Rate Adaptive Unicast Frame Aggregation

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Abstract: The increase in the rate of the data transmission leads to the overhead in the MAC. The existing Frame aggregation techniques lead to the lower throughput as the data is transferred at lowest rate of aggregated frames. This paper designs a framework that adapts the rate of frames to increase the throughput. The simulation verifies the optimization of the process. The increase in the throughput and the decrease in the delay verifies the significance of the proposed technique.

Keyword: Frame Aggregation, MAC, Overhead, 802.11n

I. INTRODUCTION

The technology is growing day by day and growing technology demand internet at home as well as at coffee shops, hotels etc[1]. That's why now a day's Wi-Fi technology is found in mobile phones, notebook computers and also in various other electronics devices, while earlier most of the devices are equipped with built-in WLAN [3]. This growing demand of Wi-Fi needs the extension of the technology as constrain of the Wi-Fi technology is increasing. The solution needs the high speed wireless internet connectivity with the existing WLAN hardware. But the data rate with the existing hardware leads to the greater overhead. The overhead can be reduced by aggregating various frames within a single transmission. This phenomenon is known as the frame aggregation. The frame aggregation reduces the number of transmission as grouping various frames in a single transmission and also reduces the header overhead and several frames are transmitted by using a single header. The 802_11n IEEE standard introduces various frame aggregation that provides high data rate as well as high throughput [4]. The transmission of the data using the 802.11.n follows the RTS-CTS-DATA-ACK sequence. The request to send signal followed by clear to send signal are the handshake signals for the data transmission. Each signal is separated by the short inter frame separation time. Two types of frame aggregation schemes exist i.e. A-MSDU and A-MPDU. A-MSDU is the aggregation of the MAC service data unit while the A-MPDU is the aggregation of the PHY service data unit.

II. EXISTING WORK

The existing Frame aggregation scheme aggregates the frame that has the same destination address. This process is not able to increase the throughput also suffers from the overhead problem. The paper increases the throughput by aggregating various frames with different destination. This process needs to change the frame format. The work needs a Frame with unicast data and each unicast data has its own destination address. In this process each node knows its geographic location. The frames are aggregated in terms of distance of the destination i.e. lower distance data will be placed firstly and vice-versa. The routing protocol will route the data from source to the destination in a multi-hop fashion. The destination will be the destination of the last unicast data. The frames having the intermediate nodes as their destination can be aggregated only. This process will enhance the throughput of the system as the data will be travelled at higher rate with less delay.

The above flowchart shows the aggregation of the n frames. Firstly n frames are sorted according the distance from the destination. The Distance between the source and destination can be easily calculated by the distance formulae: $\sqrt{(x1 - x2)^2 + (y1 - y2)^2}$ where x1,y1 are the location coordinates of the source and x2,y2 are coordinates of the destination. These coordinates are known to the sensor node and the nodes know their geographic location. Then the last frame destination is selected as the destination. Then the routing protocol will decide the route from the source to the destination. Then the routing protocols select the nearest neighbor of transmitting node to transfer the data. The process goes on until destination reached. Then the frames that has the destination in the route are kept, other frames are discarded . Then selected frames are aggregated and data is transferred form the source to destination. The intermediate nodes also get the frames of their interest

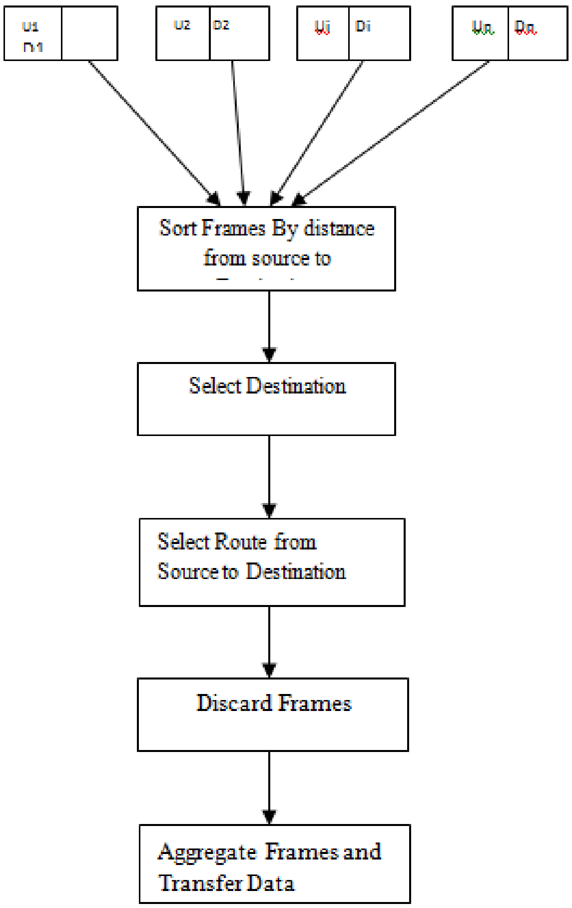

Figure 1: Heterogeneous Frame Aggregation

III. PRESENT WORK

The existing process of frame aggregation doesn't take care of the data rate Different nodes may have different data rates or the frames needs to be transmitted at different rates. But the existing process aggregates the frames and transmits the data at the lowest data rate of the selected frames. It results in the fewer throughputs. This process can be enhanced by introducing frame-adaptive data rates. This can be easily done by the ack delay. The frame will adapt its rate depending upon the delay of the acknowledgment. The less delay of acknowledgement will result in the higher data rate and vice-versa. In the existing process the next intermediate node will be the destination of the next frame in the aggregated frame. The transmitting node will send a hello packet and get ack packet only the frame will be transmitted. The transmitting node will transfer the data according to delay of the acknowledgement. The nodes have different agents to transfer the data at different rate. The different delay of the ack will lead to the different selection of the agent by the transmitting node. Different agent will transfer the data at different rates. This leads to the frames rate adaption. This process will enhance the throughput and also decrease the delay. This can be easily understood by the diagram in figure 2.

The process extends the concept of [2] the selecting the different agents to transmit the data. The agents transfer the data at different rates which leads to the frame rate adaption. The process can be explained briefly by the following algorithm:

1. Select N frames to be aggregated.
2. For I=1: N
3. Dist(I)=sqrt((s(x)-I(x))^2+((s(y)-I(y))^2)
4. End for
5. Max=1
6. Maxd=Dist(1)
7. For i=2:N
8. If Dist(i)>Maxd
9. MAxd=Dist(i)
10. Max=i
11. End if
12. End for
13. Destination=Max
14. TN=source
15. MH=1
16. Route(MH)=source
17. While TN!=destination
18. MH=MH+1;
19. Select nearest node of TN say s.
20. Route(MH)=s
21. TN=s
22. End
23. For i=1:N
24. If i(destination) is not in Route
25. Then discard the frame
26. End if
27. End for
28. Aggregate the Frames
29. Transfer hello packet from source to destination
30. Each intermediate node receives the Ack.
31. Select the transmitting agent at each node according to Ack delay.
32. Transfer the data from source to destination using selected agents.

The above algorithm explains the process of the frame aggregation which is simulated by NS2 explained in the next section.

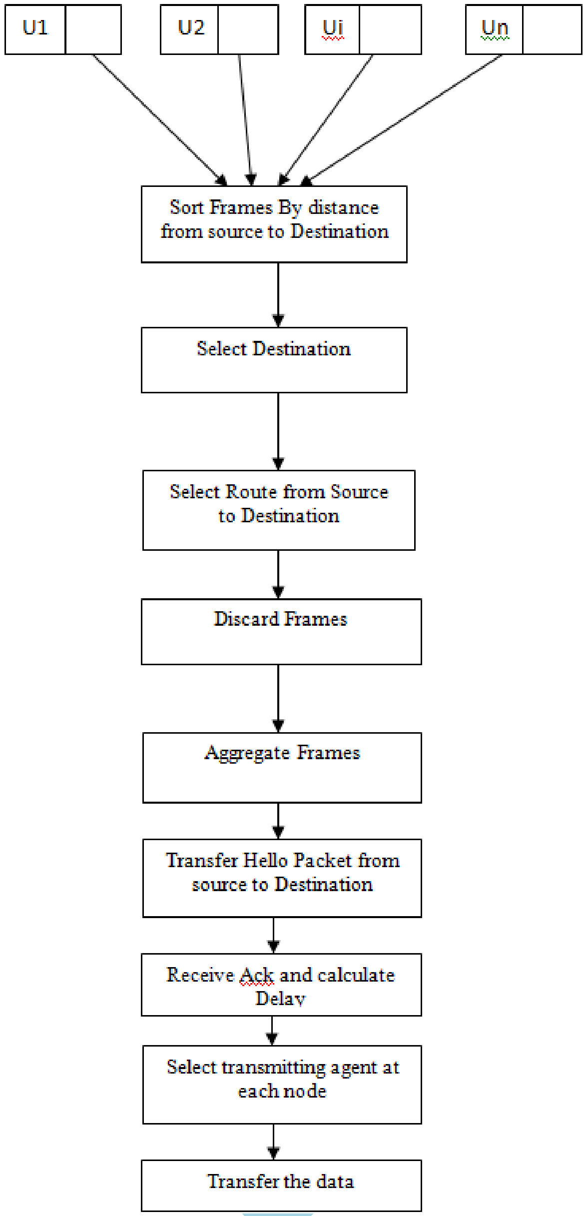

Figure 2: Proposed Frame Aggregation

IV. PROPOSED WORK

The paper simulates the heterogeneous frame aggregation and compares the delay and the throughput with the existing homogeneous frame aggregation. The comparison is done at the different data rates. The figure shows the result of the comparison of the delay and the throughput at different data rate of the existing homogeneous and proposed heterogeneous frame aggregation. This comparison can be analyzed graphically as shown in the figure 3 and 4.

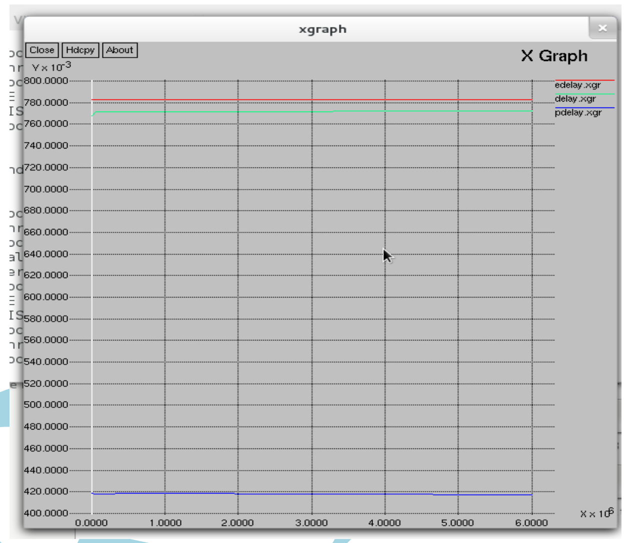

Figure 3: Comparison of Delay

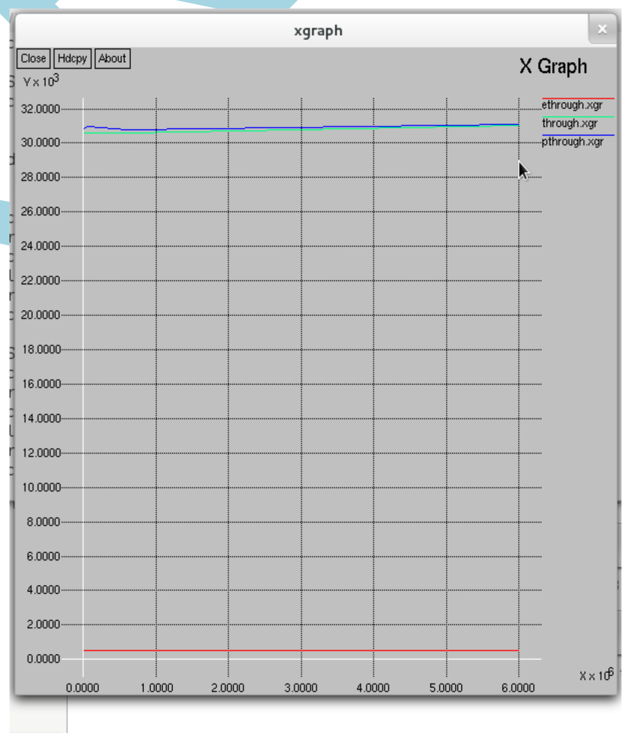

Figure 4: Comparison of Throughput

The graphical comparison shows that the throughput of the heterogeneous frame aggregation is far better than the existing homogeneous frame aggregation while the delay is reduced minutely. The increase in the throughput shows that the output in the given time gets increased.

V. CONCLUSION

This paper discusses the frame aggregation with different destination to decrease the load. The simulation results show the effectiveness of the concept by comparing the throughput and the delay with the existing homogenous frame aggregation. The delay is reduced minutely but the throughput gets enhanced. The large enhancement is throughput increases the effectiveness of the concept. In future the delay can be reduced in the heterogeneous frame aggregation.

VI. REFERENCES

[1]. Kim W, Wright H.K, Nettles S.M, “Improving the Performance of Multi-hop Wireless Networks using Frame Aggregation and Broadcast for TCP ACKs”, ACM CoNEXT 2008, December 10-12, 2008, Madrid, SPAIN.

[2]. Bharat Bhushan Naib, Prof.(Dr.) V.R. Singh,” Unicast Frame Aggregation with Heterogeneous Destination”.

[3]. Broad Cam, “802.11n: Next-Generation Wireless LAN Technology” , April 2006.

[4]. IEEE 802.11n Working Group. Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specification-Draft 2.0: Enhancements for Higher Throughput, Part 11Standard ed., 2007

[5]. Kolap, J., Krishnan, S., & Shaha, N. (2012). FRAME AGGREGATION MECHANISM FOR HIGH-THROUGHPUT 802.11N WLANS. *International Journal of Wireless & Mobile Networks (IJWMN) Vol, 4.*

[6]. Selvam, T., & Srikanth, S. (2010, January). A frame aggregation scheduler for IEEE 802.11 n. In *Communications (NCC), 2010 National Conference on* (pp. 1-5). IEEE.

[7]. Lin, Y., & Wong, V. W. (2006, November). WSN01-1: frame aggregation and optimal frame size adaptation for IEEE 802.11 n WLANs. In *Global Tele Communications Conference 2006.*