# Performance Evaluation of Load Balancing System By using Effective Parameters

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***Abstract:*** Wireless networking has experienced fast development in the last few years. A large number of handhelds, portables have become implanted with wireless communication capabilities. The mobility and the freedom offered by these wireless devices allow users to remain connected to their enterprise networks, while on the move. This paper explains about various wireless technologies which are currently being used. It also deals with the result analysis with and without load balancing, under this various analysis has been done on behalf of DB traffic sent & received, FTP download & upload response time, FTP traffic sent & receive, HTTP traffic sent & received, Wireless load, WLAN delayed, HTTP page response time and WLAN throughput. In this paper we have given solution for load balancing among web servers and evaluated their performance using number of effective parameters. This paper explains the main objectives of proposed algorithm. It shows architecture diagram for load balancing in web server clusters. Proposed algorithm is explained using Pseudo code. Time complexity of proposed algorithm is also shown. Finally, it is concluded with experimental results and analysis.

***Index Terms*** **– Wireless, Ad-hoc, WLAN, FTP, HTTP, Load Balancing.**

## I. INTRODUCTION

In a wireless Ad-hoc environment, a network can be seen as a collection of end systems that are free to move randomly while maintaining a reliable connection. This kind of network requires no centralized administration or fixed network infrastructure, and can be easily and inexpensively deployed as needed. Ad-hoc wireless networks have recently received a lot of attention. This is mainly due to their potential to support a variety of applications without the need for a fixed infrastructure. The principle behind ad hoc networking is multi-hop relaying in which messages are sent from the source to the destination by relaying through the intermediate hops (nodes). In multi-hop wireless networks, communication between two end nodes is carried out through a number of intermediate nodes whose function is to relay information from one point to another. A static string topology is an example of such network. Some of the applications where such networks can be usefully deployed are military applications, emergency, search and rescue applications, university campuses, conferences, and hospitals. A key advantage of Ad-hoc networks over conventional WLAN configurations is that Ad-hoc networks have no single point of failure. Most modern networks are based on pre-established relationships between clients and service providers.

In most cases, the movement of users from their established environment may cause various difficulties and problems. To overcome some of these difficulties, wireless Ad-hoc networks provide a number of solutions. The first of these relates to ease and simplicity. A node, which is capable of reaching one or more available neighbouring nodes, can be added easily to the network. Secondly, wireless Ad-hoc networks allow the users to overcome geographical and location limitations. This is due to the fact that all nodes in the network can provide connectivity as opposed to a single access point. Scalability is also an advantage as Ad-hoc networks are robust and can be easily scaled up. Finally, wireless Ad-hoc networks offer a significant cost saving, as the existing environment does not have to be modified drastically to accommodate the addition of nodes to the existing and evolving network. Accessing web sites today has many challenges in terms of response time, throughput and resource utilization. There is a heavy load on web servers and this load has to be distributed among these web servers [1]. Load Balancing among web servers is one of the solutions for solving these problems. Performance Evaluation of Dynamic Load Balancing System by Using Number of Effective Parameters. The proposed algorithms produce solutions to the problems which have been faced by other basic algorithms. In this paper, we discuss our algorithm along with its objectives, architecture, time complexities and experimental results.

## II. BACKGROUND

Wireless is a term used to describe telecommunications in which electromagnetic waves carry the signal over part or the entire communication path. The wireless method of communication uses low-powered radio waves to transmit data between devices

### 2.1 Current Wireless Technologies

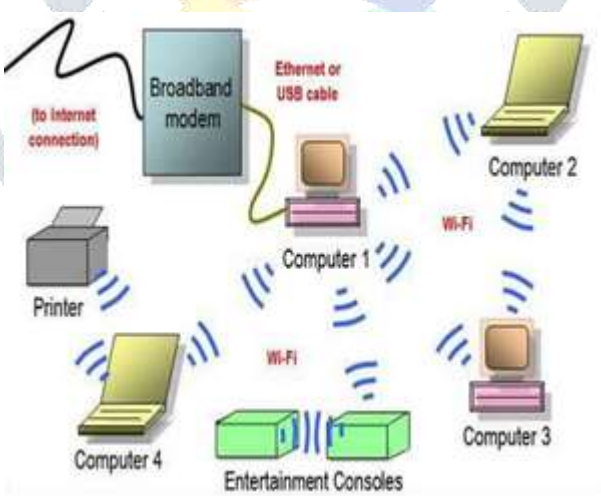
The rapid growth of the Internet together with the proliferation of mobile computing devices such as laptops, and Personal Digital Assistants (PDAs), have led to a brisk increase in the use of wireless technologies for the LAN environment. The quick access to the information involves not only new opportunities for the investors, but a challenge for the research community in order to provide suitable means for the communications to occur without restrictions. In this sense, wireless networks are one of the best technologies to offer mobility and location-independent multimedia communications.

### 2.2 IEEE 802.11

Wireless networking hardware requires the use of underlying technology that deals with radio frequencies for data transmission. The most widely used standard is IEEE 802.11 developed by IEEE in 1997. This standard defines a Medium Access Control (MAC) sublayer, and a physical layer (PHYs). The PHY layer, which actually handles the transmission of data between nodes, can use Direct Sequence Spread Spectrum (DSSS), Frequency Hopping Spread Spectrum (FHSS), or infrared (IR) pulse position modulation. IEEE 802.11 supplies data rates of either 1Mbs or 2Mbps.

### 2.3 IEEE 802.11a/b/g

In 1999, the IEEE published two supplements to the initial IEEE 802.11 standard: IEEE 802.11a and IEEE 802.11b. Like the initial standard, the IEEE 802.11b operates in the 2.4GHz band, but data rates can be as high as 11 Mbps and only direct sequence modulation is specified. IEEE 802.11b provides 11 channels, each channel being 22 MHz in width, and each channel is centered at 5 MHz. This means that there are only three channels, which do not overlap (Channels 1, 6, 11). IEEE 802.11b uses DSSS with a single carrier per channel. The IEEE 802.11a standard operates in the 5.8 GHz band with data rates up to 54 Mbps.




## III. RELATED WORKS

Nakagawa et al (2003) proposed is a new bridge architecture to address the problems associated with spanning trees in LANs. Packet forwarding in smart Bridge architecture is done along the shortest paths. Although shortest path switching may provide a low latency path, it does not address the load balancing issue in the network and requires all bridges in the network to be smart Bridge compliant. Sharma et al. (2007) discuss a novel approach named STAR (Spanning Tree Alternate Routing) to find and forward frames over alternate paths that are probably shorter than their corresponding tree paths. Although the approach reduces latency between most of the source and destination pairs, it risks overloading of critical links. Another approach to load balancing is Tree-Based Turn-Prohibition (TBTP) LTE load balancing problem has been investigated in the literature. Steenkiste et al (2003). presented a mathematical framework for quantitative study of self-optimizing wireless networks for LTE system, in which a self-optimizing network algorithm was proposed to adjust the cell-specific handover thresholds for load balancing Tang et al (2000). proposed a handover off set based load balancing algorithm using the parameter “cell specific offset” to force users to

handover from the overload e NB to the target e NB . The main goal of the proposed algorithm is to find the optimal hand over offset that allows the maximum number of users to change cell without any admission rejection at the target e NB A directional cell breathing based reactive congestion control algorithm was proposed where the coverage area of a cell can be dynamically extended towards a nearby loaded cell when it is under-loaded, or shrunk towards the cell centre when it is over-loaded. (Tarek, 2007) Has proposed a technique to balance the traffic load among the available gate ways nodes in the network. In this technique, an average queue length in the gateway is used to estimate congestion over that period of time and an alert is raised by the congested gateway upon which selective active sources are sent notification messages to switch their internet attachment to an alternative less-congested gateway. This technique can reduce overloading the gateway nodes, but a technique that balance the network load across not only the gateway nodes, but also intermediate nodes in the network thus avoiding centre loading problem is also needed. Sending notification to some sources will also increase the overhead traffic in the network. King-Shan Lui et al.

## IV. RESEARCH METHOD

This study proposes an improved scalable clustering- based load balancing routing algorithm (SCLB) that is a hybrid of the existing inter-cluster and intra-cluster routing approach. Scalability is achieved by dividing the network into overlapping multihop clusters each with its own cluster head node. Each cluster head is responsible for building a local relative map corresponding to its cluster using intra-cluster node's range measurements.

### PROPOSED ALGORITHM – Pseudo code

As discussed above, in this proposed algorithm, load is distributed among 'n' web servers on the basis of load factor. Following Pseudocode shows the working of algorithm. It first initializes the server and load balancer. When request will come from clients, it will go to load balancer first which is placed in between client and other tomcat servers. Load balancer module will check and distribute this dynamic load among web servers based on load factor.

**Begin:**

**[1]** **Server Initialization** a. Three tomcat servers are initialized based on load factor (LF)

b. Load Factor is assigned as LF=4 to WS1, LF=2 to WS2 and LF=1 to WS3

**[2]** **Load Balancer Initialization**

**[3]** **client_module ( )**

{callclient.request ( ) /* forwards the client request */ }

**[4]** **loadbalancer_module ( )**

{/*Distribute requests as per load factor (LF =4 or 2 or 1) WS 1 will get maximum jobs, WS 2 will get medium jobs and WS 3 will get least jobs.* for (int j = 0 ; j <noOfLoops ; j++) { ExecutorService executor = Executors.newFThPool(noClients); //creating a pool of 5 threads for (inti = 0; i<noOfClients; i++) { Runnable worker = new Client( ); executor.execute(worker); //calling execute method of ExecutorService } } }

**Call jk_status manager** a. Displays job distribution among 'n' tomcat web servers

b. Shows errors, number of failed requests and client errors ( if any )

c. Displays current and maximum number of busy connections

d. Shows number of bytes read and written

**End**

## V. RESULTS AND DISCUSSION

In order to carry out the analysis of the simulated outputs, some performance parameters are taken into consideration for evaluating the proposed clustering scheme with the existing multihop load balancing approach

### Performance Evaluation

Performance metrics can be described as a measure to analyze or grade an activity or event. They act as yardsticks on which decisions about such activity can be made. For this study, energy consumption, network lifetime and reliability would be the metrics.

**Results Analysis with and without load balancing**

Thirteen graphs were selected after simulating the model (Figures 5.1 through 5.13). All graphs show a combination of the 2 scenarios. From figure 5.1- 5.2 it has been observed that the Database traffic sent and received (bytes/sec) with load balancing is less in comparison with unbalanced network. X-Axis represents database in bytes and Y-Axis represents time period in mille seconds. A database server farm should be load balanced not only on the basis of the states of the servers, but also on the basis of the availability of the database on each server. From figure 5.3 shows the average database query response time with the load balancer is more than without load balancing, which indicate the performance improvement in case of Database Query response time. X-Axis represents database in bytes and Y-Axis represents time period in mille seconds. To set up database specific load balancing, you must enable the load balancing feature, configure a load balancing virtual server of type MSSQL or MySQL, configure the services that host the database, and bind the services to the virtual server response time. Fig 5.4- 5.7 deals with FTP parameters, FTP upload and download response time (sec) both are better in without load-balancer than the load-balancer by approx. 0.01(sec) with respect to distance and FTP traffic sent and received (bytes/sec) are better in without load balancer than the with load balancer by 800 bytes/sec at 0-3m and then approximately same at above 3m.

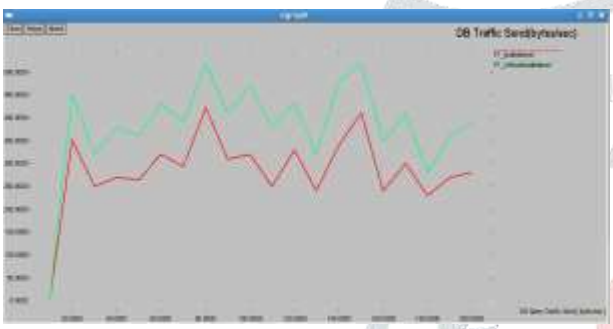


*Figure 5.1 DB Traffic Send (bytes/sec)*

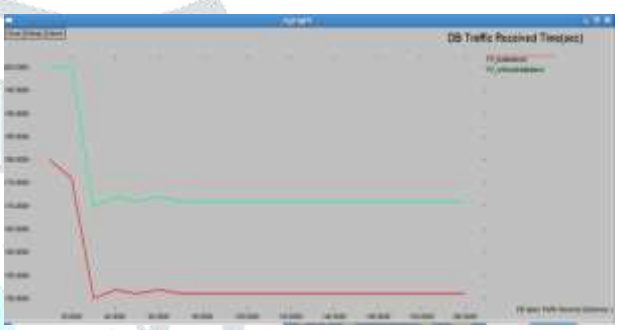


*Figure 5.2 DB Traffic Received (bytes/sec)*

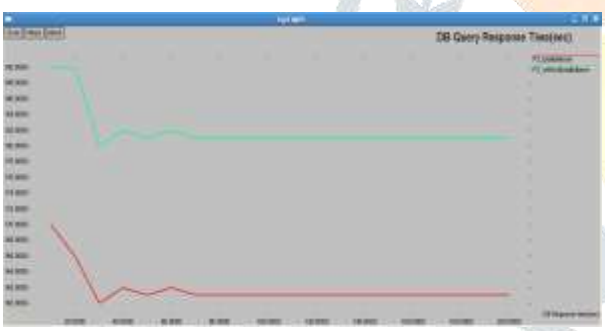


*Figure 5.3 DB Query Response Time (sec)*

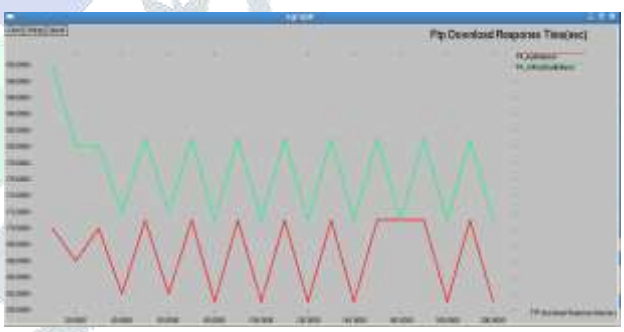


*Figure 5.4 FTP Download Response Time (sec)*

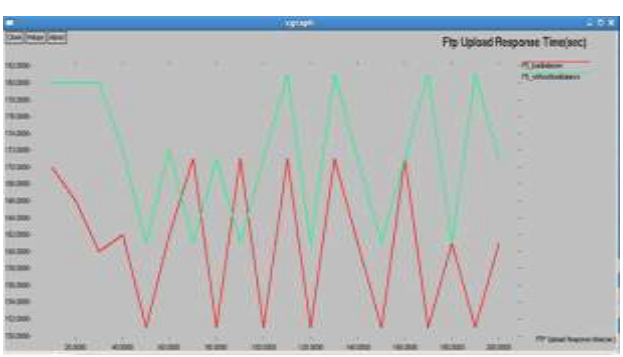


*Figure 5.5 FTP Upload Response Time (sec)*

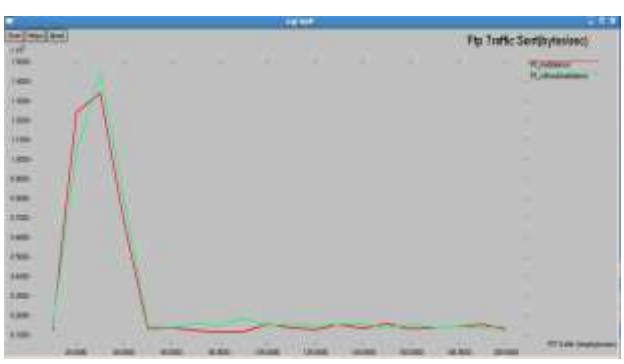


*Figure 5.6 FTP Traffic Sent (sec)*

Fig. 5.8 & 5.11 deals in HTTP parameters, Traffic received and sent (bytes/sec) gives better response in without load-balancer than the with load-balancer by approx. 1800 bytes/sec with 0-2 m then after 2 m it will better just 300 bytes/sec. The simulation model contains two scenes in this group, in the first scene the Web application is the HTTP protocol, the second one is FTP protocol, the network topology of the two scenes are observed as Figs (5.4-5.11).

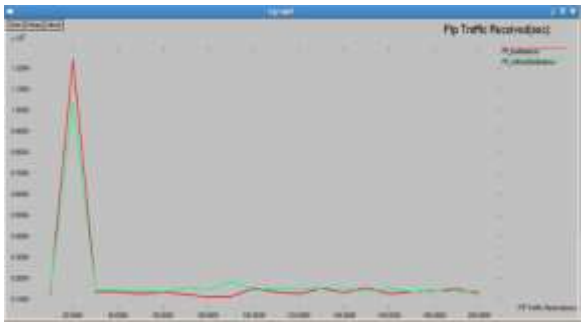


*Figure 5.7 FTP Traffic Received (sec)*

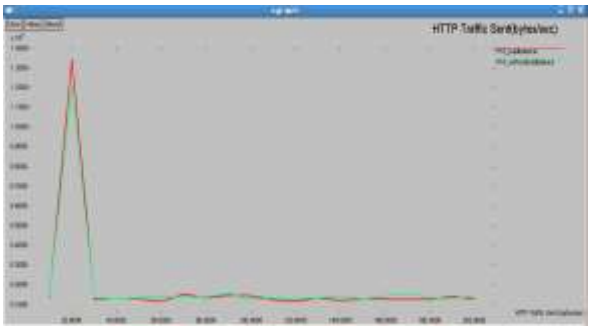


*Figure 5.8 HTTP Traffic Sent(bytes/sec)*

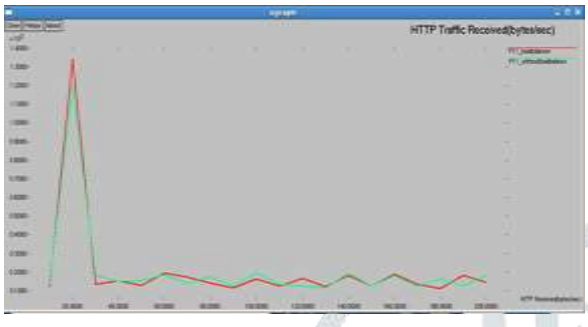


*Figure 5.9 HTTP Traffic Received (bytes/sec)*

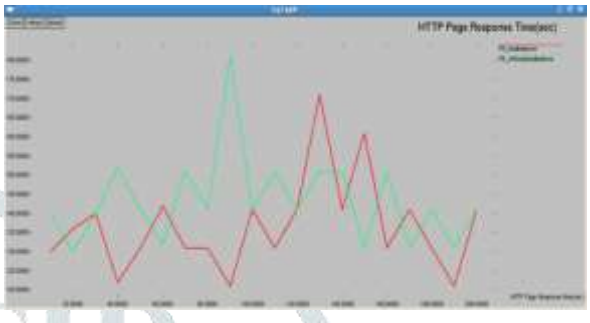


*Figure 5.10 HTTP Page Response Time(sec)*

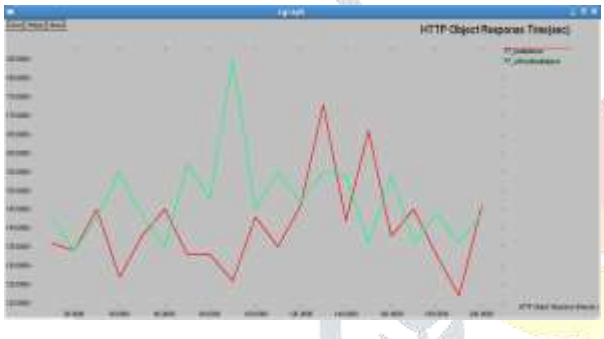


*Figure 5.11 HTTP Object Response Time (sec)*

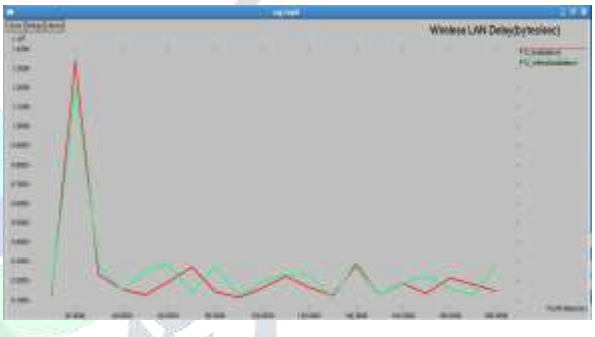


*Figure 5.12 Wireless LAN Delay (bytes/sec)*

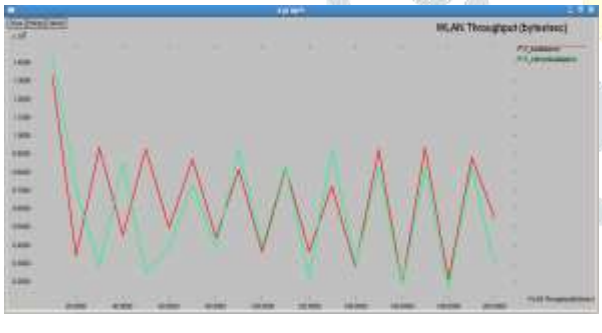


*Figure 5.13 WLAN Throughput(bytes/sec)*

Simulation of HTTP protocol and FTP protocol, By comparing the queuing delay in different scenarios based on HTTP protocol, we find what do the link bandwidth and client node number effect on the performance of HTTP; through comparing the TCP Delay in HTTP protocol and FTP protocol scene, we learned the performance of FTP protocol and HTTP protocol on Web application under the same network environment. Fig. 5.12- 5.13 deals in Wireless LAN parameters, Delay is better in without load balancer than the with load balancer and Media access delay(sec) is also same as delay and if talked about Load and Throughput(bits/sec) it will show much better in without load balancing than with load balancing. Fig (5.12-513) Wireless LAN parameters. Delay is little bit better in without load balancer than the with load balancer and Media access delay(sec) is also same as delay and if talked about Load and Throughput(bits/sec) it will show much better in without load balancing than with load balancing.

## VI. CONCLUSION

It has been observed that the Database traffic received (bytes/sec) with load balancing is less in comparison with unbalanced network improvement in case of Database Query response time. In FTP, HTTP parameters, FTP upload and download response time (sec) both are better than HTTP in without load-balancer than the load-balancer at all distances and FTP traffic sent and received (bytes/sec) are better than HTTP in without load balancer than the with load balancer at all distances. Overall FTP server is better than HTTP and database server in balanced (with load) and unbalance (without balance) network.

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