WLAN Metrics Enhancement using Buffer Size Optimization

[1]Rajan Vohra, [2]R.S. Sawhney
[1]Lecturer, Department of Electronics Technology, Guru Nanak Dev University, Amritsar, Punjab, India
[2]Sr. Lecturer, Department of Electronics Technology, Guru Nanak Dev University, Amritsar, Punjab, India

Abstract— A wireless local area network (WLAN) links two or more devices using some wireless distribution method (typically spread-spectrum), and usually providing a connection through an access point to the wider internet. This gives users the mobility to move around within a local coverage area and still be connected to the network. Wireless data connections have high bit error rates, low bandwidth and long delays. Therefore, it is very important to improve their signal to noise performance. In this paper, our main aim is to enhance the WLAN metrics using buffer size optimization. We demonstrate that WLAN performance can be improved by tuning parameters such as buffer size, fragmentation threshold and request to send (RTS) thresholds Through OPNET simulation. In this paper we emphasize on buffer size parameter. Customizing this parameter opposes to using the values specified in the standards will reduce delays, throughput and reduce load on nodes. Finally the results are compiled to improve the performance of wireless local area networks.

Keywords- WLAN, OPNET, Delay, Throughput, Load.

I. INTRODUCTION

Over the last few years, WLANs have gained strong popularity in a number of vertical markets, including health-care, retail, manufacturing, and warehousing, and academic areas. These industries have profited from the productivity gains of using hand-held terminals and notebook computers to transmit real time information to centralized hosts for data processing. Today WLANs are becoming more widely recognized as a general purpose connectivity alternative for a broad range of business customers. Many wireless network standards have appeared during last decade. The most known standards belong to the IEEE 802.11 family, which includes the popular 802.11b, the 802.11a and the 802.11g. Other standards, such as HIPERLAN and HIPERLAN/2, also had some importance but they didn't find as much acceptance in market as the others. This paper is focused on the studies of wireless Local Area networks in a simulated environment using OPNETTM IT Guru Academic IT Guru Academic Edition (2007). In this paper the work has been further extended and reported Performance enhancement of WLAN by customizing IEEE 802.11 layer related parameters has been presented.

II. OUR APPROACH

OPNET is a tool used to simulate the way networks run. In this paper, we have carried out a comparative study on delay, throughput and load in wireless LAN configured for video conferencing. We have chosen simulative tool-OPNET for our research because of the several benefits it offers over the other contemporary tools available. OPNET provides the set of complete tools and a complete user interface for topology design and development. Another advantage of using OPNET is that it is being extensively used and there is wider confidence in the validity of the results it produces. OPNET enables realistic analysis of performance measures and the effectiveness of wireless network design techniques.

III. SCENARIO AND SETTINGS

In this section, we consider the case of two scenarios in which two independent wireless LANs workstations are connected. Here, these workstations are configured for the video application only as in figure 1.

Scenario 1: workstations are operated at 11 Mbps data rate.
Scenario 2: workstations are operated at 5.5 Mbps data rate.

Two different scenarios and settings have been considered to optimize the network.

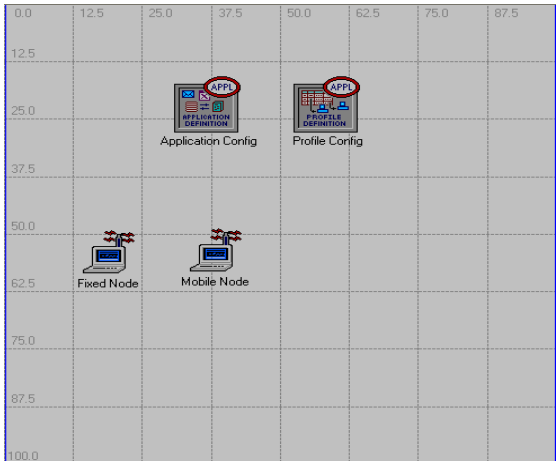

Figure 1 WLAN Network video application configured for 11 Mbps and 5.5 Mbps

Table 1 show the parameters, which are used in different scenarios for simulation. Table 2 shows the wireless LAN traffic generation parameters for both the scenario.

Table 1 Simulation Scenario Parameters

Parameter(s)	Scenario 1	Scenario 2
Address	Auto Assigned	Auto Assigned
WLAN bandwidth (bps)	11 Mbps	5.5 Mbps
PHY Characteristics	Direct Sequence	
Slot time (s)	5.0 E-05	
Packet Reception-Power Threshold (W)	7.33 E-14	
Short Retry Limit (Attempts)	7	
Long Retry Limit (Attempts)	4	
Buffer size(bits)	256000	64000
Application supported profile	Vdo_pro	Vdo_pro
Max Receive Lifetime (secs)	0.5	

Table 2 Wireless LAN Traffic Generation Parameters

Attribute	Value
Duration	End of simulation
Repeatability	Once at Start Time
Operation Mode	Serial (ordered)
Start Time (seconds)	uniform (100,110)
Inter-repetition Time (seconds)	constant (300)
Number of Repetitions	constant (30)
Repetition Pattern	Serial

IV. SIMULATION EVALUATION

A simulation model was developed using OPNET IT Guru Academic Edition (2007). OPNET 802.11b PHY module was used as a standard with maximum data rate up to 11 Mbps. IEEE 802.11b direct sequences was used. The packet size is default. In normal case when workstations are operated at 11 Mbps in scenario 1 and at 5.5 Mbps in scenario 2 respectively. Figure 2 shows the throughput at five minutes is around 2300 Kbps in case of 11 Mbps and around 1400 Kbps in case of 5.5 Mbps

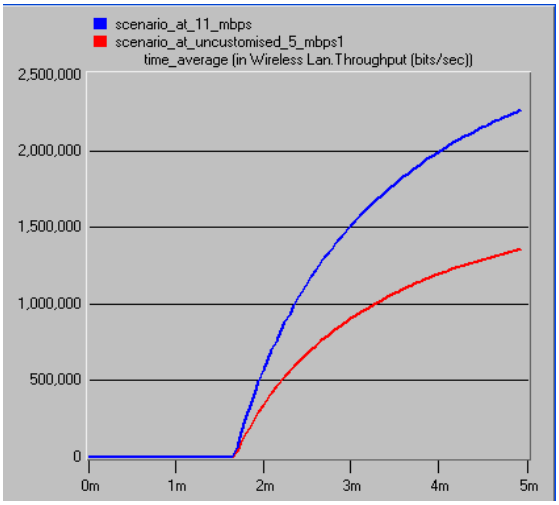

Figure 2 WLAN Throughput (bits/sec) for normal 11 and 5.5 Mbps scenarios.

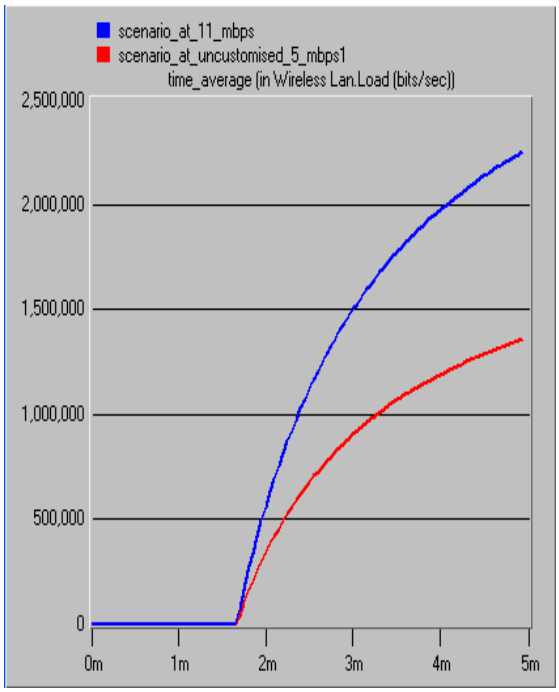

Figure 3 WLAN load (bits/sec) for normal 11 and 5.5 Mbps scenarios.

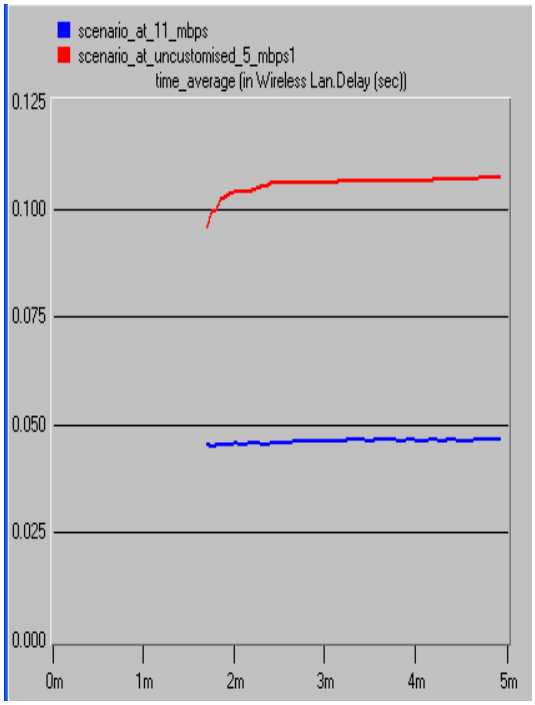

Figure 4 WLAN delay (sec) for normal 11 Mbps and 5.5 Mbps scenarios

In figure (3-4) WLAN load (bits/sec) and WLAN delay (sec) is considered for both the scenarios. In case of figure 3 WLAN load (bits/sec) is 2300 Kbps in scenario 1 and 1400 Kbps in scenario 2. For WLAN delay (sec) we consider results at 2 minutes in case of 11 Mbps scenario delay is 0.045 sec and 0.105 sec for 5.5 Mbps scenario after that delay remain constant for rest of time.

We observe the result with the customized parameters of WLAN and compare with the previous scenarios, where customization is not done. Figure 5 shows the throughput when WLAN parameters of Mobile Node (workstation) in scenario 2 is customized. We have seen that there is drastic change in the throughput as it is around 1250 Kbps at 5 minutes which is 150 Kbps less than previous results. Figure 6 shows that load on Mobile Node (workstation) is decreased with the customized scenario. In the previous case load is 1400 Kbps but with the customized scenario load is around 1250 Kbps.

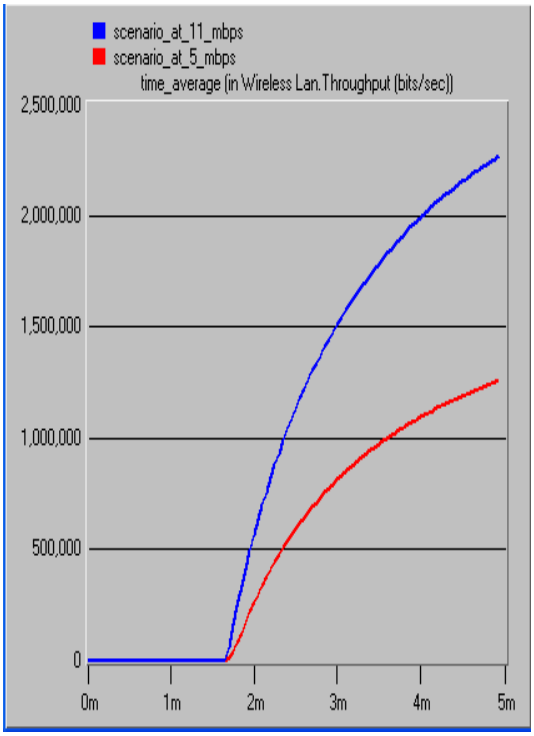

Figure 5 WLAN throughput (bits/sec) for customized scenarios

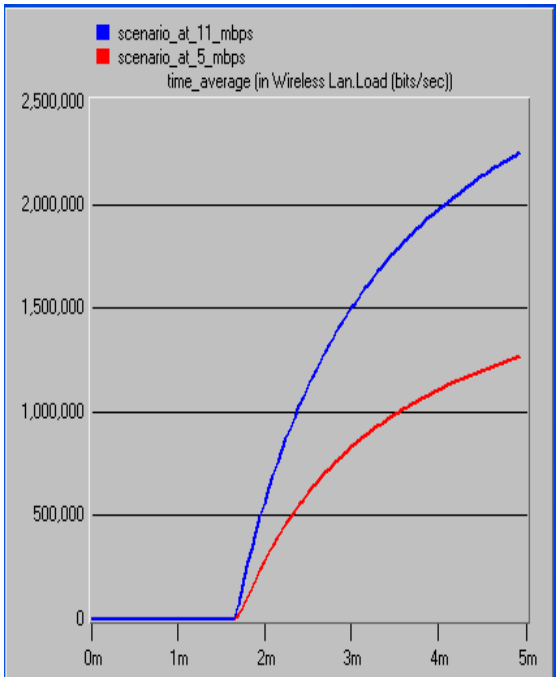

Figure 6 WLAN load (bits/sec) for customized scenarios

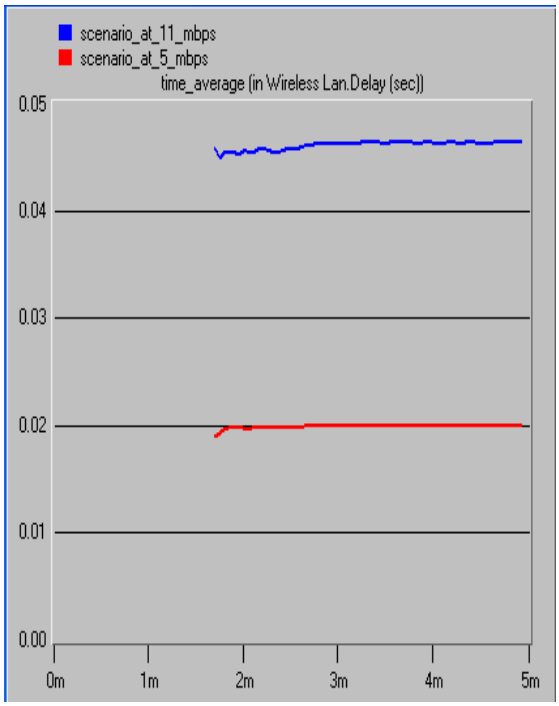

Figure 7 WLAN delay(sec) for customized scenarios

In case of delay (sec) here also we observe the result at 2 minutes. Delay for the customized scenario as compare to previous result is decreased as shown in figure 5.7 value of the delay is 0.020 sec which is 0.085sec less than previous scenario result

V. 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 network. This paper investigates the delay, throughput and load for normal and customized WLAN networks and their comparison thereof. A high delay in case of normal WLAN network of the order of 0.105 sec has been reported, while it is less in case of customized WLAN network measuring 0.020sec respectively. High throughput in case of normal WLAN network of around 1400 Kbps in 5.5 Mbps scenario have been reported, while it is low in case of customized WLAN network of around 1250 Kbps in 5.5 Mbps scenario. Further, the results demonstrate measurements of load on Mobile Node (workstation) for both the normal & customized networks. It is investigated that in case of normal network load on workstation (Mobile Node) in 5.5 Mbps scenario is high around 1400 Kbps in case of customized network in comparison to normal network it is low around 1250 Kbps. In conclusion, it is reported that the customized network offer less load, delay and throughput in comparison to normal network. Overall performance of the WLAN network with customized WLAN parameters can be enhanced

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