Proceedings of 2013 IEEE Conference on Information and Communication Technologies (ICT 2013)

Design a Novel Reverse Direction Transmission Using Piggyback and Piggyback With Block ACK to Improving the Performance of MAC Layer Based on Very High Speed Wireless LANs

Ali Ahmad Milad, ZulAzri Bin Muhamad Noh, Abdul Samad Shibghatullah and Mustafa Almahdi Algaet

Department of Computer System and Communication, Faculty of Information and Communication Technology, Universiti Teknikal Malaysia Melaka, HanngTuha Jaya, 76100 Durian Tunggal, Melaka. Malaysia

***Abstract*- A reverse direction transmission and block acknowledgement are the main features to improve the performance of MAC layer based on next generation wireless LANs. When the data send it in reverse direction from side A to B, side B does not need to send separate ACK, it may wait for a period of time is less than the sender's time of period to avoid the retransmission at sender and send a piggyback frame (ACK+data) this called piggybacking. Piggyback with block ACK represented in multi data send from side A to B with block ACK request (BAR), side B send block ACK (BA) piggybacking with multi data to side A, this called piggybacking with block ACK. In our scheme here we want to propose a novel reverse direction transmission using piggyback and piggyback with block ACK which is divided each data frame send and receive into subframes and send each subframe separately, if there is an error happened during the transmission only retransmission the corrupted subframe instead of whole frame. We want to implement this work in NS2 simulator. The research contributions are summarized and the piggyback schemes that need to be investigated via high speed wireless LANs are also highlighted.**

Key words: Piggyback*; *MAC*; *ACK* ; *reverse direction

I. INTRODACTION

There are many advantages for piggyback scheme i.e. Improve the efficiency which reducing the overhead and increasing the system throughput. The idea for piggyback scheme is when the data transferring in duplex ways from sender to receiver, the receiver side waits until the network layer send the next packet to the sender and the ACK attached with the data frame at the header, so the receiver side does not need to send separate ACK with separate data, and the ACK gets free ride as shown in figure 1and 2 [1]. and the same researcher shows the overhead with/without piggyback mechanism in case when the frame belong to the receiver is sent to the sender after receiving a frame as completion of the channel again by at least a CTS frame time, an RTS frame time, two SIFS times, a DIFS time, and a random backoff is required to be done by it. Otherwise, in a case when the frame is possible to be piggybacked by the receiver to the sender along with the acknowledgment, the ACK is sent by the sender as a way of acknowledging the piggybacked frame after reducing the SIFS time and the overhead has been already accomplished, as showed Figure. 3. The data frame can piggyback a control frame to increase the channel efficiency in wireless networks such as IEEE 802.11 WLAN. The piggyback scheme may decrease the channel efficiency while it may increase the frame transmission delay for other stations if it has a low transmission rate and the control frame presents the global control information such as the channel reservation time. So the piggyback deals with the problem concerning the low physical transmission rate, and evaluation of the effect of this problem with respect to the average frame transmission delay and the channel utilization. Therefore, the purpose of proposing the delay-based piggyback scheme by the authors was to mitigate the piggyback problem [2]. And as revealed by the same authors, the piggyback led to decreasing the channel efficiency while increasing the frame transmission delay even if one station with low physical transmission rate were present.. Nowadays, next generation wireless networks IEEE802.11n become prominent topic in the area of wireless networks. A data frame can carry the ACK information in its packet header. In [4] multi data send separately with BAR it may piggybacking the block ACK as showed in figure 4.

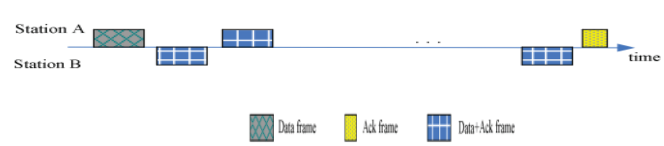

Fig. 1. Piggyback mechanism

Fig. 2. Normal piggyback frame.

To reduce the protocol overhead, one can piggyback the ACK frame with others. The MAC layer transmits the large frame and then retransmits into corrupted fragments. So only the first transmission from side A to B has been done before [3]. Our main algorithm is related to piggyback frame from side B to side A, there is a timing algorithm that make data link layer wait for period time is less than sender's time out of period to avoid the retransmission at the sender. Then, the network layer at the receiver sends the packets to data link layer. After that, set the acknowledgment at the header of data frame and aggregate the packets and divided it and then retransmission only the corrupted subframes for the ACK and data checksum and multi data send with BAR and multi data receive with BA . In the last we will report the result according the TCP and HDTV traffic.

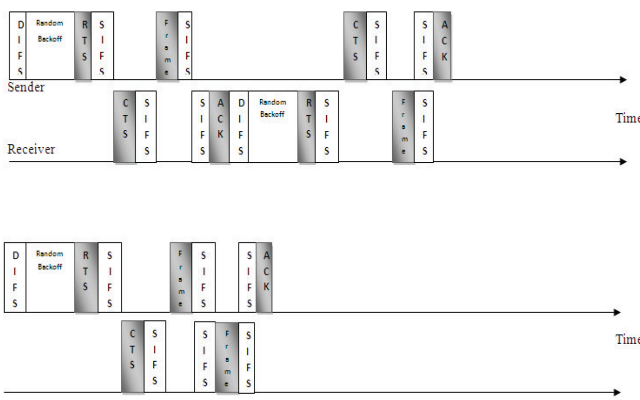

Fig. 3. The overhead with/without the piggyback scheme.

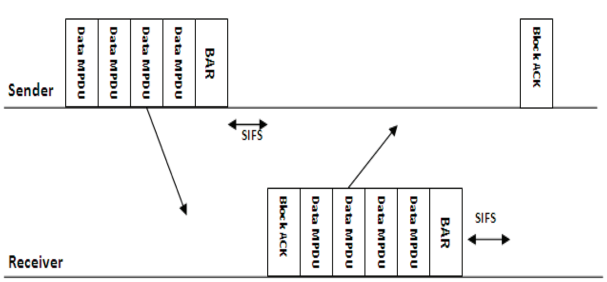

Fig. 4. Reverse direction transmission using piggyback Block ACK

There is a chance of high speed wireless LANs, the physical layer rate may reach up to 600Mbps to get high efficiency at MAC layer. The idea behind this is that the increase in the physical rate can result into increasing the transmission at MAC link, thus, causing an increase in the overhead and this is the main problem in our research proposal. See figure 5. In IEEE802.11, the throughput does not scale well with increasing the physical rate. However, in IEEE802.11n, the throughput achieves 100Mbps at a MAC layer.

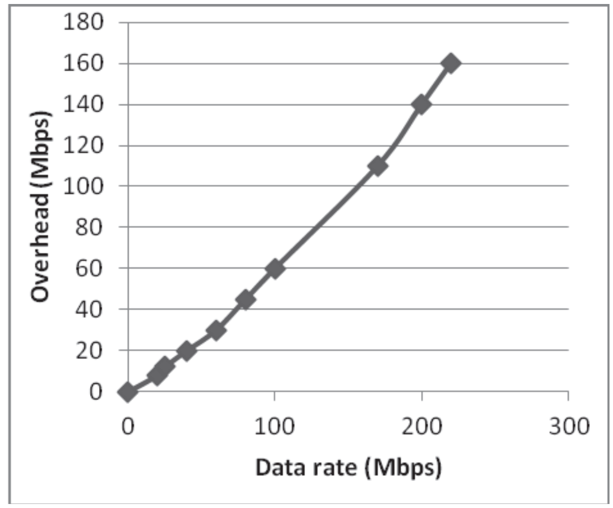

Fig. 5. Increase overhead with increase data rate

II RESEARCH OBJECTIVE

With respect to the above stated problem, this work presents a research effort to Mitigation the Overhead for Very High-Speed WLANs. Hence the specific steps required to achieve the above mentioned:

1. Design a new piggyback scheme in very high speed WLANs based on AFR Algorithm.
2. Increase of the channel efficiency in term of:

   2.1 Reduction of the ACK traffic in the reverse direction transmission.

   2.2 Reduction of the delay transmission
3. Validate the proposed method by analytical model to evaluate the throughput and delay performance.

III RESEARCH METHDOLOGY

The performance over very high speed wireless LANs has been addressed by many researchers; the main goal was to achieve a better throughput. Unlike the previous works, new Piggyback mechanisms will developed to achieve the highest throughput comparing with previous related algorithms. In our work here, we will design an algorithm make the data link layer at the receiver wait for period of time is less than sender's time out of period, to avoid the retransmission at the sender. Then, let the network layer at the receiver send the packets to data link layer. After that, set the acknowledgment at the header of the frame, and aggregate the packets and divided the frame and then retransmission only the corrupted sub frames. This methodology only for normal piggyback means one data frame send and one piggyback frame send. Figure 6 illustrates our proposed transmission in piggyback scheme.

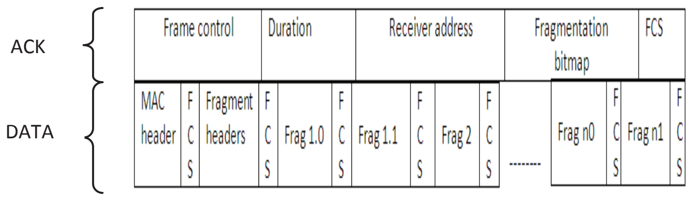

Fig. 6. Proposed scheme in normal piggyback

For multi data with piggyback the block ACK. Divided each frame in multi data frame send into subframes and send it these subframes separately with BAR, also the same from part B to A using block ACK. i.e.: For the maximum the data frame is 2048 B, and we have three packets need to send with different lengths of 1025B, 200B and 60B and the sub frame length is 512B, then the algorithm will divides these packets into 3, 1 and 1sub frames respectively, then send it them. For correctness sub frame received will indicator at block ACK bit map, and the corrupted sub frame will retransmitted.

IV EXPECTED RESULT

1. *TCP traffic*.

The figures as below describe the expected result for TCP traffic. The throughput it may achieve between 70 to 80 Mbps when BER= 10^{-6}. And the peak delay it may dose not reach 200 ms when BER = $10=^{-6}$ to follow the requirements of IEEE802.11n.

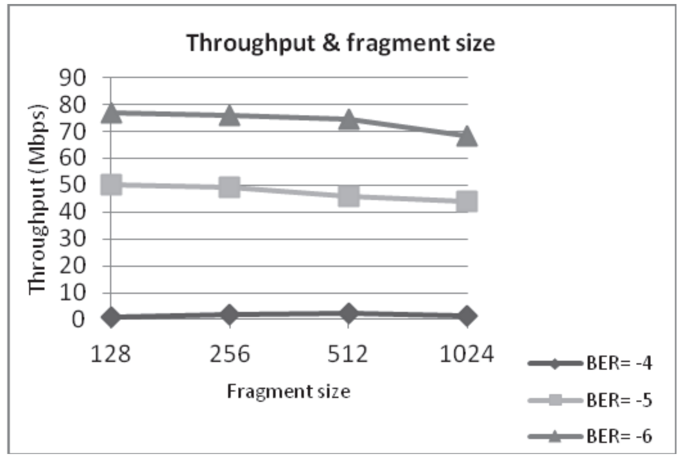

Fig. 7. Throughput compared with fragment size

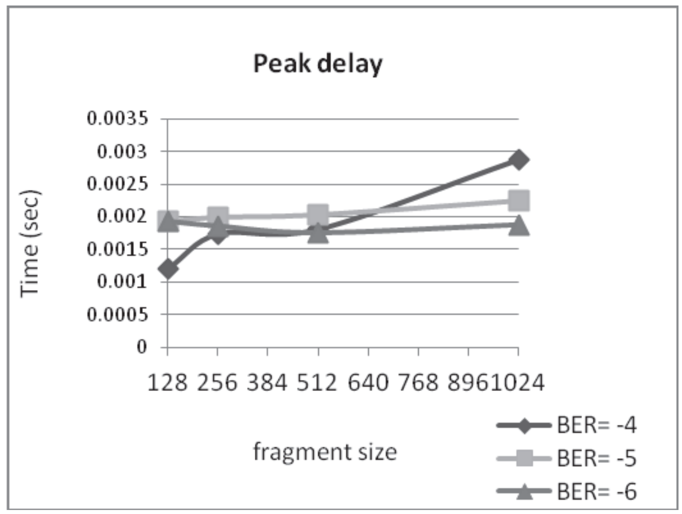

Fig. 8. Peak delay compared with fragmentation size

2. *HDTV traffic*

HDTV supports WLANs. HDTV has a constant packet size of 1500 bytes, a sending rate of 19.2–24 Mbps, and a 200ms peak delay requirement. Figures as below describe that.

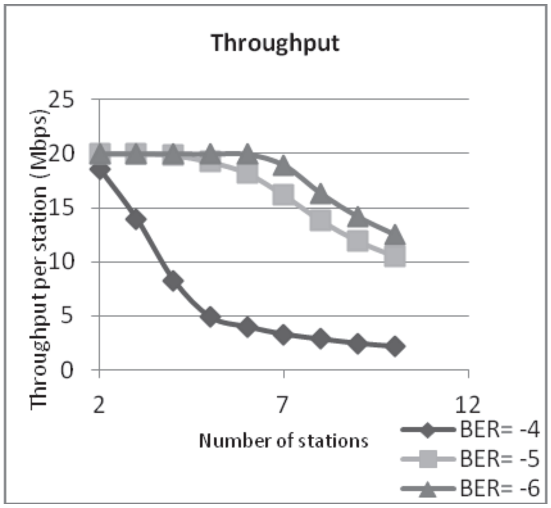

Fig. 9. Throughput compared with number of stations

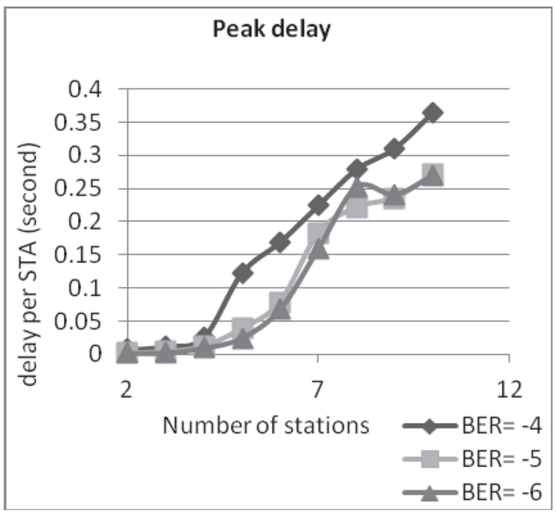

Fig. 10. Peak delay compared with number of stations

V CONCLUTTION

To achieve high efficiency for IEEE802.11n, we propose a new reverse direction transmission using piggyback and piggyback with block ACK which is divided each data frame send and receive into subframes and send each subframe separately, if there is an error happened during the transmission only retransmission the corrupted subframe instead of whole frame. We want to implement this work in NS2 simulator and the expected results have mention in the previous section.

VI REFERENCES

[1] Y. Xiao, "IEEE 802.11 performance enhancement via concatenation and piggyback mechanisms," Wireless Communications, IEEE Transactions on, vol. 4, pp. 2182-2192, 2005.

[2] Lee HJ, Kim JH and Cho SH. "A delay-based piggyback scheme in IEEE 802.11," in Wireless Communications and Networking Conference, 2007. WCNC 2007. IEEE, 2007, pp. 447-451.

[3] T. Li, et al., "Aggregation with fragment retransmission for very high-speed WLANs," IEEE/ACM Transactions on Networking (TON), vol. 17, pp. 591-604, 2009.

[4] M. Ozdemir, D. Gu, A. Bruce McDonald and J. Zhang "Enhancing MAC Performance with a Reverse Direction Protocol for High-Capacity Wireless LANs," in Vehicular Technology Conference, 2006. VTC-2006 Fall. 2006 IEEE 64th, 2006, pp. 1-5.

978-1-4673-5758-6/13/$31.00 © 2013 IEEE