# A Novel Scheme For Optimizing Contention Window Adjustment in IEEE 802.11e Wireless Networks

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***Abstract***— **Wireless LAN 802.11 is one of the widely used specifications for wlan networks.802.11 e has increased its utility and QoS by assigning priorities to different types of data packet .Method employed by 802.11e at its MAC layer specification determines the channel access mechanism ,known as EDCF. The fixed approach of EDCF of increasing the CW size without taking in consideration channel condition results in low performance at high network size. The very fundamental concept of increasing CW according to fixed scale in itself shows lack of dynamic adaption of cw according to network condition .In this paper, we introduce a new technique of determining the size of cw for backoff procedure. The mechanism proposed FHCW does take into account history of previous transmissions and fuzziness present in the channel due to various factors namely-congestion ,sensing credibility of station and priority of packet to be sent .Performance comparison of both the techniques show the capability of proposed scheme.**

***Keywords—IEEE 802.11e; contention window; FHCW; EDCF; Quality of Service (QoS).***

## I. Introduction

Prevalent use of wlan network has made researchers to delve into study and present various techniques to improve its performance and quality of service. IEEE 802.11 e is the widely used wlan specification. Its MAC layer components responsible for the medium access is known as EDCF. EDCF provides a mechanism in which it supports QoS by providing different values for contention window and other parameters for different kind of data to be transmitted.

In this paper, we present a new algorithm of determining contention window for data of different domains .Our technique is fundamentally dependent on network conditions, which act as determining factor for size of contention window. We have used history of transmissions of stations and other factors of priority, congestion and sensing credibility of transmitter. The other deciding factor comprises the use of fuzzy approach. As we know, there are many network parameters whose values are uncertain. We have taken in consideration these by taking fuzzy logic as our tool to include their effect on network in determining cw value. Performance comparison in terms of PDR, throughput reveals the efficiency of our proposal. Section I gives the overview of EDCF. section ii explains the novel mechanism proposed, FHCW. section iii and iv provides the results and discussion of simulations performed.

## II. Introduction to FHCW

In EDCF we deal with various QoS data frames, each one has a access category assigned to it. In our mechanism we also use the QoS data frames and then map them to various access category, which in turn determine their own $CW_{min}$, AIFS. The fundamental idea used to calculate the cw for backoff procedure wholly depends on the current network conditions.

$$CW = CW_{previous} + xy \tag{1}$$

We have used two variables in determining cw in equation (1).In following section we explain the concepts being used.

1. We have used the concept of utilizing the previous transmissions of station to sense channel conditions. The value of channel dependent factor x is adjusted with the history of previous transmissions.
2. The other concept used in setting the value of cw deals with fuzzy logic. In the presented scheme we have taken parameters which govern network condition-congestion, sensing credibility and packet priority to determine the y factor which helps to set the cw at most appropriate value to increase the channel utilization .The fuzzy inference system of matlab used in our scheme is mamdani and centroid as defuzzification method. Congestion factor of network is taken into account using three states (High, Medium, Low).Each of these state is attributed certain degree of membership. The second variable used is sensing credibility which in itself is a dynamic channel parameter .This helps to determine our level of credibility regarding the congestion level. The evaluation of sensing credibility of the station is dependent on two network variables. Sensing of the medium is one way of knowing the network congestion status. Acknowledgment recieval and non recieval by station for its data sent is a way to know whether our sensing conforms to the present variation in traffic .Hence, variable sensing credibility is output of fuzzy inference system consisting two above mentioned inputs. These two input

variables have three ( i.e High Medium, Low) and two (i.e High, Low) states attributed to them respectively.

The third variable factor for adjusting the cw value using fuzzy logic is priority of packet to be sent. Video data packet has to be sent earlier to continue its streaming as compared to a data packet of text mail. This packet priority is calculated using fuzzy terms-high, medium and low.

The output of the system, the variable y , containing fuzziness present in the wireless channel is defined using three states-high, medium, low. Fuzzy rules form the foundation for fuzzy engine. Fuzzy rules profiles have been created for WLAN to serve its requirement for high efficiency and optimum behavior .With the given set of inputs and output of inference system, twenty seven rules have been generated .For instance, with the observation of network parameters and channel dependent variables ,high congestion level and low reported sensing credibility ,fuzzy dependent variable for cw size for text mail data packet(low prioritized) will be medium value.

## III. Simulation And Results

Our simulation results for performance are in terms of throughput and packet delivery ratio (PDR). Simulation for network has been carried out in MATLAB. Throughput explains the utility of wireless medium being attained. As depicted in figure 1 FHCW performance shows significant improvement in utilization of the wireless in comparison to EDCF for variable sized networks.

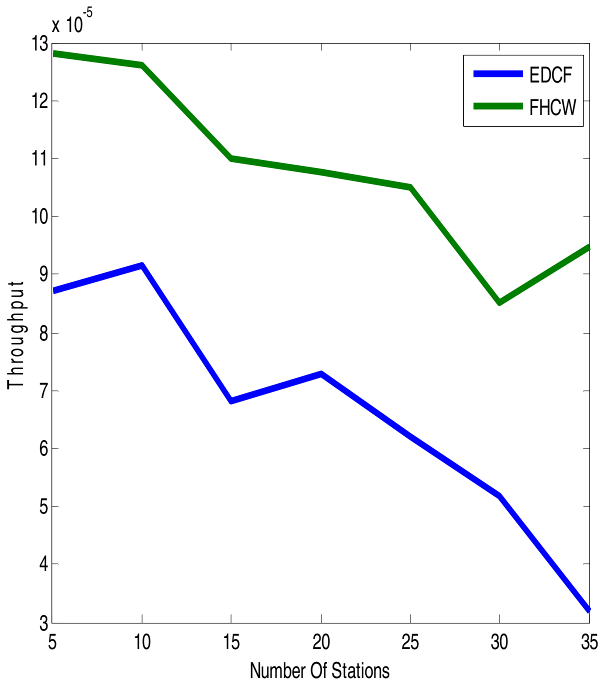


Fig 1.Increased throughput revealed by proposed scheme.

For performance evaluation, throughput has been normalized with respect to channel capacity. In figure 2 PDR ratio of both the mechanisms reveal the efficiency of FHCW over EDCF.

In separate experimental setup we evaluate normalized throughput with respect to increasing data rate being used in wireless LAN.FHCW performs better than EDCF at lower as well as higher data rates. Hence its applicability horizon has potential to produce better throughput in different data rate requirements .

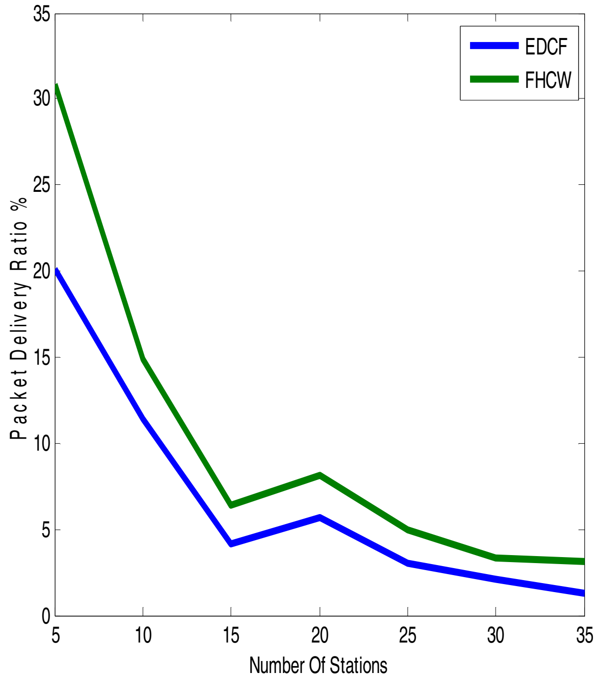


Fig.2. PDR Vs. Network size

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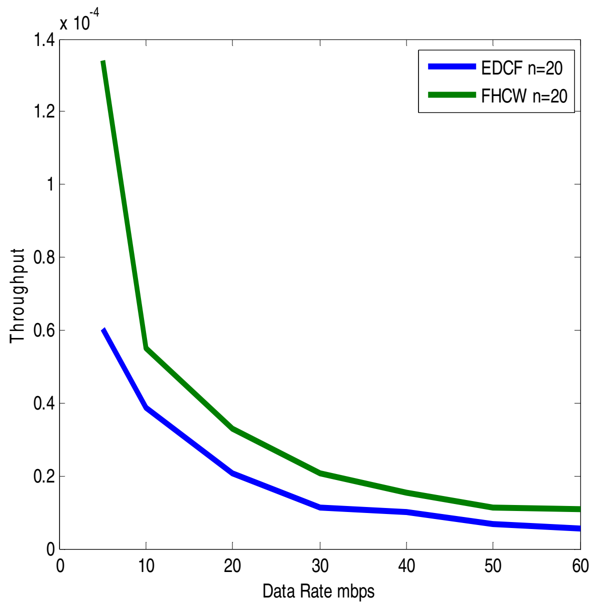


Fig.3. Throughput Vs. Data rate

The equations are an exception to the prescribed specifications of this template. In separate experimental setup we evaluate normalized throughput with respect to increasing data rate being used in wireless LAN.FHCW performs better than EDCF at lower as well as higher data rates. Hence its applicability horizon has potential to produce better throughput in different data rate requirements.

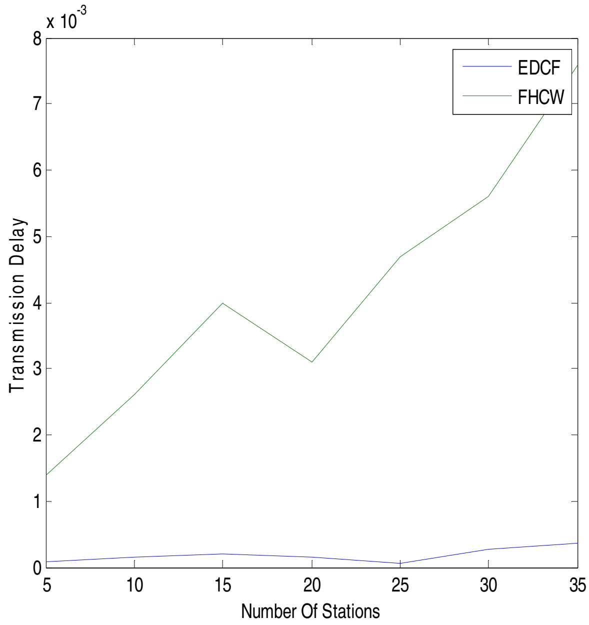


Fig.4 Transmission delay in FHCW.

All the computations performed while taking the network parameters into consideration produce substantial overhead for the processing .In figure 4,we show the compensation which exists in our proposed mechanism in terms of transmission delay. The trade-off that exists between increased efficiency and increased computational time in our proposal is shown affecting transmission delay. On the other hand, EDCF, with its simplicit design offers very little overhead computations.

## IV. CONCLUSION

In this paper we have presented a novel mechanism to optimize the network performance by dynamic adaption of contention window in IEEE 802.11e wireless networks. The proposed scheme evaluates various network parameters for resetting contention window. Simulation results show the competency of FHCW in saturated network environment in comparison to IEEE 802.11e.

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