An Efficient Delay Based Performance for IEEE 802.11e EDCA Systems

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Abstract –The model is implementing to describe the method of the EDCA (Enhanced Distributed Channel Access) and weighted random early detection mechanism of the IEEE 802.11e standard. In Enhanced Distributed Channel Access gives class based differences QoS to IEEE 802.11 wireless local area networks. This standard is measured of critical significance for delay-sensitive presentations, like Voice over Wireless systems and streaming hypermedia. The adjustment has been combined into the available IEEE 802.11 standard which is an IEEE standard which allows strategies like laptop processors or cellular mobiles to connect a wireless LAN which is normally used in the home-based scenarios, office and some marketable formations. The main issues occurs in existing work, it is notices that as the number of user's increases day by day, the fluctuation of the loads also increases and as a result the delay significantly increases. IEEE 802.11e standard is an approved alteration to the IEEE 802.11 standard which deals with a quality of service improvements for wireless LAN submissions through adjustments to the MAC which is well known by Media Access Control layer. This type of standard is measured of critical position for delay-sensitive presentations like Voice over Wireless networks and streaming hypermedia. The adjustment has been combined into the IEEE 802.11 b/a/g standard.In this distributed channel access scheme, high-priority traffic in the form of video or speech has a greater chance of being communicated than low-priority circulation in which a service station with high priority circulation that waits a less before it directs its packet, on regular, than a service station with low precedence traffic. This is skillful through the TCMA procedure, which is a disparity of CSMA/CA by a shorter inter-framing procedure for greater priority packets.

Keywords – Wireless local area networks, 802.11e IEEE standard, EDCA and WRED (Weighted Random Early Detection).

I. INTRODUCTION

Wi-Fi networks have gained wide-ranging acceptance with the prelude of the IEEE 802.11 standard. Because of the pervasive aspect of the wireless access networks, the need for real-time video-conferencing, video streaming, and voice calls over Wi-Fi networks have started to be recognized. Therefore, associated issues have recently become dynamic research areas. A Wi-Fi network is comprised of one or more access points (APs) and a number of mobile stations/STAs. An AP is a wireless node connected to high speed wireless or wired network. The job of the AP is to link the transmissions between wired and wireless networks. Performance evaluation of Wi-Fi networks have been vibrant research areas for a long time. It is quite difficult to model WLAN, where multiple traffic classes are present and functioning in real-time because of the intricate architecture of the medium access control (MAC) layer. Meeting the QoS objectives is a key challenge in WLANs due to the limited bandwidth availability. In order to guarantee the QoS support and to handle multimedia applications in WLANs, the IEEE 802.11e standards group has proposed Enhanced Distribution Channel Access (EDCA), which enhances the MAC protocol. Providing the required quality of service (QoS) support, e.g. guaranteed throughput, error rate, delay and jitter for the above mentioned multimedia applications is the most challenging task in wireless networks [1].

Enhanced Distributed Channel Access The 802.11e employs a hybrid coordination function (HCF) which essentially augments both the point coordination function (PCF) and the distributed coordination function (DCF). The HCF offers two modes for channel access, named HCCA (HCF controlled channel access) and EDCA (enhanced distributed channel access). The EDCA is comparable to DCF but has provision for four different traffic classes such as AC0, AC1, AC2 and AC3, where AC0 is the least privileged and AC3 is the most privileged class. For instance, voice call is considered as AC3 and web browsing is considered as AC1. The EDCA offers service differentiation among these traffic classes through the differentiation of MAC parameters [2].

It presents Random Early Detection (RED) gateways for congestion avoidance in packet-switched networks. The gateway detects incipient congestion by computing the average queue size. The gateway could notify connections of congestion either by dropping packets arriving at the gateway or by setting a bit in packet headers. When the average queue size exceeds a preset threshold, the gateway drops or marks each arriving packet with a certain probability, where the exact probability is a function of the average queue size. RED gateways keep the average queue size low while allowing occasional bursts of packets in the queue. During congestion, the probability that the gateway notifies a particular connection to reduce its window is roughly proportional to that connection's share of the bandwidth through the gateway. RED gateways are designed to accompany a transport-layer congestion control protocol such as TCP. The RED gateway has no bias against burst traffic and avoids the global synchronization of many connections decreasing their window at the same time [3].

II. IEEE STANDARDS

The 802.11e standard has been proposed to provide differentiated services to different traffic classes in an IEEE 802.11 WLAN. Although 802.11e inherits the basic features of the 802.11 standard, it consists of several modifications and additional mechanisms to obtain prioritized access to WLAN. This chapter discusses the EDCA mechanisms [12].

A. IEEE 802.11 MAC

The IEEE 802.11 MAC defines two medium access coordination functions: a mandatory distributed coordination function (DCF) and an optional point coordination function (PCF). DCF is based on CSMA/CA and PCF is based on polling mechanism. Moreover, PCF is defined in order to support applications that require real-time services [4].

B. Basic Access Mechanism

In the Distributed Coordination Function, the basic access mechanism is nothing but a Carrier Sense Multiple Access with Collision Avoidance mechanism (usually known as CSMA/CA). Unlike in a wired environment, in a wireless environment we cannot assume that all stations hear each other and the fact that a station wants to transmit and senses the medium as free does not necessarily mean that the medium is free around the receiver area. In order to overcome these problems, the 802.11 uses a Collision Avoidance (CA) mechanism together with a Positive Acknowledge scheme. In basic access mechanism, when a station wants to transmit, it senses the medium. If the medium is busy then it defers and if the medium is free for a specified time (called Distributed Inter Frame Space (DIFS)), then the station is allowed to transmit [5].

C. RTS/CTS Mechanism

To deal with hidden node problems, RTS (Request To Send) and CTS (Clear To Send) are specified by IEEE 802.11. If the size of the data packet is larger than the RTS Threshold, RTS and CTS packets are exchanged before the data packet is transmitted. RTS/CTS contain a duration held that specifies the time necessary to complete the transaction. This information is used to update the network allocation vector (NAV), a timer used by the station receiving the RTS/CTS packet to delay access to medium. In RTS/CTS Mechanism when a station wants to transmit, it senses the medium. If the medium is busy then it defers. If the medium is free for a specified time (called Distributed Inter Frame Space (DIFS)), then the station transmits an RTS packet with NAV information. The receiving station checks the CRC of the received RTS packet and sends a CTS packet with NAV information. Receipt of the CTS [6] packet indicates to the transmitter that no collision occurred. If the sender does not receive the CTS packet then it retransmits the RTS until it receives the CTS packet or is thrown away after a given number of retransmissions. The NAV information is read from the RTS and CTS packets by all other stations and will defer any activity in this period. The sending station, after reception of CTS packet, sends the data packet to the receiving station. During this transmission all other stations have deferred their effort to access the medium. Therefore, the data packet is never lost in collision [11].

III. RELATED WORK

Jama et al., 2013[7] developed an ns-2 patch in C++ which suites their requirements in a simulation based performance enhancement. In their work, the performance of IEEE802.11e WLAN is evaluated and discussed based on simulation study using the network simulator (ns-2.29) under Linux operating systems fedora core 4. Their simulation results showed enhanced performance for the voice and video traffics over the original IEEE802.11e standard. This shows the effectiveness and efficiency of their simulator of enhancing the performance for voice and video based applications such as video conferencing and voice over internet protocols.MacKenzie & O'Farrell, 2012[8] presented to provide a straightforward throughput and delay analysis for p-persistent CSMA that can be easily applied to an EDCA system within the rules of the current 802.11 standard. Several versions of the analysis are provided to show how further parameters of EDCA can also be included and their effects on system performance are shown. These further parameters include transmission opportunities, internal collision resolution, AIFS differentiation and retry limits. Any number and combination of these further parameters can be included at the same time making this new form of analysis extremely flexible as well as accurate to model a wide variety of EDCA system scenarios.R. Moraes, Portugal, & Vasques, 2006[9] proposes a simulation model which enables the evaluation of IEEE 802.11e EDCA networks, focusing in the behaviour of the Enhanced Distributed Channel Access (EDCA) function associated to Quality of Service (QoS) stations. When compared with currently used simulation models, their model provides a more accurate implementation of some aspects (timeouts, EIFS), a flexible implementation, and an easiness of use. Besides, a large number of different types of performance measures can be obtained. Their model is based on a high level Stochastic

Petri Net formalism referred as Stochastic Activity Networks (SAN), able to produce very compact and efficient models, and which is supported by the Mobius tool.Ricardo Moraes, Portugal, Vasques, & Fonseca, 2008[10]analyse the timing behaviour of the EDCA communication mechanism defined in the IEEE 802.11e standard, when it is used to support real-time (RT) traffic. In the context of their work, RT traffic means small sized packets generated in periodic intervals, which must be delivered before the end of the message stream period. Otherwise, the message is considered to be delayed and a deadline loss occurs. The target of their work is to understand the limitations of the highest priority level of the EDCA mechanism (voice category) when sup- porting RT communication.

IV. PROPOSED SOLUTION

In proposed work, we discussed in the EDCA and WRED (Video and Audio) techniques to reduce the interval of time. To analysis the basics of EDCA protocol and its working for delay sensitive applications. To implement the contention window based approach and evaluate the mean frame delay. To implement the optimize approach using weighted random early detection approach for reduce the end to end delay for high packet deliveries. Compare the proposed performance approach with the base paper approach to check the robustness of the system. .

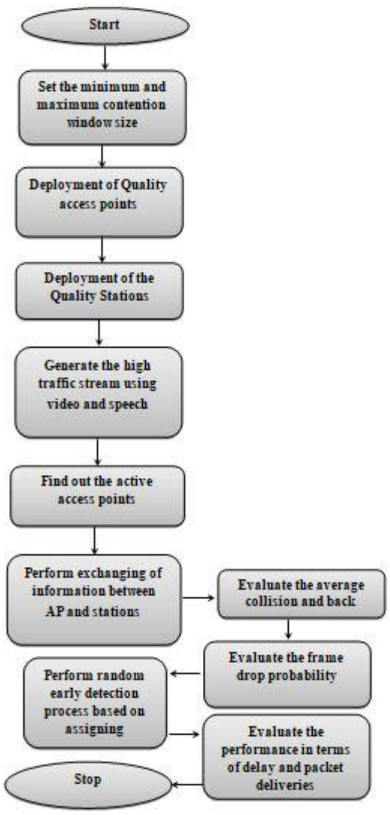

Fig 1. Proposed Flow Chart

IEEE 802.11e standard is an approved alteration to the IEEE 802.11 standard which deals with a quality of service improvements for wireless LAN submissions through adjustments to the MAC which is well known by Media Access Control layer. This type of standard is measured of critical position for delay-sensitive presentations like Voice over Wireless networks and streaming hypermedia. The adjustment has been combined into the IEEE 802.11 b/a/g standard.

In this distributed channel access scheme, high-priority traffic in the form of video or speech has a greater chance of being communicated than low-priority circulation in which a service station with high priority circulation that waits a less before it directs its packet, on regular, than a service station with low precedence traffic. This is skillful through the TCMA procedure, which is a disparity of CSMA/CA by a shorter inter-framing procedure for greater priority packets. The exact standards are contingent on the physical coating that is used to communicate the data. In calculation, EDCA delivers contention-free admittance to the station for a period which is well known by a Transmit Opportunity (TXOP). It is a restricted time interval through which a position can send as numerous frames as conceivable as long as the length of the transmissions will not exceed beyond the supreme period of the TXOP. If a length of the frame is too big to be communicated in a solitary TXOP, it must be fragmented into lesser frames. The usage of TXOPs decreases the difficulty of low rate positions gaining an excessive quantity of channel time in the inheritance 802.11 MAC.

So an efficient delay procedure is needed for the successful packet deliveries with less error rate probabilities which will increase the lifespan of the networks and having low error rates.

In this research an efficient scheduling process which is known by weighted random early detection process which will decreases the delay according to the threshold priorities and will work in a hierarchical manner which will be delay efficient and helps in increasing the lifespan of the network with high packet deliveries.

V. RESULT AND DISCUSSION

In this section, we explained the results in EDCA and WRED technique to improve the performance of the parameters in two phases: (i) Video Traffic and (ii) Audio Traffic . The deployment of the access points and quality of service stations. The network area is considered 1200 by 1200 meters in terms of length and width of the network.

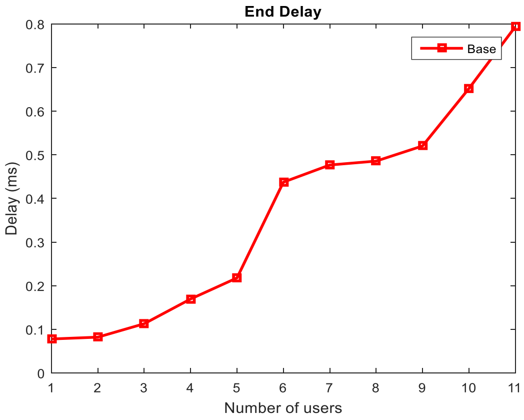

Fig 2 . End Delay with EDCA

The above figure shows the end to end delay in milli seconds. The end delay shows that the how much packets are successfully delivered in short span of time which must be low for high efficiency of the system. It is one of the important parameters for the performance evaluation.

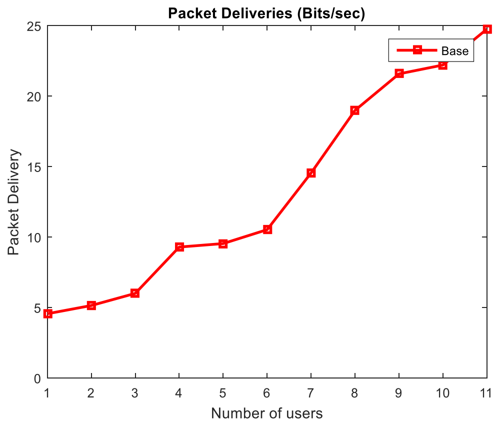

Fig 3. Packet Delivery Rate with EDCA

The above figure shows the packet deliveries in bits per second and shows that the base approach is able to achieve less packet deliveries because of high end to end delays.

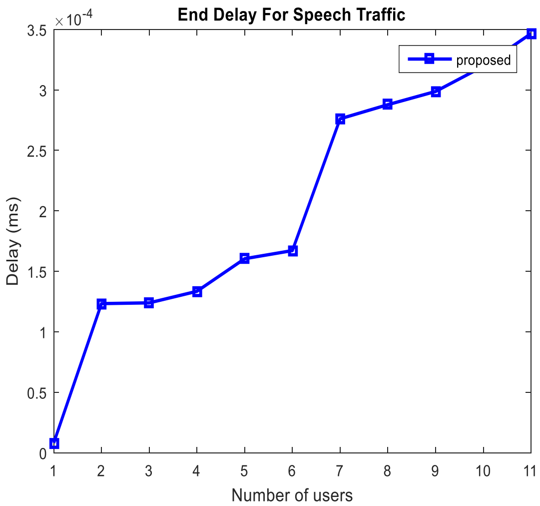

Fig 4. End Delay for Speech Traffic with WRED

The above figure shows the end to end delay using proposed approach and shows that the system is achieving less delay than the base approach and having high packet deliveries.

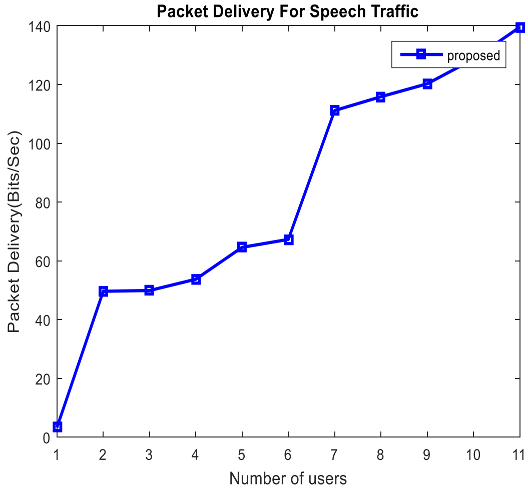

Fig 5, Packet Delivery with WRED

The above figure shows the successful packet deliveries

Parameters	Base	Proposed
End Delay (Video)	0.8 ms	0.0002 ms
End Delay (Speech)	0.79 ms	0.00032 ms

Using proposed approach for speech traffic which shows the low packet losses and low bit error rates and having throughput of the network.

Table 1. Comparison between Existing and Proposed Work

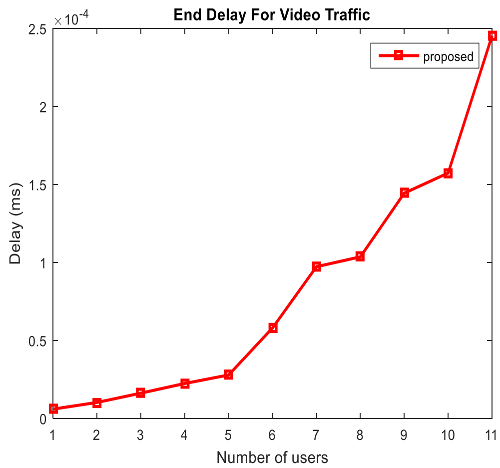

Fig 6. End Delay for video traffic

The above figure shows the proposed end to end delay using for video traffic streams and shows that the system is achieving less delay than the base approach and having high packet deliveries which shows the robustness of the network in handling heavy traffics.

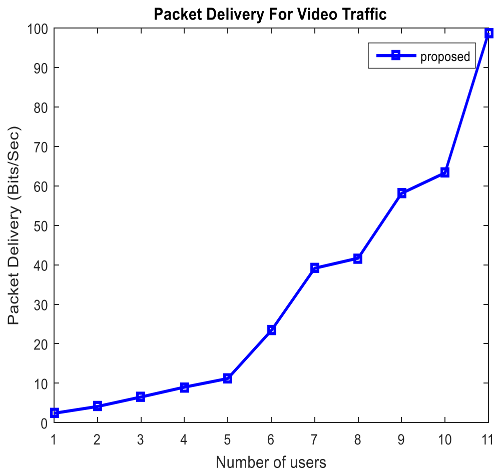

Fig 7. Packet Delivery for video Traffic with WRED

The above figure shows the proposed packet deliveries in bits per seconds which is having high significance in network performance evaluation and shows that the network is achieving less bit error rates.

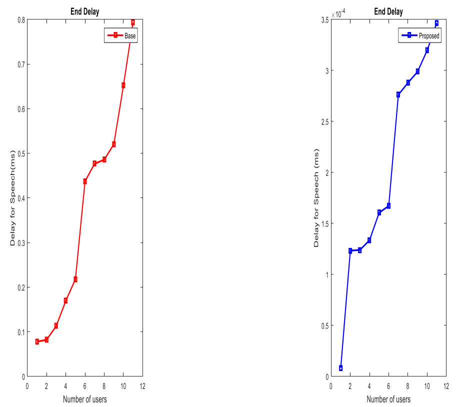

Fig 8. Comparison between existing and proposed work in delay in Video

The above figure shows the comparison of end delays with respect to the number of users for speech traffic and shows that the proposed approach is able to achieve less end delay for high speech traffics than the base approach.

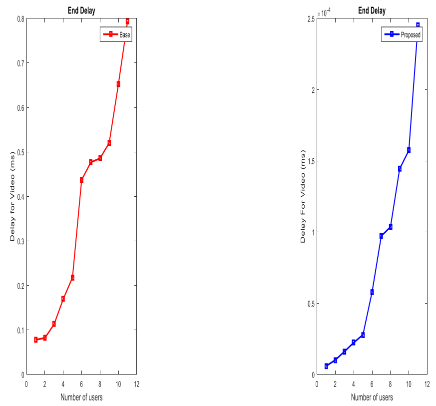

Fig 9. Comparison between existing and proposed work in delay in Speech

The above figure shows the comparison of end delays with respect to the number of users for video traffic and shows that the proposed approach is able to achieve less end delay for high video traffics than the base approach.

VI. CONCLUSION AND FUTURE SCOPE

In conclusion, EDCA delivers contention-free admittance to the station for a period which is well known by a Transmit Opportunity (TXOP). It is a restricted time interval through which a position can send as numerous frames as conceivable as long as the length of the transmissions will not exceed beyond the supreme period of the TXOP. If a length of the frame is too big to be communicated in a solitary TXOP, it must be fragmented into lesser frames. The usage of TXOPs decreases the difficulty of low rate positions gaining an excessive quantity of channel time in the inheritance 802.11 MAC. In this research an efficient scheduling process which is known by weighted random early detection process which will decreases the delay according to the threshold priorities and will work in a hierarchical manner which will be delay efficient and helps in increasing the lifespan of the network with high packet deliveries.

The future work includes analysing the performance of eHCF by dynamically assigning the values for the allocation parameter αACi based on the observed pattern every certain interval. This allocation is used by HC to adjust its transmission schedule on the fly, which provides QoS guarantees to high priority traffic while maintaining reasonable service to low priority traffic. Open problems such as the presence of hidden stations, overlapping basic service sets and multi-hop network scenarios are considered in the future evaluation.

VII. REFERENCES

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