مجلة التربوي

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العدد التاسع

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بحوث العدد

الافتتاحية

من سمات المجتمعات المتحضرة سعة ثقافة أبنائها وكثرة قرائها، والكتاب لديهم هو أفضل صديق، يرافقهم أينما كانوا وحيثما ما حلوا، فكما أن الطعام غذاء أبدانهم فإن القراءة غذاء أرواحهم، ولا عجب أن للقراءة أهمية عظيمة في الإسلام فهو يدعو إلى التدبر والتفكير والقراءة والتعلم، يكفي أن أول آية نزلت على حبيبنا محمد صلى الله عليه وسلم هي قوله تعالى ﴿ اقْرَأْ بِاسْمِ رَبِّكَ﴾ فكان الأمر بالقراءة فاتحة عقد الاتصال بين السماء والأرض، وللقلم في تثبيت ركائز العلم مكان لذلك خصه المولى عز وجل بالذكر مصاحبا للأمر بالقراءة فـقال ﴿اقْرَأْ وَرَبُّكَ الأَكْرَمُ الَّذِي عَلَّمَ بِالْقَلَمِ* عَلَّمَ الإِنسَانَ مَا لَمْ يَعْلَمْ ﴾ .

ولكن العجب في أمة القرآن، أمة اقرأ أن تكون أمة عازفة عن الكتاب والقلم، تتصدر مجتمعاتها آخر الصفوف، وتبقى القراءة في ذيل اهتمامات أبنائها، فلقد تدنى المستوى الثقافي والمعرفي لديهم إلى أدنى درجة، فالأمم لا تقاس بكثرة المال والأبناء وإنما تقاس بمدى ثقافة أبنائها، ومستواهم المعرفي، وأولى سمات ذلك حبهم للقراءة، والملاحظ والدارس لحال أمتنا في هذا العصر يرى وبكل بوضوح ودون أي مجهود قلة نسبة من يعشقون الكتاب، ومن يقتنونه، وارتفاع نسبة العزوف عن قراءته بل يتجاهلونه.

لقد تسرب إلى قلوب أبنائنا حب المال، ويا ليته من أوجهه السليمة الصحيحة فالثقافة وحب القراءة لا يتعارضان مع النشاط الاقتصادي، بل هما داعمان له ورافدان من روافده، فما علت الأمم الغربية في عصرنا الحاضر وازدهر نموها إلا بالعلم والثقافة، ونحن أمة القرآن أمة الثقافة تأخرنا حتى وصفنا بالتخلف مع أن أسلافنا أخذوا بناصية العلم فسادوا الدنيا بدينهم ولغتهم وثقافهم والشواهد في أواسط آسيا وأدغال أفريقيا باقية إلى الآن خير دليل، فهل لهذه الأمة من صحوة ثقافية ونهضة حضارية تبني بها حاضرها، وتعيد بها مجدها التليد.

هيئة التحرير

A novel Piggyback Scheme to Improve the Performance Of MAC Layer Based on IEEE802.11n

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ABSTRACT:

Our scheme is to improve the performance of MAC layer based on IEEE802.11n, when the data transferring in reverse direction from side A to side B, side B does not need to send only ACK, it can be wait for a time and send a piggyback data frame (ACK+data) and the ACK get a free ride. In this paper we propose bidirectional frame incorporated in to the aggregation with fragment retransmission (AFR). The Packets from the upper layer can be done with the help of AFR. Packets that exceed the size threshold are divided into fragments. The MAC layer then transmits the large frame and only retransmits corrupted fragments. The piggyback frame is also the same, but with the ACK and make sure to put the ACK in the first fragment. We have implemented this scheme in the NS-2.27 cygwin simulator to show the results for TCP and HDTV traffic.

KEYWORDS

Piggyback scheme, MAC, IEEE802.11 and ACK.

1. Introduction:

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 [1-2] see figure 1. 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. To reduce the protocol overhead, one can piggyback the ACK frame with others.

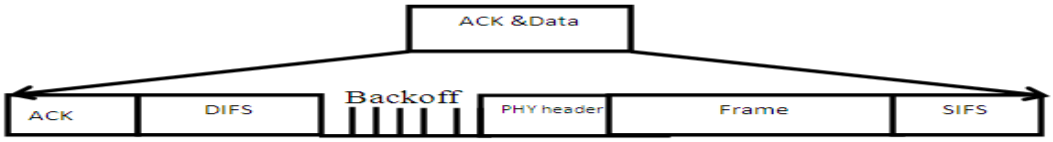

Figure 1: Normal piggyback frame

In our work here, we want to propose a novel scheme that represented into bidirectional transmission frame incorporated in aggregation fragment retransmission (AFR) scheme. The MAC layer transmits the large frame and then retransmits into corrupted fragments. So the first transmission from side A to B has been done before in [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 fragmented and then retransmission only the corrupted frames for the ACK and data checksum. In the last we report the result according the TCP, HDTV traffic. The rest of this paper is organized as follows. Section 2 introduces the related previous works, and Section 3 shows the proposed AFR in bidirectional frame. Section 4 the simulation results. Finally, we conclude in section 5.

2. Related works

When the receiver has a frame to the sender allowing sending the data frame with ACK to the sender, this process is called a piggyback scheme. So the acknowledgment gets a free ride in the data frame and takes few bits, and this is a distinct ACK. Therefore, each frame requires an ACK header and data frame (checksum). This means that the piggyback merely relies on the receiver since the fewer the frames are sent, the fewer the frames that arrive and this is dependent the way the receiver is organized. However, the emergence of the piggyback scheme has posed some cases of complexity. For example, the question of how

long the data link layer is supposed to wait until the packet is transmitted to piggyback the ACK is still a posing a complex case. As far as we know, the link layer usually waits for a certain period of time, and if this waiting period consumed by the data link layer is longer than the sender timeout period, it is expected that the frame will be retransmitted. Therefore, it is assumed that the data link layer must wait for fixed time like Ad hoc scheme such as number of Milliseconds. On the other hand, one of the benefits of the piggyback is that the piggyback frame does not need to rivalry the channel again in a case when the receiver has a frame to send to the sender. This is because it does not need to be in the front of the queue but the nearest frame to the destination at the sender [4], and the same reference [4] 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, See Figure 2. 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 [5]. 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

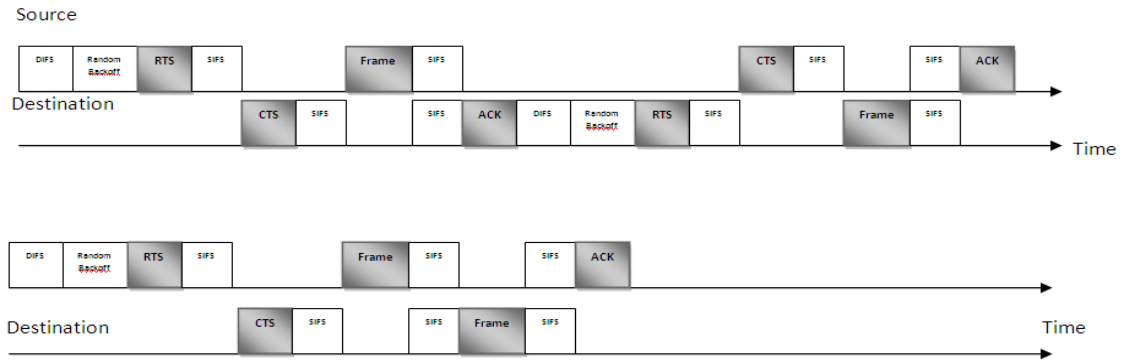

Figure 2: the overhead with/without the piggyback scheme

[6] Investigated the piggyback scheme when the data frame was transmitted in two cases for the station. If the frame was corrupted, so whole the process would re-start, or the data frame would be received successfully. The researcher also showed that the wireless station turn on piggyback scheme when the packet is less than 1100bytes. Moreover, the throughput is very low because the overhead is high, and the data rate is better than the piggyback because the time missed in retransmitting the "data+ Acknowledgement" frames is reduced. The throughput improvement by piggyback in the best case is about 40%. According to[7] the performance of the piggyback requests is already evaluated, so the ratio of the piggyback requests and the influence on the delay were insistences for different traffic. With the large number of users, the performance increased by using the piggyback requests, and the web traffic model showed that large number of bandwidths can piggyback on previous packets. In [8] defined the piggyback problem that when the control frame is piggybacked the channel efficiency is decreased and at the same time, the station has a low physical rate. The researchers also showed that and evaluated the channel utilization with and without the piggyback frame, and they proved that utilization of channel means the ratio of the total frame transmission time to the super frame length. So they solved the piggyback problem as the low physical rate by calculating

the delay of the piggyback scheme and proposed the delay base piggyback scheme and found that the piggyback was decreasing the channel efficiency while increasing the frame transmission delay even in one station physical rate. However, when the physical transmission rate increases. The channel efficiency and the delay efficiency are also increased. Therefore, if the piggyback practices well, the channel efficiency and the_delay transmission will increase. But the proposed algorithm is expected to decrease the average frame transmission delay and the channel utilization is estimated to be about 24% and 25%, respectively if there is one station which has low a physical transmission rate. [9] Showed that types of QoS data frames and their related usage rules to increase the channel efficiency. A CF-boll used to grant the channel to QSTA and piggybacked in QoS the data frame to increase the channel efficiency. However, the channel efficiency may be decreased by CF-boll piggyback problem when QSTA associated in QBSS uses the low physical rate. The CF-boll piggyback scheme varies between 24 and 36Mbps depending on the traffic load. [11] Proposed a study in which the impacts of channel access, bandwidth and piggyback scheme on the performance were examined, and it was observed that the bandwidth utilization can be improved if the bandwidth for random channel access is properly configured according to the channel access parameters, piggyback scheme and the traffic of network. The piggyback requests can be used to the piggyback mechanism reduces the delay for uplink and downlink packets, and the packets loss probability for uplink traffic and downlink traffic for the case of backoff method and piggyback method. For downlink data, packets do not occur for piggyback method and the loss packets of downlink data packet for the backoff is not small. Moreover, the piggyback method reduces the energy consumption significantly and there are no losses of downlink data packets. [10] Investigated that many improve the bandwidth efficiency, but it is possible to increase the delay of channel access. The bandwidth efficiency with piggyback requests can be saturated more quickly with the increased number of SSs than that without piggyback requests.

3. AFR in bidirectional frame

Aggregation fragment retransmission has been addressed in [3], and the main goal was mitigated the overhead and improve the distributed coordination function model (DCF) to get high throughput and less overhead, In AFR method, multiple packets are aggregated into and transmitted in a single large frame. If errors happen during the transmission, only the corrupted fragments of the large frame are retransmitted. See figure 3

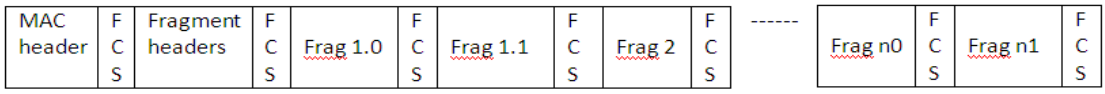

Figure 3: data frame in AFR scheme

In our approach, there are some packets at the receiver are waiting to transmitted to the sender, so the receiver does not require to send separate ACK, it can send both (ACK+data), then we implement the AFR in both direction from side A to B, and side B to A. And the detailed ACK frame formats for the AFR scheme are described in Figure 4. The length of the new Fragment Bitmap field is 32 octets, which allows the maximum number of fragments in a MAC frame is 256, for the first ACK side B to side A and Conversely from side A to side B.

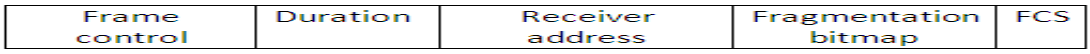

Figure 4: ACK in AFR scheme

How the AFR protocol works in bidirectional transmission?

At the sender side, on receiving one IP data packet from the upper layer, the MAC layer divides it into several fragments and save them into the MAC queue. After receiving some other IP data packets, the MAC queue aggregates all the available fragments into a large MAC frame and transmits the aggregated frame through the PHY layer. At the receiver side, after receiving the aggregated frame, the receiver's MAC sends back an (ACK+ data) frame, at the ACK part confirming which fragments have been correctly received in the ACK frame's Fragment Bitmap field. If all the fragments of an aggregated frame have been

successfully received, the receiver's MAC layer transmits the whole frame to the upper layer and deletes it from the queue. And in data part we used the AFR scheme again at the receiver side that combined with the ACK. And to confirm the fragments arrived at sender we used the fragment bitmap in the ACK from the sender to the receiver. See figure 5.

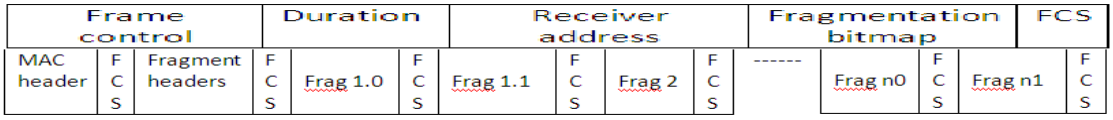

Figure 5: piggyback frame in AFR scheme

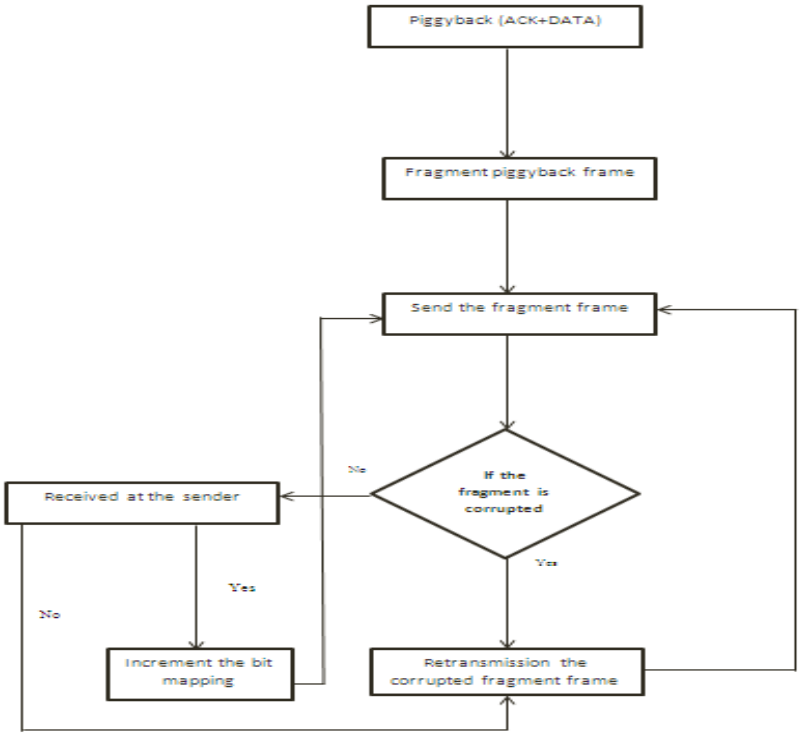

Figure 6: system design flow chart

4. EXPRIMENTAL RESUTLS

We have implemented the AFR in piggyback scheme in the network simulator NS-2.27 (cygwin) in windows XP. The network topology that we used is a peer-to-peer one where STA sends packets to STA. We report here the simulation results for two types of traffic (TCP,

HDTV) all of which follow the requirements of the 802.11n usage model [12].We have compared performance of the AFR in piggyback scheme with normal piggyback scheme [13]. Our simulation parameters are list in table I.

Table I: parameters used in NS 2.27 for our simulation

Type of parameter	TCP	HDTV
Number of stations	Varied	Varied
Data rate	432 Mbps	432 Mbps
Basic rate	54 Mbps	54 Mbps
AFR sending queue	10 packets	10 packets
Packet size	1024 bytes	1500 bytes
AFR frame size	8192 bytes	9000 bytes
AFR fragment size	varied	750 bytes

TCP traffic:

TCP currently carries the great majority [14] of network traffic and it is therefore important to investigate the support of the AFR scheme for TCP traffic. Important feature of TCP include the fact that traffic is elastic and so achieved throughput is related to network capacity.

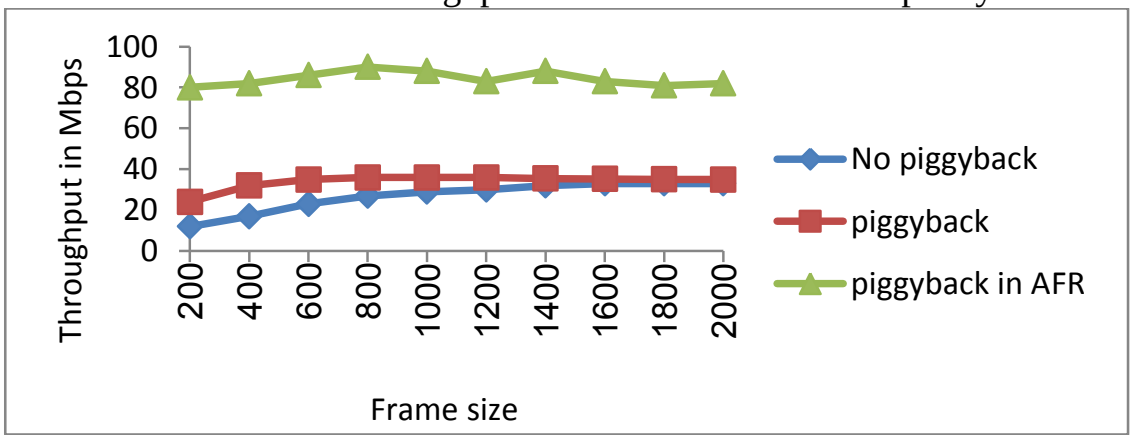

Figure 7: Throughput comparison in basic rate 54Mbps and BER=10^{-6}

This piggyback scheme AFR achieves great throughput gains (by a factor of between 2 and 3 depending on channel conditions) over normal piggyback. Although as might be expected the choice of fragment size becomes more
important at higher BERs

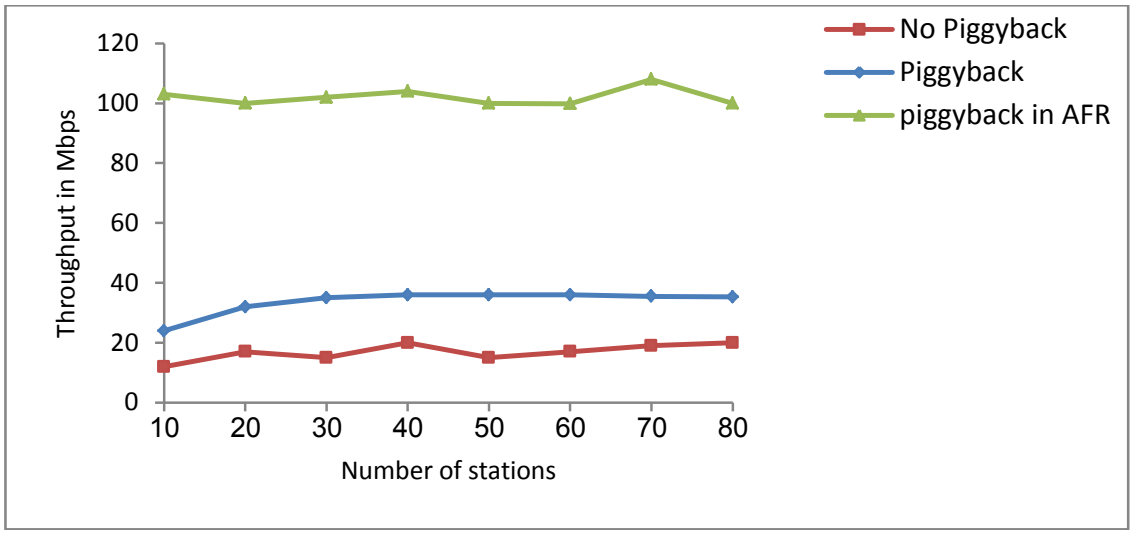

Figure 8: Throughput compared with number of stations

We evaluate the piggyback in AFR performance as the number of STAs is varied from 10 to 80; figure 8 shows the piggyback in AFR and normal piggyback and without piggyback scheme throughput. Piggyback in AFR achieves between 2.5 and 3 times the throughput of normal piggyback over this range of network conditions.

HDTV will be supports WLANs. HDTV has a constant packet size of 1500 bytes, a sending rate of 19.2–24 Mbps, and a 200-ms peak delay requirement.

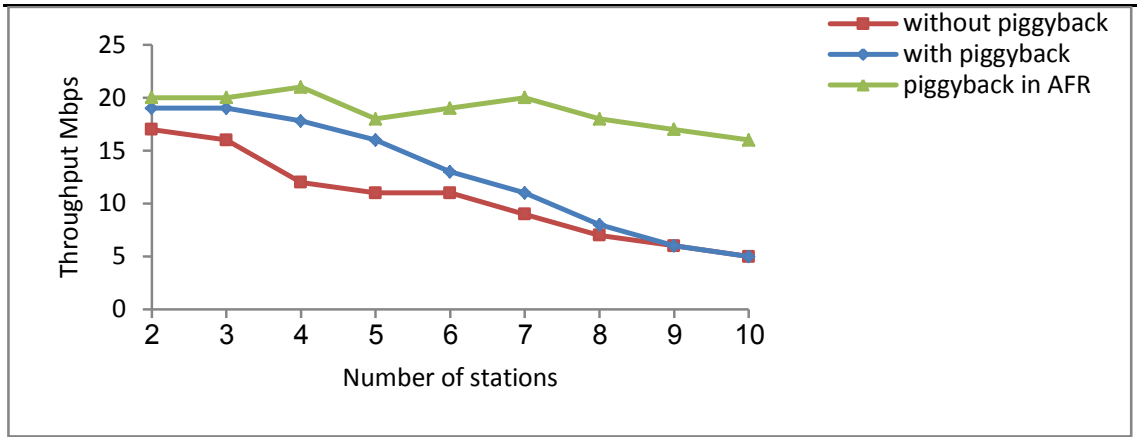

Figure 9: Throughput compared with number of stations

So Final Result in piggyback in AFR HDTV performance with a 432MbpsPHY data rate. Figure 9 shows the throughput performance of the piggyback in AFR and normal piggyback and without piggyback schemes as the number of STAs(and so HDTV flows) is varied.

5. Conclusion: To achieve high efficiency for IEEE802.11n, we developed the bidirectional frame incorporated in to the aggregation with fragment retransmission (AFR), in which multiple packets are aggregated into and transmitted in a single large frame. The simulation model is developed to evaluate the throughput performance of piggyback in AFR scheme.

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