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Performance Analysis of wireless Local Area Network

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Abstract - performance optimization methods have been presented using network simulator NS2, Here Performance Optimization has been shown via a series of simulation tests with different parameters such as Data rate, Fragmentation threshold, RTS/CTS threshold, Buffer size and the physical characteristics. The different quality of service parameters are chosen to be the throughput, media access delay, the retransmission attempts, dropped data packets and Queue size etc. in this paper The wireless networks can be employed to provide network connectivity almost anywhere, and gives user the option to use any kind of application regardless of its source or vendors. However, the WLAN performance is a key factor in spreading and usage of such technologies. Also the Wireless Local Area Networks (WLAN) are more bandwidth limited as compared to the wired networks because they rely on an inexpensive, but error prone, physical medium (air). Hence it is important to improve their performance.

Then finally the results are compiled to improve the performance of wireless local area networks.

Keywords – Wireless LAN, IEEE 802.11a, NS2 tool.

I. INTRODUCTION

As technological advances in IEEE 802.11a wireless networking presents us with larger bandwidths, faster speeds and better quality of service (QoS), WLANs are becoming more widely deployed and intensely used. A WLAN is comprised of one or more access points (APs) and a number of mobile wireless clients. An AP is a wireless node connected to a high-speed wireless or wired network. The job of the AP is to link the transmissions between wired and wireless networks. An AP operates on Open Systems Interconnection (OSI) (ISO/IEC 7498-1) Layer 2 (aka the Data Link layer), but some models may also operate on OSI Layer 3 (aka the Network layer) by acting as a router. However, the WLAN performance is a key factor in spreading and usage of such technologies. So this paper deals with the optimization techniques based on the advanced network simulator, NS2. The NS2 (Network Simulator 2 Tool) can be best described as a set of decision support tools, providing a comprehensive development environment for the specification, simulation and performance analysis of communication networks, computer systems, and applications and distributed systems. Future Wireless local area networks(WLAN) enable people on the move to communicate with anyone, anywhere at any time with a range of multimedia services The exponential growth of cellular telephones and mobile systems coupled with spreading of laptops and palmtops indicate a bright future for such networks both as standalone as well as network infrastructures.

The results are based on following parameters:

1) Transmission delay is the amount of time that packets take to pass through the transmission medium.
2) Throughput depicts the number of bits or packets per second that is transmitted successfully.
3) Packet loss is inversely proportional to throughput and used to indicate the number of packets that do not reach its destinations.

II.NS2 IMPLEMENTATION AND SIMULATION

All the wireless station nodes and the access point use Frequency Hopping Spread Spectrum at the physical layer. All the nodes employ the PCF basic CSMA/CA access mechanism. The nodes transmit at a maximum data rate of 11 Mbps. Packets received at a node with power less than 7.33 E-14 Watts will find receiver to be busy. In this implementation all the nodes are static receiving and forwarding the packets through the access point. In the NS 2 implementation, the effects of following parameters are analyzed based on throughput (bits/sec), the media access delay and the retransmission attempts, load, queue size etc. The NS2 implementation (Fig-1) consists of six nodes with one Access Point (AP), forming a wireless infrastructure network. Simulation environment was set as per the Table 1(a) and Table 1(b). All the simulations in this chapter are done for 600 simulation-second(s). The packet size distribution is exponential with a mean of 92 bytes. The inter arrival time is exp (0.02) for all the nodes unless otherwise specified. Since the packet size is exponentially distributed with mean of 92 bytes, RTS/CTS exchange is required for most of the packets.

- Data rate
- Fragmentation threshold
- RTS/CTS exchange
- Physical characteristics
- Buffer size

Table 1(a) Parameter Setting of WLAN Network

WLAN environment	Office
Workspace area	100m x 100m
Node model	Wireless_LAN

Table 1(b) Parameter Setting of WLAN Network

Number of nodes	7 (node_0 to node_6)
Access Point	1 (AP)

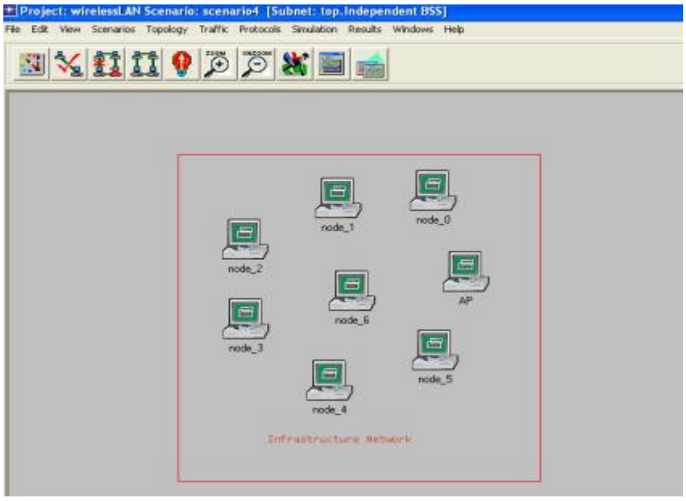


Fig. 1 NS2 Implementation

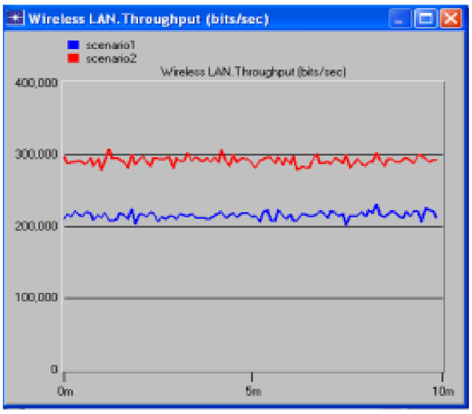
A. Data Rate

Two scenarios are created one is with data rate of 1Mbps and another scenario is created with data rate of 11Mbps, rest of the parameters is same in both the scenarios. The data rate is the parameter signifies the speed of the nodes connected in the network. The WLAN model in NS2 modeler supports data transfer at 1, 2, 5.5, and 11 Mbps. These data rates are modeled as the speed of transmitter and receiver connected to the WLAN.A station can only transmit data packets at the data rate specified by the attribute. However, it can receive data at any data rate.

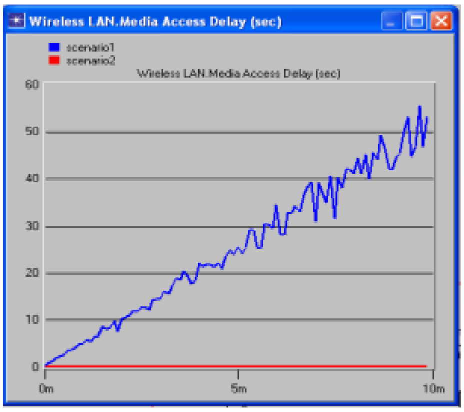
TABLE 2: SIMULATION PARAMETERS

Attribute	Scenario-1	Scenerio-2
RTS Threshold	None	None
Fragmentation	None	None
Data Rate	1 Mbps	11 Mbps
Physical Characteristics	FH	FH
Buffer Size (bits)	256000	256000

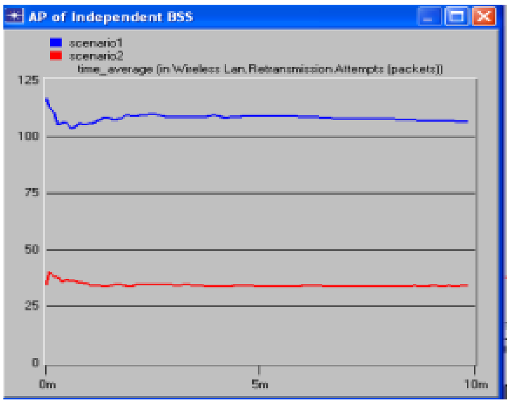
Simulation Results: The first set of simulation scenarios show the effect of data rate (Fig-2) on the performance of WLAN. From the simulation of above two scenarios, it has been observed that as we increase the data rate from 1Mbps to 11Mbps, the throughput increases by about 27-30%. This is also predictable from the theoretical viewpoint that as we increase the data rate, the number of bits received increases. This is very encouraging result and it is understandable because the data will stay for less time in media (buffer) for higher data rate scenarios. The retransmission attempts also decreases by about 69% from scenario 1 to scenario 2 that is as we increase the data rate the packets are delivered accurately and there is less requirement of retransmissions. Also the average media access delay reduces from scenario1 to scenario 2. Initially it was near to the value of media access delay of scenario1 and after that it increases linearly and then it will end up at the difference of about 90-95% to scenario1 at the end of simulation period of 600 simulation seconds.



(a) Throughput



(b) Media access delay



(b) Retransmission attempts

Fig-2: The effect of data rate on (a) Throughput (b) Media access delay (c) Retransmission attempts

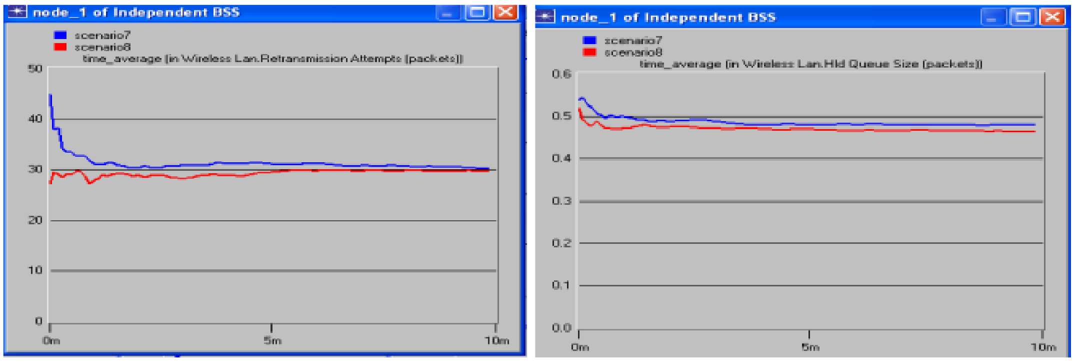
B. Fragmentation Threshold

The two scenarios are created, one with no fragmentation of incoming packets and one with fragmentation of 1024 bytes packets. The fragmentation threshold decides whether the packets received from higher layers need fragmentation before transmission. The default value is none that means there is no need of fragmentation before transmission. Fragmentation threshold specifies the value to decide if the MSDU received from the higher layers needs fragmentation before transmission. The number of fragments to be transmitted is calculated based on the size of the MSDU and the fragmentation threshold. In NS2 the default value is none which means that no fragmentation will take place regardless of the MSDU size. The destination station received these fragments and stores them in the reassembly buffer until all fragments are received. This fragmentation and reassembly is implemented using the built-in SAR (segmentation and reassembly) package in NS 2 Tool. If there is fragmentation of packets before transmission, this will definitely increase the load on both the transmitter and the receiver.

TABLE 3: SIMULATION PARAMETERS

Attribute	Scenario-3	Scenerio-4
RTS Threshold	None	None
Fragmentation	None	None
Data Rate	11 Mbps	11 Mbps
Physical Characteristics	FH	FH
Buffer Size (bits)	6400	256000

Simulation Results: Also the size of the queue will be decreased for larger buffer due to the fact that the larger buffer will take less time to send the packets, so the queue size will not build up continuously for larger buffer. This reduction difference is about 1-1.5% throughout the simulation duration of 600 simulation seconds. If the buffer size is increased, (Fig-6) then the number of Retransmission attempts would be reduced, at the starting time of simulation period it is about 33-35% lesser than scenario7, but till the end of simulation the retransmission attempts become approximately equal to the retransmission attempts of scenario.



(a) Retransmission attempts *(b) Queue Size*

Fig-3: Effect of the Buffer Size on (a) Retransmission attempts (b) Queue Size

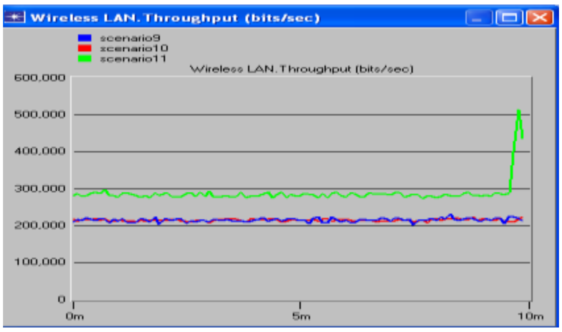
C. Physical Characteristics

Local radio networks use radio or infrared waves in order to transmit data. The technology used for sending radio transmissions is called narrowband transmission, which runs different communication signals through different channels. However, radio transmissions are often subject to numerous limitations, which make this type of transmission difficult. Here the effect of WLAN Physical layer (PHY) characteristics will be analyzed. These physical characteristics will have appreciable effect on the throughput, media access delay but it will have a significant effect on the number of retransmission attempts. The NS 2 supports three pre-defined physical Layer characteristics that is "Direct-sequence," Frequency-hopping" and" Infrared".

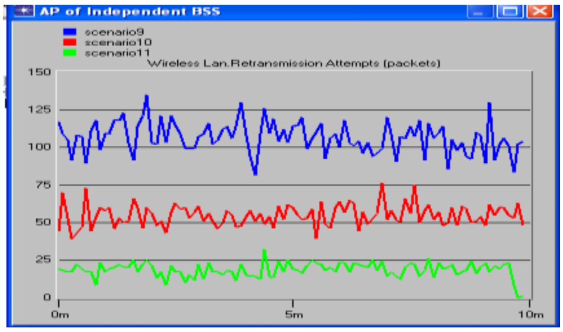
TABLE 4: SIMULATION PARAMETERS

Attribute	Scenario-9	Scenerio-10	Scenario-11
Rts Threshold	None	None	None
Fragmentation	None	None	None
Data Rate	11 Mbps	11 Mbps	11 Mbps
Physical Characteristics	FH	DS	Infrared
Buffer Size (bits)	256000	256000	256000

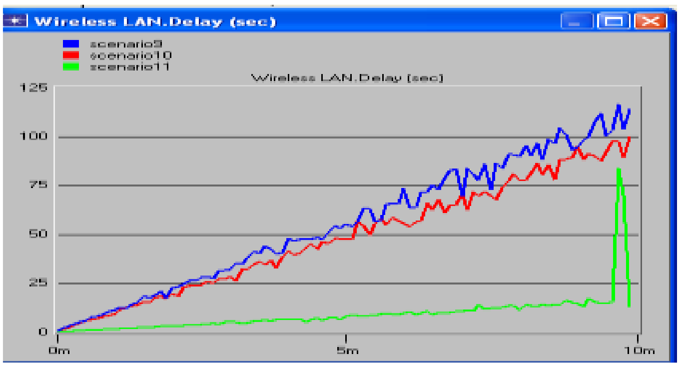
Simulation Results: The difference in the DS and FH coding is very less for throughput and for the delay the difference in these coding techniques is not very high which is about 15-17%, but for retransmission attempts the DS is performing much better than the FH coding by about 40-43%. Moreover, for all the three parameters the infrared coding is the best among three available options. For throughput, the performance of infrared is better by about 30-33% as compare to the DS and FH coding, also at the end of simulation there is a transition in the throughput of infrared coding by about 70-75%. Using the above simulation parameters, the simulation results (Fig-7) show that the infrared coding proves to be the best technique, while the frequency hopping method proves to be the worst among the three and the direct sequence coding proves to be lying between the infrared and frequency hopping techniques for the three parameters that are the throughput, number of retransmission attempts and the Delay. For retransmission attempts, the performance of infrared coding is performing well by about 60-62% as compare to DS coding while this reduction is about 78-80% for the FH coding. For the overall delay in WLAN, the infrared performs better than DS and FH by about 85-90% for entire simulation duration of 600 simulation seconds. However, at the end there is a transition in the delay of infrared coding.



(a) Throughput



(b) Retransmission attempts



(c) WLAN Delay

Fig-4: Effect of Physical characteristics on (a) Throughput (b) Retransmission attempts (c) WLAN Delay

III. CONCLUSION

The overall performance of the IEEE 802.11a Wireless Local area networks has been analyzed in detail with the help of NS2 Modeler. These different parameters reveal the different methods to optimize the performance of wireless local area networks such as by increasing the data rate the performance can be optimized in terms of throughput, media access delay and the number of Retransmission attempts or by incorporating the RTS/CTS exchanges the number of retransmission attempts can be reduced or by increasing the buffer size the number of dropped data packets can be reduced and the infrared coding at the physical layer proves to be the best if performance criteria is defined in terms of throughput, the media access delay and the number of retransmission attempts while the frequency hopping is not preferred coding method at the physical layer for the above performance parameters. The performance has been analyzed with the help of the parameters like throughput, media access delay, the number of retransmission attempts, dropped data packets etc. for data rate, fragmentation threshold, RTS/CTS threshold, physical characteristics and the buffer size.

IV. REFERENCES

[1] Stakeholder technology branch. Wireless local area network (WLAN) best practices guide; October 2007.
[2] Haitao Wu, Shidnan Cheng, Yong Peng, Keping Long, Jian Ma. Performance of reliable transport protocol over IEEE 802.11 wireless LAN: Analysis and enhancement. IEEE; 2002.
[3] European Telecommunications Standards Institute, Spectrum Allocation RES.2, 1998.
[4] IEEE Standard for Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Now. 1997. P802.11.
[5] Sun-Hwa Lim, Jung-Mo Mun, Ye0ng-Jin Kim, and Sun-Bae Lim,"Design of protocol conversion gateway based on Diameter for interworking between WLANs" in Proc. CIC'2002, Vol.II, pp.267-271,2002.
[6] IEEE Standard, "Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment 6: Wireless Access in Vehicular Environment", 2010.
[7] Cooklev, T. "Wireless Communication Standards: A study of IEEE 802.11" Wiley-IEEE Standards Association
[8] G.Bianchi, "Performance analysis of the IEEE 802.11 Distributed Coordination Function", IEEE Journal on Selected Areas in Communications, Vol. 18. No.3 March 2000.
[9] C.-J.M.Liang. N.B. Priyantha, J.Liu,and A. Terzis,"Surviving Wi-Fi interference in low power ZigBee networks." in Proc. SenSys '10, New York, U.S.A,, Nov.2010.

