Packet Aggregation Scheme in VoIP over WLAN for Throughput and PDR enhancement

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***Abstract*— In infrastructure 802.11 WLAN networks multimedia applications need more QoS requirements which ia getting degraded due to queuing delays, transmission delays, traffic load and jitters. In this paper we have proposed new packet aggregation scheme due which throughput will get increased and will increase the QoS for multimedia or VoIP applications**

***Keywords*— QoS, WLAN, packet aggregation, Multimedia.**

II. INTRODUCTION

Recent years, there has been a growing interest towards delay sensitive multimedia applications. The delay sensitive nature of multimedia packets creates several issues in WLAN.

Here we consider the issues related to small sized multimedia packets. In a wireless communication system, MAC layer and Physical layer overheads are necessary for the proper synchronization between transmitter and receiver as well as to share the wireless medium efficiently. To increase the network efficiency, the ratio of header size to payload size in a packet has to be reduced. The new IEEE WLAN amendment, IEEE 802.11, allows aggregation of packets to increase the payload size. Here a node aggregates the packets of different applications to compose a larger packet before it is send to the access point (AP). However, this method fails in the case of delay sensitive multimedia applications.

The original version of the IEEE 802.11 standard was released in 1997. It specified two PHY data rates of 1Mbps and 2Mbps, and three PHY layer technologies i.e. Diffuse Infrared (DIR), Frequency Hopping Spread Spectrum (FHSS) and Direct Sequence Spread Spectrum (DSSS). The FHSS and DSSS PHY layers operate over the Industrial Scientific Medical (ISM) frequency band at 2.4GHz. The other amendment to the original standard released in 1999 is IEEE 802.11a [26]. 802.11a operates in the 5GHz band and uses a 52- subcarrier orthogonal frequency division multiplexing (OFDM) technology at the PHY layer. The maximum raw PHY rate is increased up to 54Mbps. Since the 2.4GHz band is heavily used to the point of being crowded, using the relatively unused 5GHz band potentially offers 802.11a the significant advantage of less interference. For the applications like VoIP in WLAN there is need of high throughput requirements and jitter free communication strategies. The QoS for VoIP service offered by 802.11 WLAN base infrastructure network depends on queuing delays, transmission delays, traffic load and jitters.

We have proposed scheme in which we are implementing the packet aggregation which increases throughput and QoS for VoIP Service.

In this paper we consider Voice over IP (VoIP) application to elaborate the need of packet aggregation schemes for multimedia applications and suggest packet aggregation scheme to improve the network efficiency.

II. PCF OPERATION

1) Reserving the Medium During the Contention-free Period: At the beginning of the contention-free period, the access point transmits a Beacon frame. One component of the beacon announcement is the maximum duration of the contention-free period, CFP Max Duration. All stations receivin g the Beacon set the NAV to the maximum duration to lock out DCF-based access to the wireless medium .

As an additional safeguard to prevent interference, all contention-free transmissions are separated only by the short interframe space and the CF interframe space. Both are shorter than the DCF interframe space, so no DCF-based stations can gain access to the medium using the DCF.

2) The Polling List: After the access point has gained control of the wireless medium, it polls any associated stations on a polling list for data transmissions. During the contention free period, stations may transmit only if the access point solicits the transmission with a polling frame. Contention-free polling frames are often abbreviated CF- poll. Each CF-poll is a license to transmit one frame. Multiple frames can be transmitted only if the access point sends multiple poll requests.

The polling list is the list of privileged stations solicited for frames during the contention-free period. Stations get on the polling list when they associate with the access point. The Association Request includes a field that indicates whether the station is capable of responding to polls during the contention-free period.

Transmissions from the Access Point Generally, all transmissions during the contention free period are separated by only the short inter frame space. To ensure that the point coordinator retains control of the medium, it may send to the next station on its polling list if no response is received after an elapsed CF inter frame space. The access point polls the second station on its list but receives no response. After waiting one CF inter frame space, the access point moves to the third station on the list. By using the CF inter frame space, the access point ensures that it retains access to the medium.

The access point may use several different types of frames during the contention-free period. During this period, the point coordinator has four major tasks.

III. PROPOSED PACKET AGGREGATION SCHEME

In this section we propose the packet aggregation scheme. The primary responsibility of the WLAN MAC is to control medium access, but it can also provide optional support for roaming, authentication, and power conservation. Modification in AP mechanism for packet aggregation and to deliver the bunch of packets continuously back to back to respective nodes. When Bunch of packets are sent back to back continuously it increases throughput which results in enhancement of QoS for VoIP kind of multimedia applications in infrastructure network. If specific VoIP service requirement from all the nodes is considered in the network, then it is possible to achieve enhancement of QoS as compared to existing systems. The packet aggregation scheme implementation can be done as discussed in next methodology section.

Figure 1 indicates the time slots in 802.11 MAC frame mechanism. For the sake of implementation of packet aggregation scheme we consider the inter frame spacing in terms of time slots indicated in figure 3. The packet aggregation in infrastructure network can be obtained by increasing the PIFS time slot during which all the packets intended for particular receiver will be gathered together and will be sent back to back when it gets its turn of delivery. This is possible in the polling mechanism of mobile stations which are connected with the access point of 802.11 infrastructure network as indicated in Figure 4 for three nodes A, B and C. The time out for PIFS space can be increased with additional time during which all the upcoming new packets intended for the same receiver will get more time available and will get aggregated for fast delivery which is expected for VoIP based services.

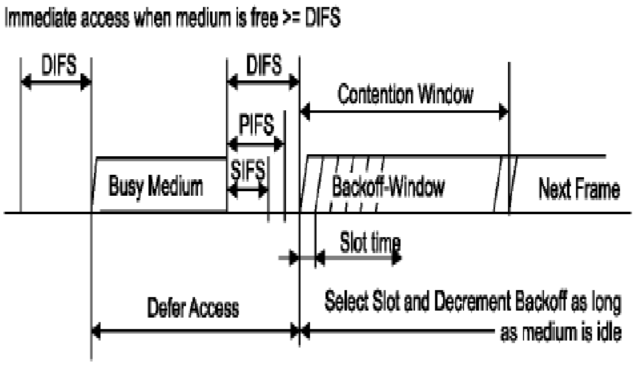

Figure 1: Medium Access and Frame Spacing

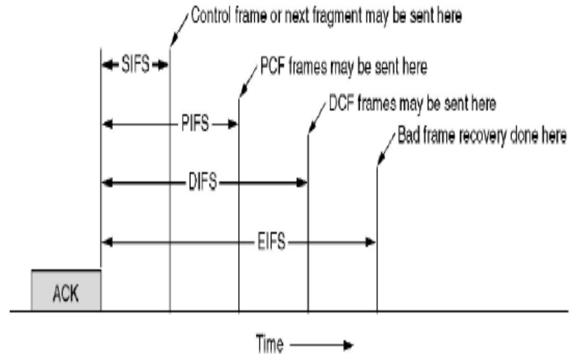

Figure 2: Interframe Time Spacing

IV. METHODOLOGY

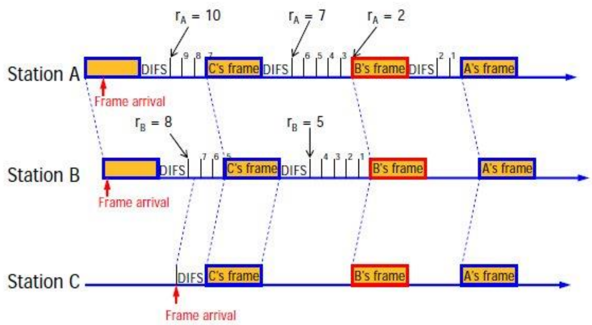

Figure 3: Channel Sharing Mechanism

$$Ptotal = \sum_{i=t}^{T} Pi \qquad \ldots(1)$$

Where, t1 to t2 is time slot available for communication. Equation (1) represents total number of packets to be delivered to the node in time slot t1 to t2.

We modify equation (1) to equation (2) with increment of time slot by ‘Γ’ for packet aggregation

$$\mathrm{Ptotal} = \sum_{i=t}^{T+\tau} \mathrm{Pi} \qquad \ldots(2)$$

The time out for PIFS space can be increased with additional time during which all the upcoming new packets intended for the same receiver will get more time available for fast delivery which all the time supports for enhancing QoS in VoIP based service.

$$\text{Timeout} = (\text{existing Timeout}) + \Gamma \qquad \dots (3)$$

Where,
PIFS is time slot of station got from polling,
τ is additional time allotted for packets aggregation.

V. SIMMULATION RESULTS

We simulated the concept on ns2 by adding PCF support for MAC of 802.11 protocol. We analyzed system performance by considering parameters indicated in table1.

TABLE I
PARAMETERS FOR SIMULATION

Parameter	**Settings**
MAC	802.11 pcf support
Routing Protocol	AODV
Number of nodes	20,32,40,50,70
Increment in time slots of contention free period(microseconds)	0, 105, 200, 500, 800, 1400, 2500, 2750, 2800, 3000, 5000
Simulation time	100 seconds

The throughput performance can be indicated in the graphs as indicated in figures below.

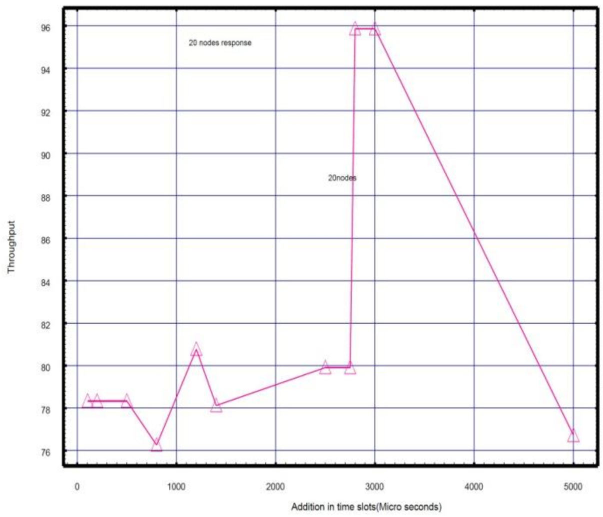

Figure 4: graphs of Throughput vs Increment in time slots for 20 nodes

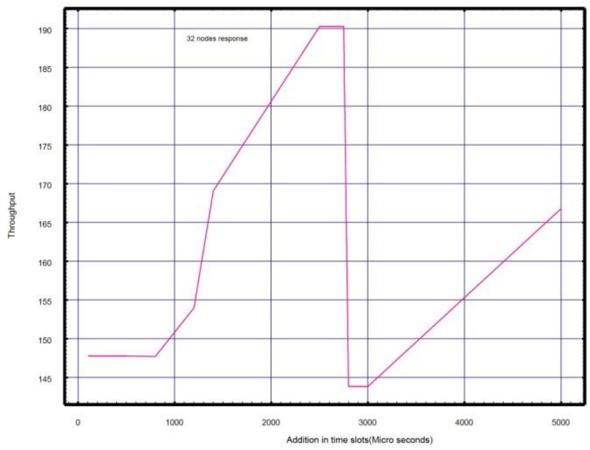

Figure 5: graphs of Throughput vs Increment in time slots for 32 nodes

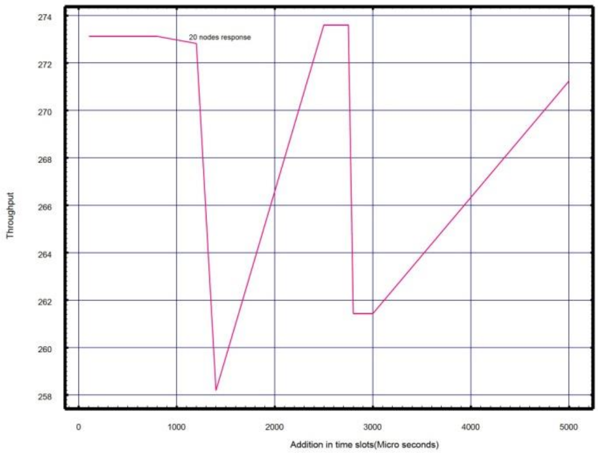

Figure 6: graphs of Throughput vs Increment in time slots for 40 nodes

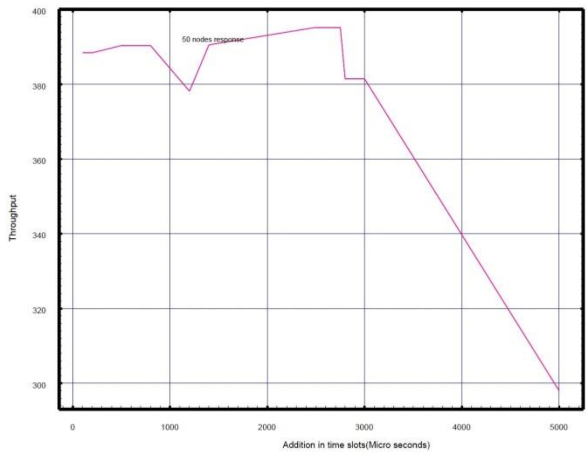

Figure 7: graphs of Throughput vs Increment in time slots for 50 nodes

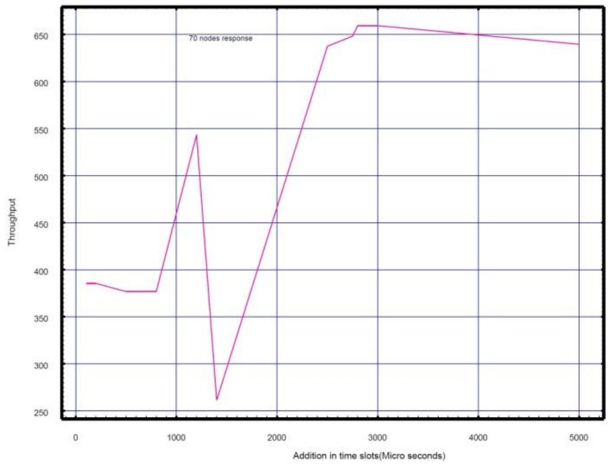

Figure 8: graphs of Throughput vs Increment in time slots for 70 nodes

From throughput performance graphs we observe that throughput can be enhanced by packet aggregation scheme

THE packet delivery ratio can is observed and graphs for different time slot increments can be plotted as indicated in figure below.

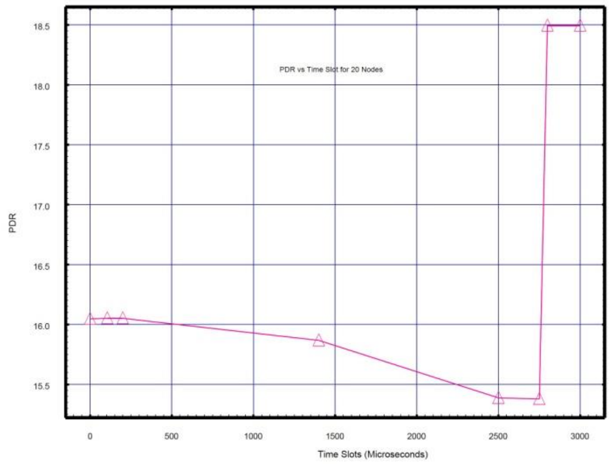

Figure 9: graphs of PDR vs Increment in time slots for 20 nodes respectively

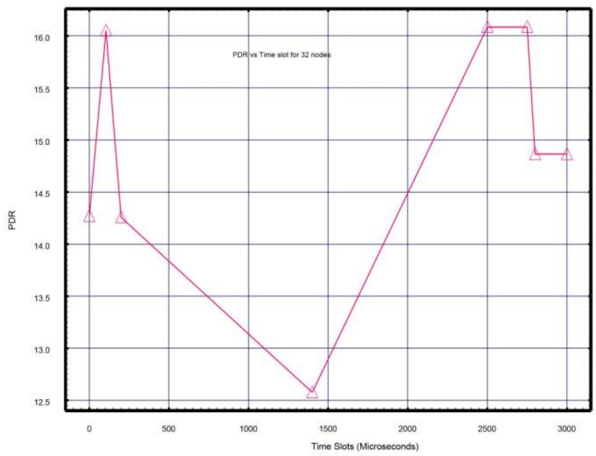

Figure 10: graphs of PDR vs Increment in time slots for 32 nodes respectively

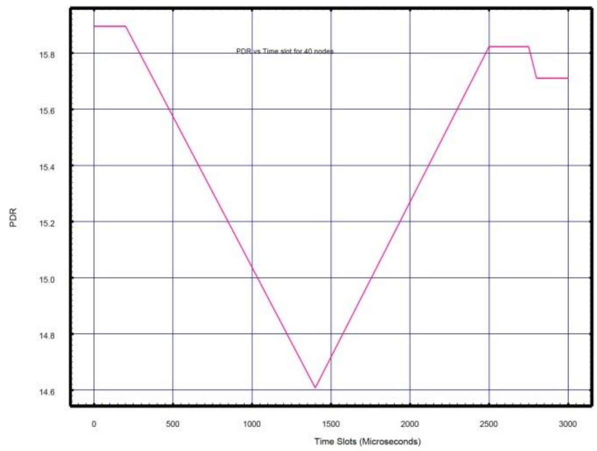

Figure 11: graphs of PDR vs Increment in time slots for 40 nodes respectively

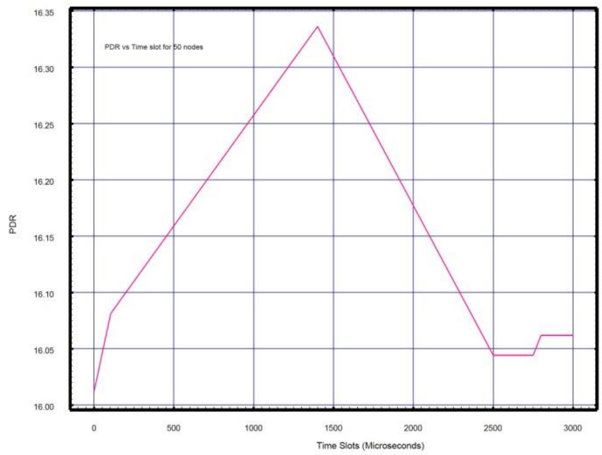

Figure 12: graphs of PDR vs Increment in time slots for 50 nodes respectively

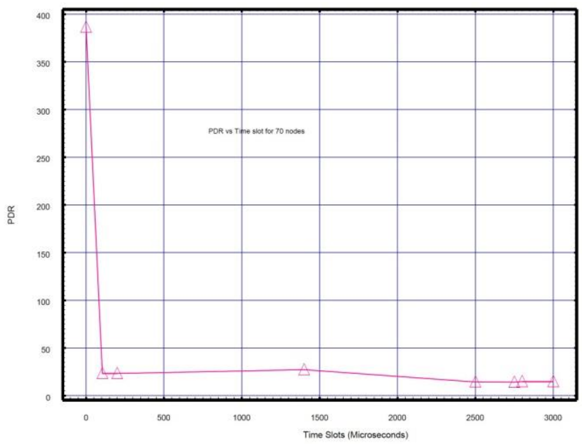

Figure 13: graphs of PDR vs Increment in time slots for 70 nodes respectively

From PDR performance graphs we observe that PDR also increases by packet aggregation scheme.

V. REFERENCES

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VI. CONCLUSION

The new packet aggregation scheme in infrastructure WLAN can improve the throughput of the system. As throughput of the system is basic need for VoIP our proposed design can satisfy the need.

Also along with throughput PDR also gets increased which adds the reliability in the scheme.

VII.ACKNOWLEDGEMENT

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