be performed employing public cloud.

Service Models
Service Models are looked as a reference models upon which the Cloud Computing is usually depend. Service models are grouped into even three models which have been as follows:
i. Infrastructure as a Service
ii. Platform as a Service
iii. Software as a Service
i.)Infrastructure As A Service (IAAS)
It offers a superior access to basic resources such as physical machines, virtual machines and virtual storage and many others.
ii.)Platform As A Service (PAAS)
It offers a superior access to the runtime environment for development, applications, & deployment tools, etc.
iii.)Software As A Service (SAAS)
This model allows the end users to use software applications as a service.
The rest of the paper is further categorized into following sections Section 2 defines Related work, Section 3 defines concept of Load Balancing, Section 4 defines Load Balancing Techniques, Section 5 defines the concept of cell networks, Section 6 defines Limitations in earlier work,

Section 7 defines Comparative work, Section 8 Concludes the paper.

II.RELATED WORK

Yang Xu et al.(2015) [1] has proposed a distributed biasing scheme in order to achieve load balancing over heterogeneous networks. Depending upon the limited backhaul capacity and user distribution over the system each small cell base station distributively and adaptively changes there cell range by setting the bias value to effectively use the wireless resource and also achieving better load balancing. The Q-learning algorithm is suggested in order to create the biasing scheme in every small cell base station. The main characteristics of the proposed scheme are as follows. First, each Small Base Station can adjust its bias value adaptively and independently based on the system performance, such as the outage probability. Second, the time scale of bias value changing is adjusted according to user distribution.

Collotta, Mario (2015) [2] proposes a load balancing way of IEEE 802.11 networks in relation to fuzzy logic for the better achievement of typical Quality of Service constraints that characterize a wireless network. In order to test this proposed strategy, several actual test scenarios were implemented and several Quality of Service parameters were evaluated.

Muñoz et al.(2015) [3] has proposed an unified self-management process i.e. based upon Fuzzy Logic and Reinforcement Learning. The proposed algorithm changes handover parameters to optimize the main key functionality indicator parameter relevant to Load Balancing. Results shows that the suggested scheme successfully provide greater performance as opposed to independent entities which can be running simultaneously within the network.

Gódor et al.(2015) [4] has proposed the information of this handover method i.e. decision strategies, information collecting, and the base station changes process and also all most of all these three methods face quite a few problems with multi-tier networks. High dense small cell deployment makes handover relevant to information gathering very hard, efficient decision mechanisms will also be important in order to reduce the volume of unnecessary handovers. The base station exchange has to be accelerated to get appropriate method performance.

Singh et al.(2015) [5] has discussed an algorithm that provides dynamic load balancing for cloud environment. They proposed an Autonomous Agent Based Load Balancing Algorithm. The described mechanism has been implemented in order to provide good and satisfactory results.

Krishan et al.(2015) [6] proposes a load balancing algorithm that enhance the network performance. The demonstrated algorithm will dynamically balance the network load by distributing use the mobile stations among access points (APs). They uses Riverbed Modeller 17.5 Simulator to evaluate the results of proposed load balancing algorithm. The results have been shows the network performance enhancement in terms of parameters like Throughput, Data Dropped, and Load on an AP. The demonstrated algorithm shows efficiency of the load distribution over the network and enhances the network performance.

Sreenivas et al.(2014) [7] They will mainly described the concept of load balancing technique in cloud computing, the earlier used load balancing techniques as well as discusses the several qualitative parameters or metrics like performance, fault tolerance, associated overhead, scalability and so forth.

Domanal et al.(2014) [8] has proposed a load balancing algorithm i.e. novel VM-assign load balance algorithm. It aids in allocating the incoming requests to the available virtual machines. Also, the performance on the network is examined applying CloudSim simulator as well as it is compared with Active- VM load balance algorithm i.e. used earlier as well as the simulation results has described that the proposed algorithm distributes the load on all the available virtual machines without under and over utilization.

Kumar et al. [9] has proposed that the demand of Cloud Computing and also clients are demanding a lot of services intended for better results, in the concept of Cloud load balancing is now a useful and critical research area. Load balancing guarantees that each node in the network and all the processors in the system accomplish approximately equal number of work at any instant of time. In this particular paper they have discussed a number of load balancing techniques which are used to solve the problems in cloud computing environment. This paper presents numerous approaches that are using the load balancing techniques**.**

Yang et al.(2014) [10] has proposed how the network traffic problem has been solved so that mobile network operator (MNO) can effectively use the existing private small cell network. They propose an effective framework regarding small cell networks that has limited-capacity backhaul, where each small cell holders (SHs) obtain efficient network utilization through the MNO and then admit macro cell users. They proposed a power allocation algorithm along with the numerical results ensures that there recommended framework along with the proposed algorithms yield to major improvements within the MNO's as well as SHs' utilize their cell network with no facing any risk.

Zhang et al.(2015) [11]has proposed that Heterogeneous small cell networks have attracted a lot attention regarding satisfying user's data traffic requirements it combines cloud computing and heterogeneous small cell network together and also it will play an vital role in 5G mobile communication networks. They analyse the issues of handover management and cooperative interference mitigation in a Heterogeneous small cell network. Numerical results ensures that with the particular proposed network architecture as well as handover management schemes the

ability of Heterogeneous small cell network can proficiently increase though maintaining user's quality of service.

Ge, Xiaohu, et al.(2014) [13] has proposed that in small cell networks backhaul traffic models Gauss-Markov mobile models of mobile stations plays an important role for enhancing the efficiency of network. For this, an energy efficiency model have been introduced regarding small cell backhaul networks with Gauss-Markov mobile models. The mathematical results explains that with the help of trade-off the particular radius and quantity of small cells in cellular networks the energy utilized by each small cell backhaul network could be minimized.

Zou et al.(2015) [14] has proposed that the development of wireless networks for next generation (i.e., 5G) is at its very first phase, it offers that a few key technologies may also play the vital role inside 5G technology, such as small cells, new radio air interfaces along with millimeter waves. The densely deployed small cell networks are essentially the most suitable practical strategy to the 5G. Within this, they described the existing network synchronization methods and handle their limitations in modest cell multilevel deployment situations.

III. LOAD BALANCING

Load Balancing [7] is one of the main issue linked to cloud computing. The load could be a memory, network or delay load, CPU capacity. It is vital that the different nodes can easily carry sufficient load from the distributed system to improve the resource utilization and in addition for much better performance of system. This helps to avoid the situation exactly where nodes are both heavily loaded and under loaded over the network. The aims of load balancing are as follows:

- Improve the performance
- Maintain process stability
- Build fault tolerance process
- Accommodate future modification.

Load balancing algorithms are further divided into two categories:

1.2.1 Static Algorithm

In static algorithm the load is divided evenly in access of servers. This algorithm required an effective knowledge connected with system resources, so that this decision connected with distributing the load does not rely on the recent state connected with server.

1.2.2 Dynamic Algorithm

In dynamic algorithm the server when lightly loaded inside the whole network is searched and is also selected for balancing a load. In this the current state of the system is needed so that the correct decision has been carried out for managing the load.

IV. LOAD BALANCING TECHNIQUES

Load balancing techniques helps with efficient usage of resources to ensure performance with the system is usually enhanced. The main aim of load balancing is to reduce the employment of resource consumption which can further minimize energy consumption.

Comparison of Load Balancing Techniques	Description	Advantages
Dynamic Round Robin Algorithm	1. Uses a pair of rules to save the energy consumption 2. Works regarding consolidation associated with VM	Slow up the power consumption
Decentralized Content Aware Load Balancing Algorithm	1. Uses Unique and Special Property(USP) Associated with nodes 2. To thin down the actual search this uses content information	1. Improves the actual searching performance hence increasing overall performance 2. It reduces the idle time of nodes
Join-Idle Queue Algorithm	1. To the availability associated with idle processors this assigns idle processors to dispatchers. 2. After that it assigns jobs to processors to relieve average queue length	1. Decreases system load 2. It provides Less communication overhead
Honeybee Foraging Behavior(ABC)	Achieves global load balancing over the nearby local server actions	Improved scalability

Table-1

V. CELL NETWORKS

Heterogeneous networks uses combination of macro cells and small cells that provide solutions in order to meet the increasing demand of mobile traffic. The deployment of small cell access points (SAPs) also leads to continuous increase in energy consumption. The rising of environmental awareness and the growth in the price of energy, it is very important to design wireless systems that efficiently uses energy for both macro cells and small cells. Now a days, Heterogeneous small cell networks have attracted high of the attention of user's pertaining to satisfying the actual user's data traffic requirements so that is why they combines heterogeneous small cell network and cloud computing together for obtaining better results and also it will play a vital role in 5G mobile communication networks.

VI. LIMITATIONS IN EARLIER WORK

The review has shown that the following limitations:-

1.) The use of soft computing algorithm is ignored in existing research.
2.) Also Q-learning can be improved further using multivalent logic i.e. fuzzy logic.

VII.COMPARATIVE WORK

Metrics/ Techniques	Throughput	Overhead	Fault tolerance	Migration time	Response time	Resource Utilization	Scalability	Performance	Static	Dynamic
Round Robin	Max	Min	Min	Min	Max	Max	Max	Max	Yes	No
Dynamic Round Robin	Max	Max	Max	Max	Min	Max	Min	Min	No	Yes
PALB	Max	Max	Max	Max	Max	Max	Min	Min	Yes	No
Active Monitoring	Max	Max	Min	Max	Max	Max	Max	Min	No	Yes
FAMLB	Max	Max	Max	Max	Min	Max	Max	Max	No	Yes
Min-Min	Max	Max	Min	Min	Max	Max	Min	Max	Yes	No
Throttled	Min	Min	Max	Max	Max	Max	Max	Max	Yes	No
Honeybee Foraging	Min	Min	Min	Min	Min	Max	Min	Min	No	No
Active Clustering	Min	Max	Min	Max	Min	Max	Min	Min	Yes	No
Biased Random Sampling	Min	Max	Min	Min	Min	Max	Min	Max	No	Yes
Genetic Algorithm	Max	Max	Min	Max	Max	Max	Max	Max	No	Yes
Map Reduce	Max	Max	Min	Min	Max	Max	Max	Min	Yes	No

Table-2

VIII. CONCLUSION

Load Balancing plays an important role in Cloud Computing environment. In this, various load balancing schemes, has been studied each having some advantages and disadvantages. Static load balancing algorithm provides easiest techniques but it is fail to model heterogeneous type of cloud. But dynamic load balancing algorithm are difficult to simulate but they are best for heterogeneous environment of cloud computing. Hence, dynamic load balancing techniques in small cell networks has been introduced that increase the overall performance.

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