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Performance of WLAN under HTTP, FTP and DATABASE server for Wireless and Wire-line Network

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***Abstract*: - This paper analysis the Wireless Local Area Network (WLAN) using different parameters based on OPNET. Here OPNET is used to develop a new suitable model for campus/university environment. Our model was calculated to measure the performance of parameters of the wireless local area network based on such campus/university environment. Our model was tested against three types of applications (database, http and ftp) in four sites and found that among a set of other parameters Delay and Throughput were highly affected by the number of users per application with and without load balancing. OPNET simulation showed the impact of loan balancing on wireless and wire-line network for three different types of applications.**

Keywords- WLAN, BER, MAD.

1. INTRODUCTION

Wireless access points are now common place on many university campuses [1]. Wireless technology has helped to simplify networking by enabling multiple computer users to simultaneously share resources in a home or business without additional or intrusive wiring. These resources might include a broadband Internet connection, network printers, data files, and even streaming audio and video. This kind of resource sharing has become more prevalent as computer users have changed their habits from using single, stand-alone computers to working on networks with multiple computers, each with potentially different operating systems and varying peripheral hardware [2]. Several wireless 802.11 technologies are now available. The initial technology known as 802.11, used the 2.4 GHz frequency and supported a maximum data rate of 1 to 2 Mbps then The 802.11b specification released which increased the performance to 11 Mbps in the 2.4 GHz range while the 802.11a specification utilized the 5 GHz range and supported up to 54 Mbps. 802.11g is the most recent IEEE 802.11 draft standard and operates in the 2.4 GHz range with data rates as high as 54 Mbps over a limited distance. IEEE 802.11a has the advantage of working in different band from cordless phones, microwave ovens, and Bluetooth. IEEE 802.11b and IEEE 802.11a are not compatible. For this paper we focus on IEEE 802.11b more details on these technologies and others are available in reference [4]. Wireless LAN protocol is based on the IEEE 802.11 standard [1]. The standard defines a medium access control (MAC) sub-layer and three physical (PHY) layers. The goal of the IEEE 802.11 protocol is to describe a wireless LAN that delivers services commonly found in wired networks, e.g., throughput, reliable data delivery, continuous network connections. Some researchers use the OPNET simulator to show that tuning the physical layer related parameters such as Slot Time, Short Inter-Frame Space (SIFS) and Minimum Contention Window can significantly improve the network performance. Also, by choosing appropriate WLAN parameters such as Fragmentation Threshold, WLAN performance could be improved in the face of high channel bit error rate (BER) [5-6]. They also indicated that the number of collisions can be reduced by the adaptive back-off algorithm in the MAC layer; this algorithm can also save power for wireless devices without affecting the performance of the WLAN.

Our paper uses simulation to study a campus/university area network scenario. We use the OPNET [5] simulation environment, with its detailed models of IEEE 802.11b, TCP/IP, HTTP, FTP and DATABASE. It was used to investigate the various performance metrics in wireless and wire-line LAN for a balanced and unbalanced network has been presented.

2. SIMULATED SCENARIOS

A simulation model was developed using OPNET [6]. OPNET 802. 11b PHY module was used as a standard with maximum data rate up to 11Mb/s. IEEE 802.11b frequency hopping was used. In this section we will introduce the two scenarios we tested:

Scenario 1: Here four WLAN Sites each with 30 Users through 1 access points using DATABASE (10 users), and HTTP (10 users) and FTP (10 Users) connected with outside wire-line network without load balance (table I).

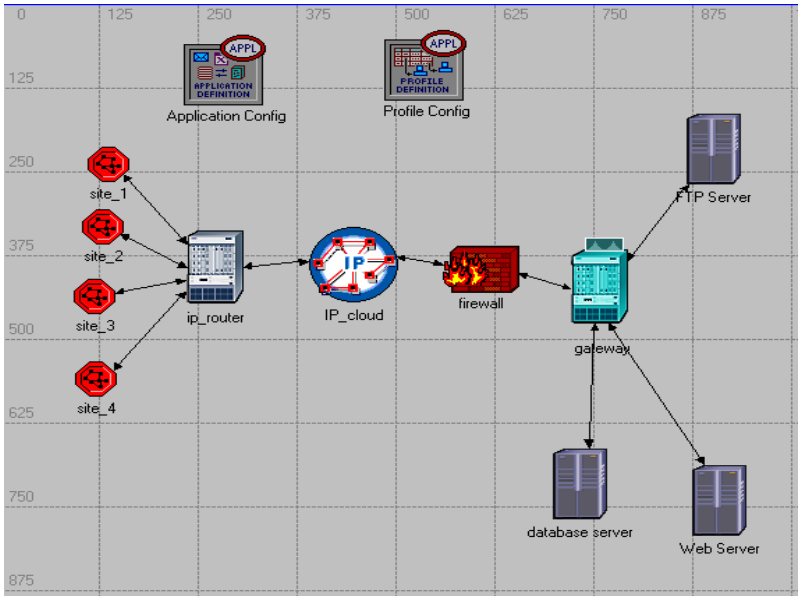

Fig 1: OPNET Model without load balancer

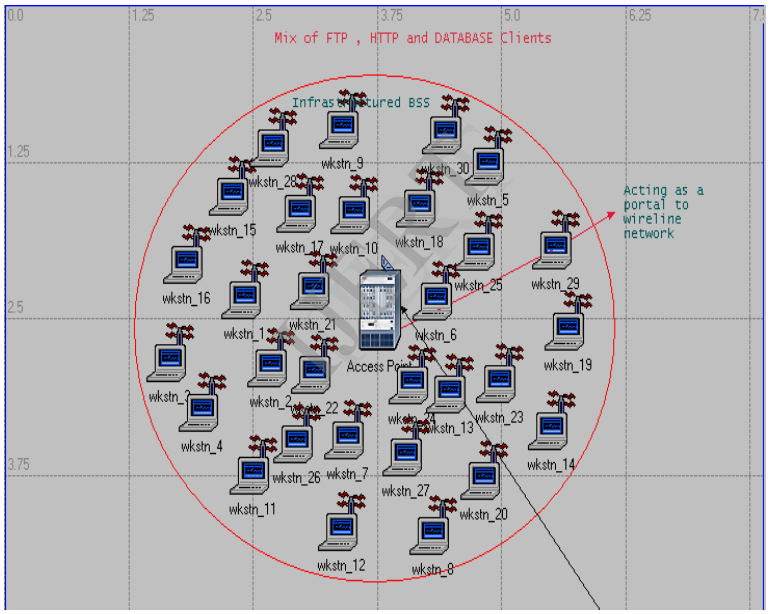

Fig 2: Mix of FTP, HTTP and DATABASE clients

Scenario 2: Here four WLAN Sites each with 30 Users through 1 access points using DATABASE (10 users), HTTP (10 users) and FTP (10 users) connected with outside wire-line network with load balance (table I).

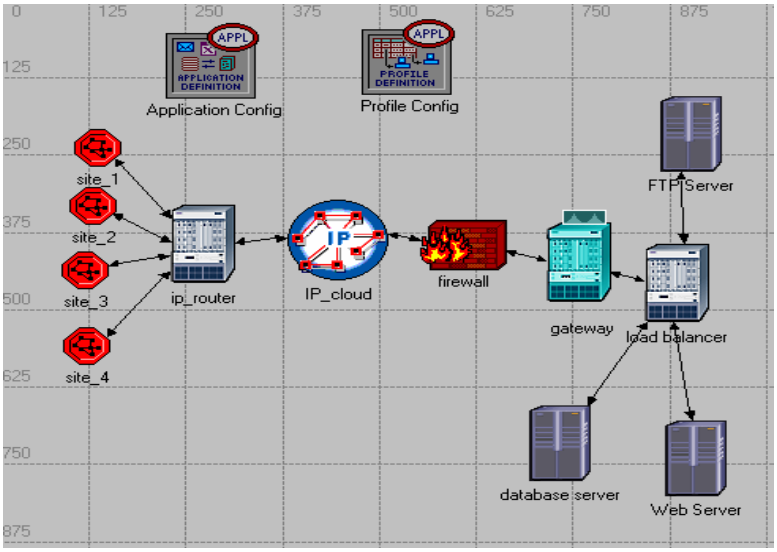

Fig 3: OPNET Model with load balancer

Notice that scenario 2 is a duplicate of scenario 1 in terms of number of users and type of application each user accesses. In our model we considered installing four access points (sites) in a campus/university environment where mix of DATABASE, HTTP and FTP clients are there.

Simulations have been carried out for our model to determine performance of the parameters. Table I and II indicate the application description and the wireless traffic generation parameters.

TABLE I.
APPLICATION DESCRIPTION

Applications	Attribute
Browsing	HTTP
Video Conferencing	Database
File Transfer	FTP

TABLE II. WIRELESS LAN TRAFFIC GENERATION PARAMETERS

Attribute	Value
Start Time Offset (seconds)	uniform (5,10)
Repeatability	Once at Start Time
Operation Mode	Serial (Random)
Start Time (seconds)	uniform (100,110)
Inter-repetition Time (seconds)	constant (300)
Number of Repetitions	constant (30)
Repetition Pattern	Serial

TABLE III. SIMULATED PARAMETERS

Application	Parameter	Unit
HTTP	Traffic Sent Traffic Received Page Response Time Object Response Time	Bytes/sec Bytes/sec Seconds Seconds
Database	Traffic Sent Traffic Received Response Time	Bytes/sec Bytes/sec Seconds
FTP	Traffic Sent Traffic Received DownloadResponse Time Upload Response Time	Bytes/sec Bytes/sec Seconds Seconds
WLAN	Delay Load Media Access Delay Throughput	Seconds Bits/sec Seconds Bits/sec

3. RESULTS ANAYLSIS

Fifteen graphs were selected after simulating our model (Figures 4 through 18). All graphs show a combination of the 2 scenarios. From figure 5-6 it has been observed that the Database traffic sent and received (bytes/sec) with load balancing is less in comparison with unbalanced network. From figure 6 we have also observed that the average Database Query response time with the load balancer is more than the without load balancing, which indicate the performance improvement in case of Database Query response time.

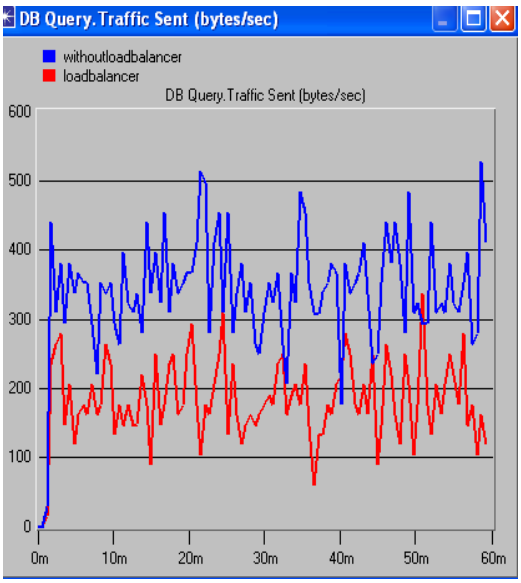

Fig 5 DB Traffic Sent (bytes/sec)

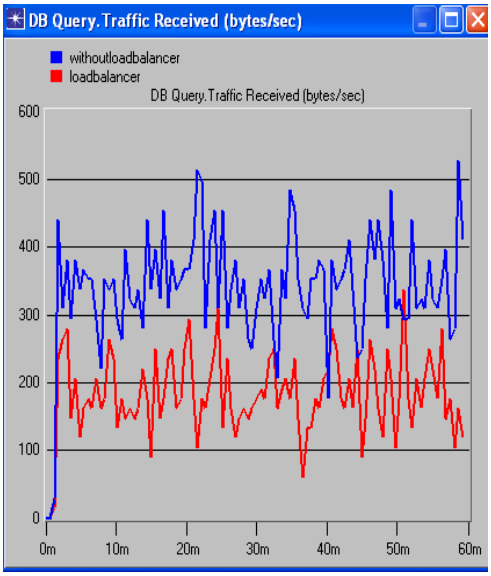

Fig 6 DB Traffic Received (bytes/sec)

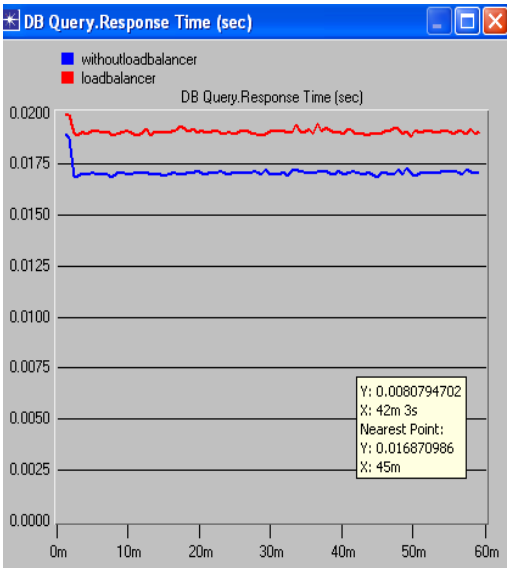

Fig 7 DB Response time (sec)

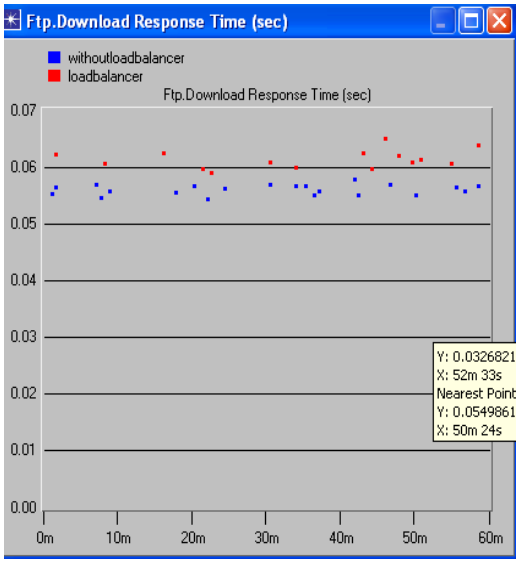

Fig 8 FTP Download Response time (sec)

In 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 after overlapping above 3m.

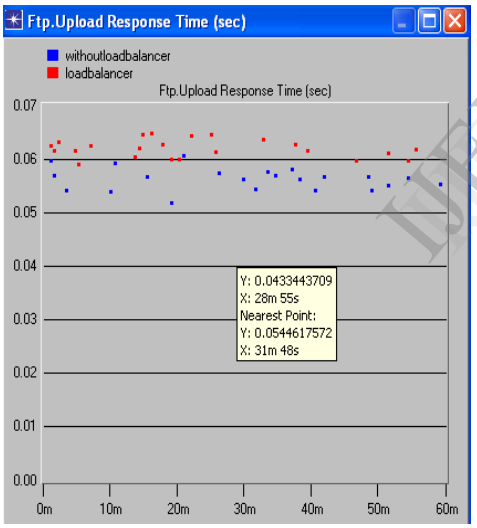

Fig 9 FTP Upload Response time (sec)

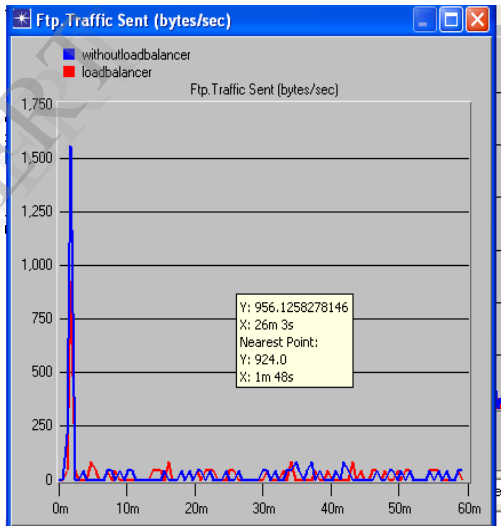

Fig 10 FTP Traffic Sent (bytes/sec)

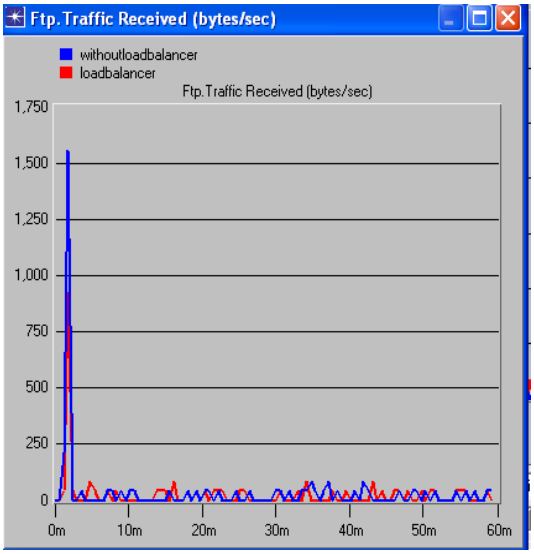

Fig 11 FTP Traffic Received (bytes/sec)

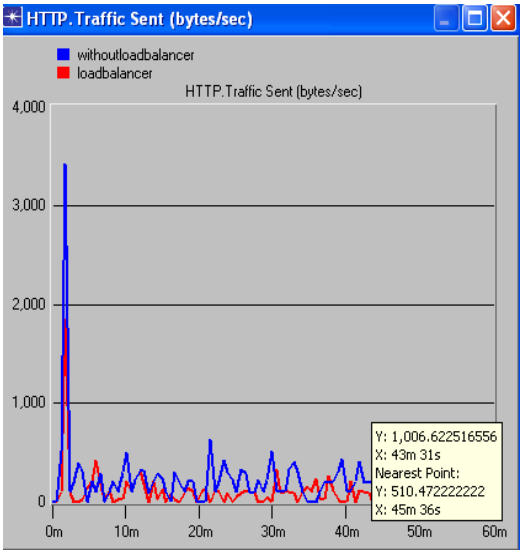

Fig 12 HTTP Traffic Sent (bytes/sec)

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.and if we talk about page response time and object response time it shows better result in load-balancing by 0.015 and 0.022 respectively in seconds than unbalance network.

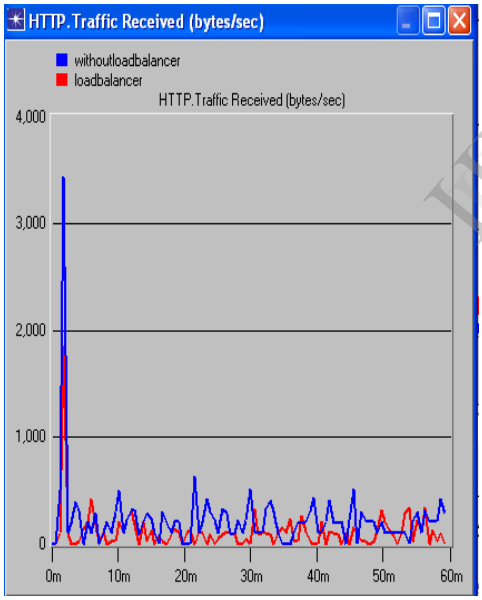

Fig 13 HTTP Recieved (bytes/sec)

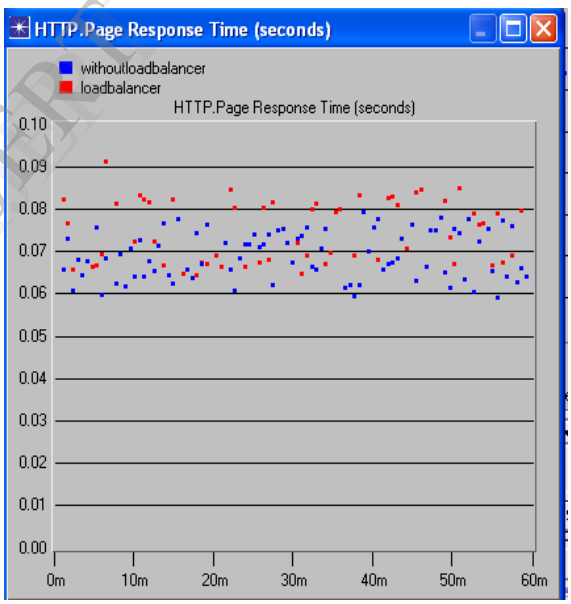

Fig 14 HTTP Page Response time (sec)

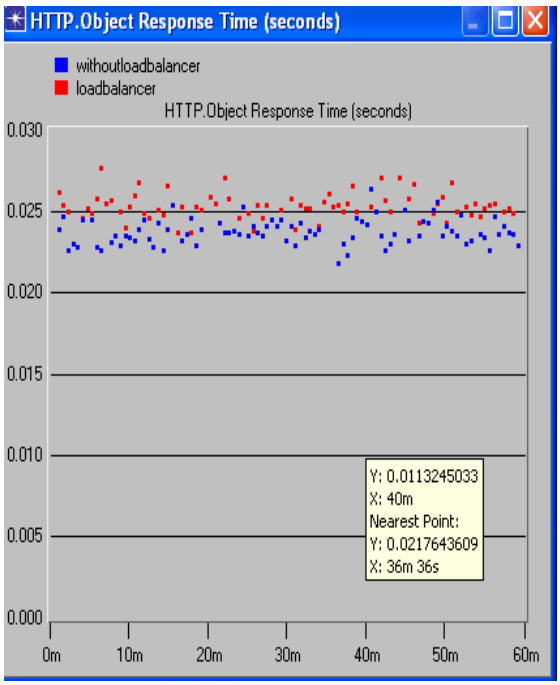

Fig 15 HTTP Object Response time (sec)

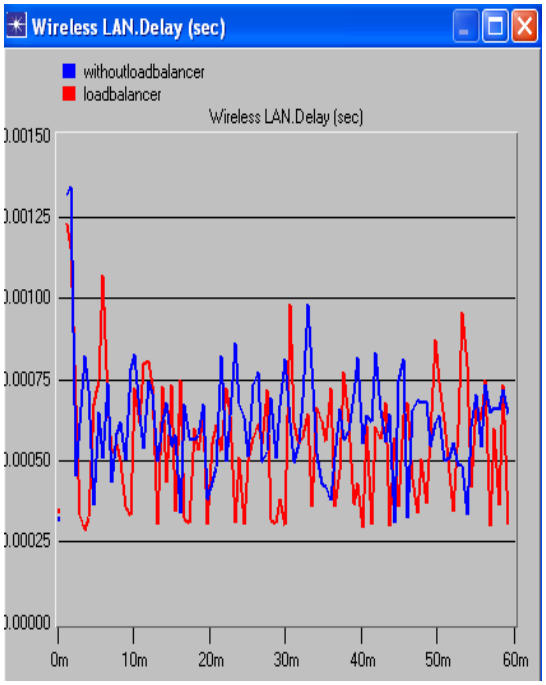

Fig 16 WLAN delay (sec)

In 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.

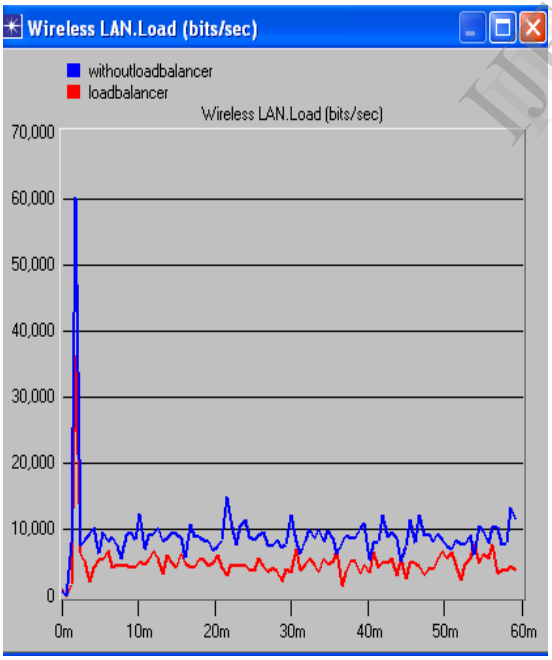

Fig 17 Wireless LAN Load (bits/sec)

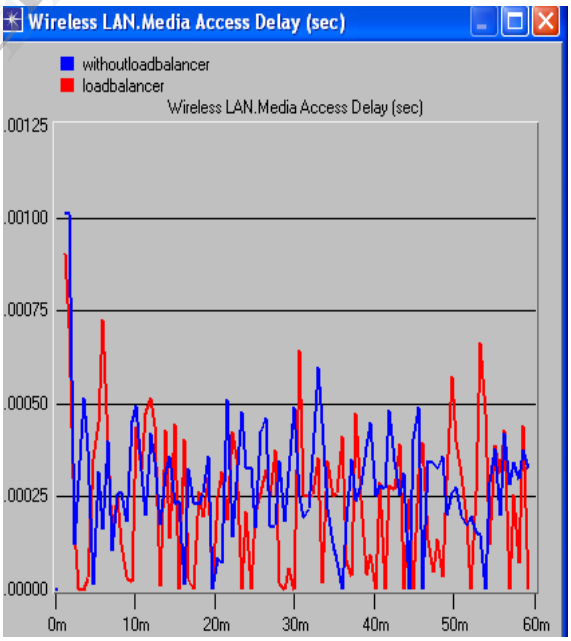

Fig 18 Wireless LAN Media Access Delay (sec)

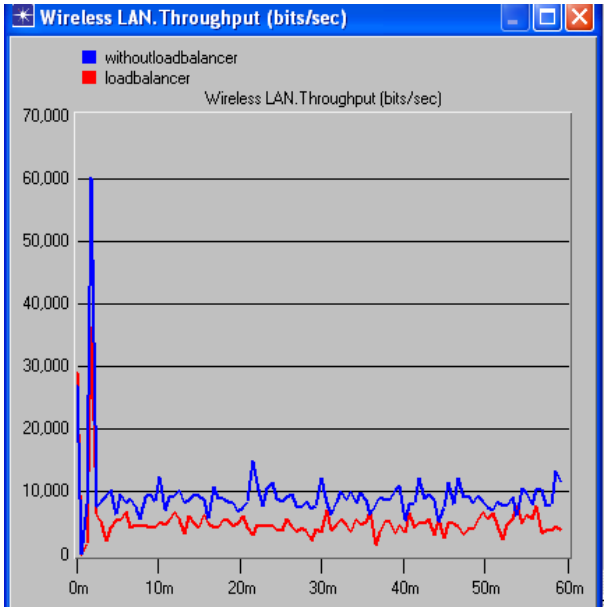

Fig 19 WLAN Throughput (bits/sec)

IV. CONCLUSION

In this paper we have build a model of browsing behavior for a Web client, and use this model in a simulation study addressing the performance of the campus area network. Based on OPNET we have focused on the HTTP, FTP and Database statistics in the wireless network environment, and the impacts of factors such as page/object response time, wireless LAN media access delay, HTTP, FTP and Database server utilization have been seen. Moreover the comparative investigation on various performance metrics in wireless and wire-line LAN for a balanced and unbalanced network has been presented. 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 parameters, Ftp upload and download response time (sec) both are better in without load-balancer than the load-balancer by approx 0.03(sec) 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 after overlapping above 3m.

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.and if we talk about page response time and object response time it shows better result in with load-balancing by 0.015 and 0.022 respectively in seconds. In 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.

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