Performance Comparison of Link Layer Protocol in IEEE 802.11 using NS-2

Anurag Pendharkar[1] Saurabh Prabhu[2] S.V.Prashant[3] Siddhant Sapte[4]
[1,2,3,4]Student
[1,2,3,4]Department of Electronics & Tele Communication Engineering
[1,2,3,4]SIES-GST, Maharashtra, India

Abstract— the project entitled “Performance comparison of link layer protocol in IEEE 802.11” is a performance enhancement mechanism. The main objective of this mechanism is to improve the overall efficiency and data packet delivery in wireless LANs. IEEE 802.11 Wireless Local Area Network Medium Access Control layer provides a fair access protocol to the shared wireless medium based on Carrier Sense Multiple Access with Collision Avoidance. It is a contention based mechanism to access the medium. IEEE 802.11 physical layers support multiple transmission rates. The transmission rate should be chosen in an adaptive manner since the wireless channel condition. If the stations refer to access point with a low data rate, data packets may be delivered slower than high data rate stations. This will reduce the usage of bandwidth and system performance in the wireless environment. A mechanism was proposed to assign the back off time slot dynamically. We have evaluated the mechanism by using network simulator version2.

Key words: Software Implementation, Proposed mechanism

I. INTRODUCTION

This project is based on improving efficiency and throughput of the system in WLAN. In the conventional mechanism the stations keep on delivering the packets, even when collision occurs. As a result the throughput and efficiency of the system decreases.

Hence we are proposing a new mechanism which will increase the throughput of the system as the collision occurring in the system will be less.

The sender will send the test packet and the receiving station will send an acknowledgement packet (ACK) for the test packet. Receipt of the acknowledgement will indicate the transmitter that no collision has occurred. If the sender does not receive the acknowledgement then it will retransmit the packet until it gets acknowledged or thrown away after a given number of retransmissions.

A Station desiring to initiate transfer of data shall invoke the carrier-sense mechanism to determine the busy/idle state of the medium. If the medium is busy, the station shall defer until the medium is determined to be idle without interruption for a period of time equal to DIFS when the last frame detected on the medium was received correctly, or after the medium is determined to be idle without interruption for a period of time equal to EIFS when the last frame detected on the medium was not received correctly. After this DIFS or EIFS medium idle time, the STA shall then generate a random backoff period for an additional deferral time before transmitting, unless the backoff timer already contains a nonzero value, in which case the selection of a random number is not needed and not performed. This process minimizes collisions during contention between multiple stations that have been deferring to the same event.

II. METHODOLOGY

A. Software Implementation:

NS-2 is a discrete event simulator targeted at networking research. NS-2 provides substantial support for simulation of TCP, routing, and multicast protocols over wired and wireless networks. The full source code of NS-2 can be downloaded and it can be compiled of multiple platform, including most popular Linux and Windows system. NS-2 was chosen as the simulation tool because it is a free software and popular in academic research. It has an open source code that can be modified and extended. NS-2 provides substantial support for simulation of TCP, UDP, HTTP, FTP, DSR, routing and multicast protocols over wired and wireless networks.

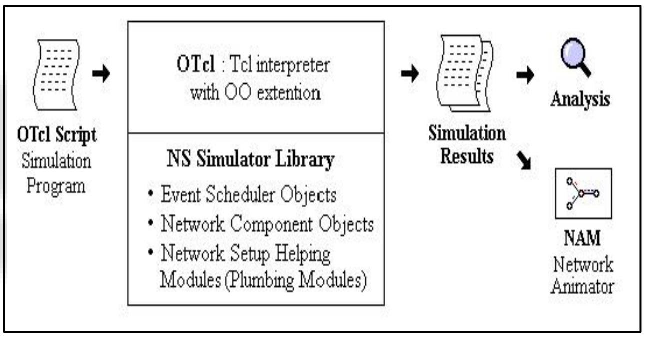

Fig. 1: Simplified User’s View of NS-2

B. Proposed Mechanism:

A station with a new packet to transmit monitors the channel activity. If the channel is idle for a period of time equal to a distributed interframe space (DIFS), the station transmits. Otherwise, if the channel is sensed busy (either immediately or during the DIFS), the station persists to monitor the channel until it is measured idle for a DIFS. At this point, the station generates a random backoff interval before transmitting to minimize the probability of collision with packets being transmitted by other stations. In addition, to avoid channel capture, a station must wait a random backoff time between two consecutive new packet transmissions, even if the medium is sensed idle in the DIFS time. DCF adopts an exponential backoff scheme. At each packet transmission, the backoff time is uniformly chosen in the range (0, CW). The value CW is called contention window, and depend on the number of transmissions failed for the packet.

At the first transmission attempt, CW is set equal to a value CWmin called minimum contention window. After each unsuccessful transmission, CW is doubled, up to a maximum value CWmax= 2mCWmin. The values CWmin and CWmax reported in the final version of standard. The operation is illustrated, because the backoff time of Station 1 is shortest, when the backoff time counter is decremented to zero, the Station 1 starts to transmit the data. In the meantime, the other stations in the WLAN environment are interrupted by Station 1. When the Station 1 is transmitted completely, the ACK is immediately transmitted at the end of the packet, after a period of time called short interframe space (SIFS). As the SIFS is shorter than a DIFS, no other station is able to detect the channel idle for a DIFS until the end of the ACK. If the transmitting station does not receive the ACK within a specified ACK timeout, or it detects the transmission of a different packet on the channel, it reschedules the packet transmission according to the given backoff rules. If the Station 1 receives the ACK successfully, a station that wants to transmit data, waits until the channel is sensed idle for a DIFS. Then each station decreases the backoff timer until any station is zero. In this sample, the Station 3 has a shortest backoff time, the station transmits when the backoff time reaches zero. The procedure is continuous as above. In the CSMA/CA mechanism, the value of backoff time slot is the same.

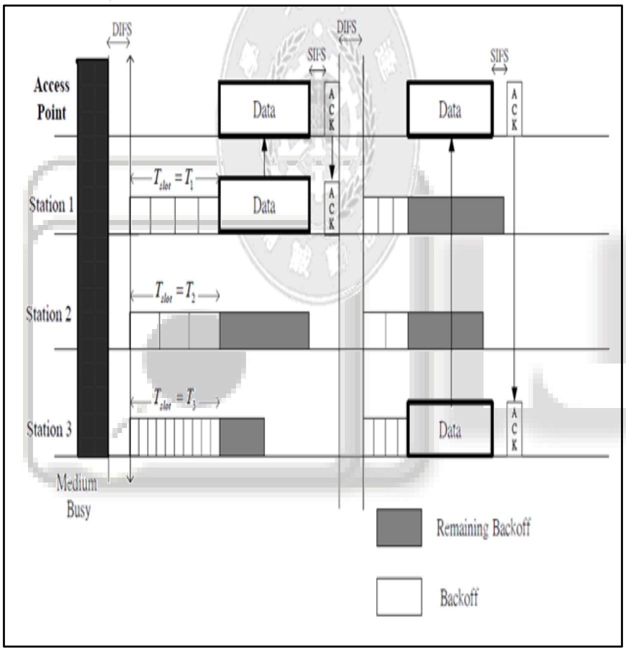

Fig. 2: The Backoff Procedure of Proposed Mechanism

C. *Simulation:*

In our mechanism first we transmit a test packet from the source to the destination, to check whether the channel is busy or idle. If the destination sends an acknowledgement for the received test packet then we can say that the channel is idle.

If the acknowledgement is not received then we can say that the channel is busy and the source station waits for DIFS time slot.

After this, it sends second test packet and checks whether channel is busy or idle. If channel is idle then source station starts transmitting the data packets. The receiving station starts receiving the packets and sends acknowledgement for them.

If the packet is damaged or collision occurs then the destination station drops the packets and does not send the acknowledgement. If the acknowledgement is not received in the time period then the sending station understands that a collision has occurred and it readies for retransmission. The sender now waits for a period of time equal to the Distributed Interframe Space and then retransmits the packet. If no collision occurs then the destination station receives the packet and sends an acknowledgement to the sender for that packet.

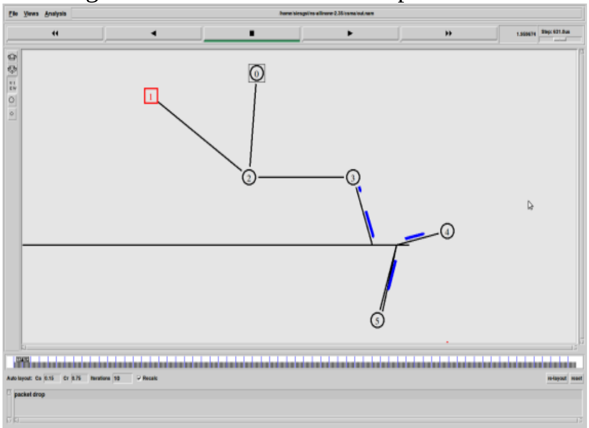

Fig. 3: NAM Window

III. CONCLUSION

We have observed that the throughput and efficiency of the conventional mechanism is less due the collisions occurring between the packets sent between various stations. So we have implemented our proposed mechanism in NS2 and with comparison with the conventional mechanism we have observed that the throughput and the efficiency of the system has increased. The mechanism provides a better usage of the bandwidth over the medium. This mechanism can be used in various institutions where the data is critical and the loss of data packets is undesirable.

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