Analyzing Load and Delay in Wireless LAN using TTL and Fragmentation

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Abstract— A wireless LAN or WLAN (wireless local area network) is one in which a mobile user can connect to a local area network (LAN) through a wireless (radio) connection. WLAN is standardized as 802.11 by IEEE. The services like FTP, HTTP demands a good flow in a network. So users expect a good network quality and a delay free environment. The size of the packets is a very important performance factor. Too small packets yield poor efficiency; too large packets are likely to get dropped and cause delay. In this paper, we analyze two parameters, Delay and Load in wireless LAN using TTL and fragmentation. OPNET has been used to evaluate the various simulation results.

Keywords—*IEEE802.11,TTL Fragmentation,OPNET,load,delay*.

INTRODUCTION

A wireless LAN or WLAN is linking of two or more computers without using wires. As WLANs eliminate the need of wires for connecting end users, they provide a very easy, viable access to the network and its services. WLAN makes use of spread-spectrum modulation. It makes promising mobile communication and Wireless networking. WLANs allow users in a local area, such as a university or library; to structure a network or achieve admittance to the internet [2]. The chief driving force and advantage from Wireless LANs is better mobility. Unlike conventional network connections, network users can travel about almost without constraint and access LANs from nearly anywhere. The other advantages for WLAN include cost-effective network setup in dynamic environments requiring numerous modifications, credit to minimal wiring and installation costs per device and user. WLANs unfetter users from dependence on hard-wired access to the network backbone, giving them anytime, anywhere network access.

IEEE 802.11 is a set of standards, which specifies WLAN computer communication in the 2.4 and 5 GHz frequency bands. The original version of the IEEE 802.11 standard was released in 1997 and clarified in 1999. It specified two bit-rates of 1 and 2 Mb/s, plus a Forward Error Correction (FEC) code. It also specified three alternative PHY layer technologies: diffuse InfraRed (IR) operating at 1 Mb/s, Frequency-Hopping Spread Spectrum (FHSS) operating at 1 Mb/s and 2 Mb/s; and Direct-Sequence Spread Spectrum (DSSS) at 1 Mb/s and 2 Mb/s.

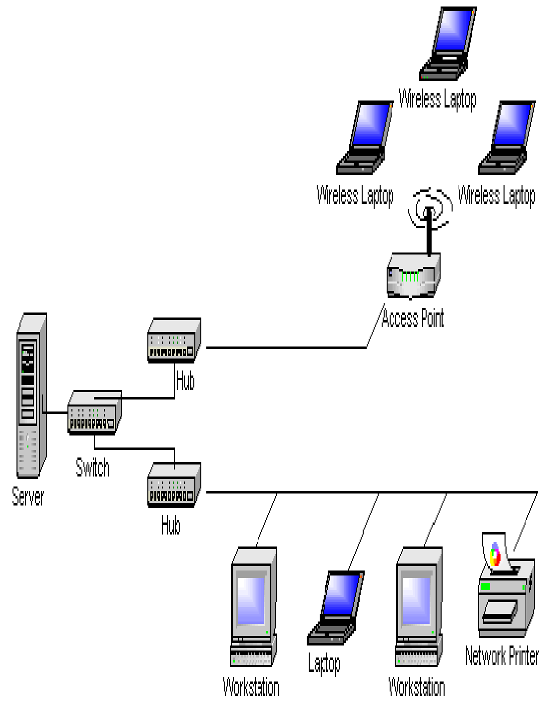

Fig 1 Wireless LAN

The data packet size is a major factor in reliable and delay free delivery of data . If the data packet size is too small, it yields poor efficiency and if the size is too large it is likely that it will increase the load and cause delay . The delay and load will thus result in poor performance. So it is must that the data packet should reach its destination without delay. To achieve this, TTL and Fragmentation are used. The simulation result is evaluated in a form of graph.

The paper is organized around four sections. Section I discusses paper's introduction. In Section II, we study the related work. Section III tells about the simulation technology and the results thereafter obtained with the use of TTL and Fragmentation. The conclusion has been summed up in section IV.

RELATED WORK

The low-cost and high-speed WLANs can be incorporated inside the cellular coverage to provide exposure for high-speed data services, thus fitting as a vital part of next generation wireless communication networks. The performance of Wireless local area network (WLAN) degrades, when jamming circumstances occurs with many real applications due too large packet size . These effects are a serious obstacles for the operation and development of wireless technologies and, therefore, some solution is needed.

IEEE 802.11 WLANs use the unlicensed 2.4 GHz industrial, scientific and medical (ISM) band, which is vulnerable to noise generated by TVs, microwaves, and cordless phones. Yusun Chang, Lee, C.P. et al. proposed an algorithm to enhance system goodput through the dynamic optimal fragmentation. The number of contending stations, packet collisions, packet error probabilities, and fragmentation overheads are modeled in the analysis. Using an adaptive SNR estimator, the sender estimates the SNR of the receiver, and chooses a fragmentation threshold to shape arbitrary sized packets into optimal length packets [7].Through the rigorous analysis and extensive experiments with implemented test-bed, we show that the dynamic optimal fragmentation enhances the goodput approximately 18% in a typical WLAN environment. They proved that an algorithm is a comprehensive analytical model applicable to any CSMA/CA based MAC protocol for next generation wireless networks, and a realistic approach that can be deployed without changing the IEEE802.11 MAC protocol.

Because medium contention occurs for each packet that is transmitted in a IEEE 802.11 wireless network, transmission of a large number of small packets can be particularly detrimental to performance. As a result of contention overhead, end-to-end delay and energy dissipation increase and the medium utilization decreases. Ramya Raghavendra, Amit P. Jardosh proposed a protocol to reduce contention through concatenation of several small packets into a single large packet, and subsequently transmit this large packet [4]. They proposed IPAC, an IP-based packet concatenation protocol that adaptively selects an appropriate packet size based on the route quality.

Delay analysis can be divided into two main threads: medium-access delay of head-of-line (HOL) packets under saturation condition and queueing delay (also referred to as packet delay hereafter) under non-saturation condition. In saturated systems, mean medium-access delay is easily derived as the reciprocal of saturation throughput [1], [5]. More recently, Sakurai and Vu derived moments and generating function of medium-access delay under saturation.
It was found that the EB mechanism induces a heave-tailed delay distribution. Similar observation was also made by Yang and Yum in [6] when binary EB is deployed. In this paper, we show that inunsaturated WLANs, packet delay distribution also exhibits a heavy-tail behavior. It is for precisely this reason that the sustainable throughput subject to finite mean delay and delay jitter may differ from the saturation throughput.

SIULATION TECHNOLOGY AND RESULTS

OPNET modeller 14.5 is used to expand the simulation and analysis for this paper. It has been used to evaluate the effects on congested network by using fragmentation and TTL and thereafter the two performance metric delay and load have been calculated. A snap shot of the system simulation model is captured in Figure 2. The planned scenario consists of a wireless Network implemented as a WLAN network, which was modelled within an area of 600 m*400 m. It consists of 50 nodes and simulation goes for total one hour. The flow of dats is 54Mbps.The steps used to make the above network are as follows:

1. A subnet in hexagonal shape is designed by using subnet designing module.
2. The LAN is populated with mobile wireless workstations (wlan_station_adv) taken from the wireless_lan_adv module of the object pallet of the OPNET.
3. An access point (wlan_ethernet_slip4_adv) is deployed in the LAN to the communication happen between all the nodes. The access point is a wireless lan based router with one Ethernet and 4 SLIP interfaces.
4. To generate data, Applications are defined by using "Application Config" node for a cell or subnet.
5. To configure the applications "Profile config" node is used for a cell.

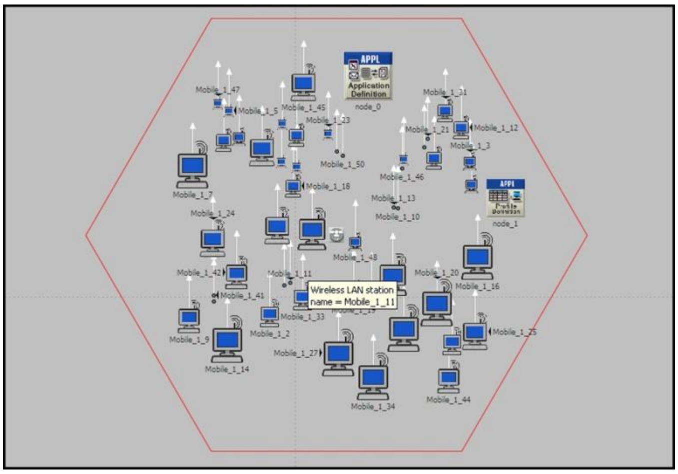

Fig 2: The Simulation Network

The table below states the various parameters considered for the simulation with their respective values.

SNo	Parameter	Value
1	Data Rate	54Mbps
2	Packet	4096 Bytes(constant)
3	RTS threshold	1024 Bytes
4	Transmit Power	.03 watt
5	Buffer Size	102400000 bits
6	Short Retry Limit	7
7	Long Retry Limit	4
8	Packet Interval Time	1 sec
9	Fragmentation Threshold	1024 Bytes
10	No. of Cells	1
11	No. of Nodes	50

TABLE 1: Parameter in Simulation Model

The simulation implementation shows the performance matric with and without the use of fragmentation and TTL. The performance matric load is the measure of computational work that a computer system performs. It includes all the control and acknowledgement messages and the number of such messages increases with the increase in number of fragmented packets. As more packets are received thus more number of acknowledgement messages sent.

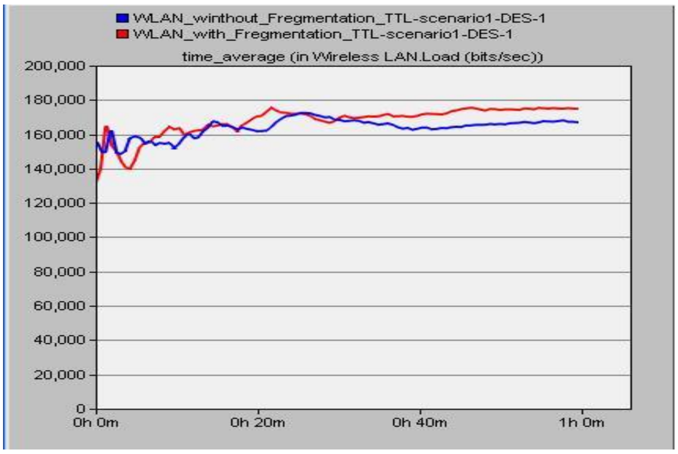

Fig 3 Load

The results and values of the simulation, evaluated using the performance metric Load of this study have been shown in Table 2. Values of the data packets in the network, both with and without fragmentation and TTL, after every ten minutes has been shown in the Table 2.

Time (sec)	WLAN_Without TTL & Fragmentation	WLAN_With TTL & Fragmentation
0	155659.5556	131993.7778
612	154385.0864	163537.8765
1188	161779.2941	170399.634
1800	168338.0218	169908.6013
2412	163880.4967	171590.6144
2988	166007.4709	174134.455
3564	166989.6	174881.2267

TABLE 2: Load Analysis with and without the use of TTL and Fragmentation

Fig 4 depicts that both the networks posses very minute delay, if the fragmentation is implemented or not but the network using TTL and Fragmentation posses more delay than the other because of the TTL, every packet will survive till the expiration of TTL to get itself delivered. And on the other hand, the processing time of each packet at the sender side is increased due to the fragmentation and at the receiver end due to the reassembly of the data packet.

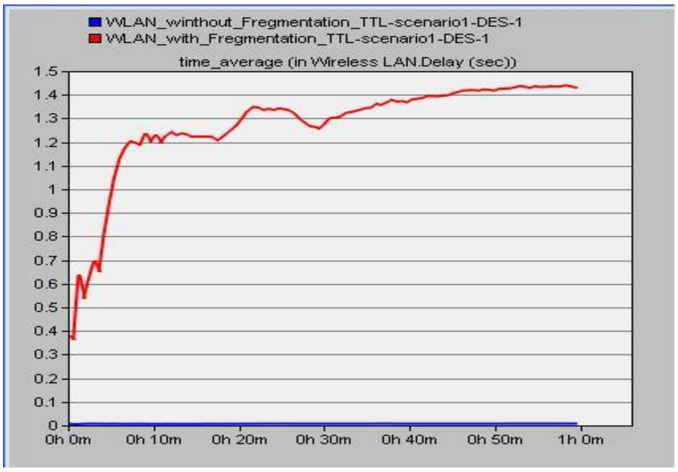

Fig 4 Delay

It can be evaluated from Figure 6.6 that the delay caused by the fragmented data packets in the network after using TTL constraint on them is more than the other scenario by 0.57 %. Values of the data packets in the network, both with and without fragmentation and TTL, after every ten minutes has been shown in the Table 3.

Time(sec)	WLAN_Without	WLAN_With
0	0.006235094	0.382380599
612	0.006086169	1.231536442
1188	0.006680778	1.276254398
1800	0.007104879	1.277590699
2412	0.007145644	1.379676329
2988	0.007234111	1.417331071
3564	0.007314441	1.43066594

TABLE 3 Delay evaluation with and without the use of TTL and Fragmentation

The use of TTL and Fragmentation shows that only minute variations occur in the delay and load parameters but this technique results giving higher throughput [3]which is one of the most important parameter in the simulations

CONCLUSION

In this paper, we analyze the network performance in terms of delay and load. Simulation results show that the performance of the network shows minute variation and which further results in a better throughput. With high TTL value, the occurrence of jamming in network becomes very high and if TTL is kept low then less chances of the congested network. The data packets using TTL and fragmentation flowing in the network performs better giving higher throughput. There is always a scope to improve the concluded results by calculating the proper values of the taken parameters.

REFERENCES

[1] G. Bianchi and I. Tinnirello, “Remarks on IEEE 802.11 DCF performance
analysis,” *IEEE Commun. Lett.*, vol. 9, no. 8, Aug. 2005.

[2]“Introduction to Wireless LAN ", Website:

http://www.wlan.org.uk

[3] Jashanpreet Kaur and Amoldeep kaur, “ Evaluating Data drop in Wireless LAN using TTL and Fragmentation” in IJERA, vol. 2, issue 5, pp.585 588,October 2012.

[4] Raghavendra R, Amit P.Jardosh, “IPAC- An IP based Adaptive Packet Concatenation for Multihop Wireless Networks” in the conference on System Signals and Computer, 2006.

[5] Y. Xiao, “Performance analysis of priority schemes for IEEE 802.11 and
IEEE 802.11e wireless LANs,” *IEEE Trans. Wireless Commun.*, vol. 4,
no. 4, pp. 1506–1515, July 2005.

[6] Y. Yang and T.-S. Yum, “Delay distributions of slotted ALOHA and

CSMA," *IEEE Trans. Commun.*, vol. 51, no. 11, pp. 1846-1857, Nov.
2003.

[7]Yusun Chang; Lee, C.P.; Kwon, B.; Copeland, J.A., "Dynamic Optimal Fragmentation for Goodput Enhancement in WLANs," Testbeds and Research Infrastructure for the Development of Networks and Communities, 2007. TridentCom 2007. 3rd International Conference on , vol., no., pp.1,9, 21-23 May 2007