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# QoS Analysis of Multi Priority DCF Algorithm in Wireless Local Area Network

**Savitri Sharma[1], Vishnu Sharma[2*], Ankur Goyal[3]**

[1]Department of CSE, Yagyavalkya Institute of Technology, Jaipur, INDIA
[2]Department of CSE, Rajesh Pilot Govt. Polytechnic College, Dausa, INDIA
[3]Department of CSE, Yagyavalkya Institute of Technology, Jaipur, INDIA

[*]*Corresponding Author: vishnu061990 @rajasthan.gov.in, Tel.: +91-86194-28507*

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***Abstract***— The network is moving towards the wired to wireless. It has created a great challenge in the design and implementation of the networks. The Medium Access Control (MAC) protocol of the IEEE 802.11 standard plays a major role in the management and coordination of shared channel access and data transmission. This research work focuses on developing new efficient model to enhance the DCF that improves the performance of WLANs. The data rate of the node with packet size is considered and new Multi Priority DCF (MP-DCF Algorithm) is proposed. The proposed scheme decreases the delay and increases the throughput.

***Keywords***— WLAN, DCF, MDCF, Multi Priority DCF, delay, throughput.

## I. INTRODUCTION

A Wireless LAN (WLAN) is a data transmission network that is specially designed to provide the location-independent network access between different computing devices by using radio waves. The wireless networks, developed to provide high data rate to moving or stationary users in a limited geographical region. Wireless networks are superior to wired networks in comparison to flexibility and ease of installation [1].

The IEEE 802.11 protocol enables fast installation, with minimum management and maintenance costs, and is a very robust protocol for the best–effort service in the wireless medium [2]. The IEEE 802.11 standard only covers the two layers - Physical layer PHY and Medium Access Layer (MAC) [3]. Physical layer is responsible for the actual data transmission through the transmission medium. The MAC layer has to perform several tasks. First of all, it control medium access, but it can also support for roaming, authentication, and power conservation. Wireless technologies, particularly IEEE 802.11- based become the first choice by many consumers for home networks [4].

Wireless LAN standard IEEE 802.11gives two modes for wireless channel access [5] Distributed coordination function (DCF) and Point coordination function (PCF). DCF and PCF based channel access is used in WLAN during the CP and CFP, respectively [6]. DCF mode is based on the random access of channel that is suitable for non real-time traffic. PCF mode is based on the polling mechanism that is suitable for real-time traffic.

DCF is implemented in all stations in the wireless local area networks by default. [7]. The DCF mode is based on traditional carrier sense multiple accesses with collision avoidance (CSMA/CA). (CSMA) is a network protocol that listens to or senses network signals on the carrier/medium before transmitting any data [8]. In the DCF mode, there is no central control. Control to the access of channel is distributed among all the stations. In DCF, a host that want to transmit senses the channel to check if it is free or not. On finding the channel free, the host waits for a random amount of time before transmitting to avoid the collision.

The PCF mode works in the Contention Free Period. There is no contention between the stations. Each station transmits data in their allotted time slot. In the PCF mode of operation, the access of the wireless channel is controlled centralized by a polling-based protocol by the point coordinator (PC). This PC is generally called the access points (AP). The PCF mode provides contention-free service to the wireless stations [5]. Wireless Technology with PCF has become one of the important parts of our everyday life [9].

 

The performance of any network is measured in terms of Quality of service (QoS). QoS in the network is the ability to provide good services that satisfy its customers. There are different factors affecting QoS like delay, throughput, jitter, etc. [10].

This paper is divided in five different sections. Section I contains the introduction of the WLAN, IEEE 802.11, DCF, PCF etc. The Section II gives the literature survey. The Section III discuss about the proposed algorithm. Section IV contains the results and their comparison with present algorithm. Section V gives the conclusion of and future scope.

## II. LITERATURE SURVEY

In [1] authors proposed the Enhanced DCF mechanism. The EDCF is an extended version of the basic DCF access Mechanism. Authors in [11] proposed a new method of DCF. The proposed protocol implicitly divides the stations into groups and they compete for the channel only within their group, thus decreasing their collision probability. In [12] authors proposed the new Markov Models for DCF assuming perfect channel conditions. Authors proposed the new method for enhancing the MAC performance of the DCF in IEEE 802.11 wireless LANs in [13]. In [14] authors proposed the Group-Synchronized DCF for Dense IEEE 802.11 Networks, in [15] authors proposed the delayed DCF, in [16] authors proposed ABA-CW algorithm.

In [17] authors proposed a new scheme to improve the QoS. 2-Buffered Packet ICF, which decreases the delay in WLAN. In [18] authors proposed the History Based Adaptive Backoff (HBAB) algorithm. In [19] authors presented the performance evaluation of the IEEE 802.11 Distributed Coordination Function (DCF) in a multi-rate WLAN. In [20] authors proposed the high-performance DCF (HDCF). In [21] authors proposed the Modified DCF. The modified version of DCF called MDCF gives a far better performance for nodes with high data rate. In [22] authors proposed Cooperative communication techniques which enable wireless technologies to overcome challenges. In [23] authors proposed utilizes the real-time statistics from the wireless driver to consider the wireless contention, congestion, and channel loss. In [24] authors proposed to make a solution to detect the most risky and dangerous wormhole attack in the context of mobile Adhoc networks that can drift the normal traffic flow completely.

## III. PROPOSED WORK

In present paper Multi Priority DCF (MP-DCF) algorithm is proposed. In MP-DCF Algorithm packets come from higher layers. There are different nodes in the network. The nodes are classified in the Gold Priority, Silver Priority and Bronze Priority. Now each node has the priority. The priority value '2' indicates that the node sending important data and its packet cannot be discarded. The priority value '1' indicates that the node sending less important data and its packet also cannot be discarded. The priority value '0' indicates that the node is sending data and if required, it can be discarded if space is not available. The data packet is also categorised as important and non-important. MP-DCF Algorithm node can use high data rate, medium data rate and low data rate in the network.

The nodes are divided in to three categories according to the data rate. The packets are forwarded according to the DCF method. Using the MP-DCF Algorithm, the low data rate node is capable to transmit its packets. The total number of packets transmitted by node increases and it increase the throughput of the network.

## IV. SIMULATION AND RESULT ANALYSIS

### *A. Multi Priority DCF Algorithm (MP – DCF Algorithm)*

The numbers of nodes are taken as 10, 50, 100, 150, 200 and 250 and experiment is performed. The delay and throughput is obtained. The delay graph is shown in fig. 1 and throughput graph is shown in fig. 2 for MDCF Algorithm. It is observed that the delay varies from 2244 μs to 2884 μs. The throughput varies from 18.39% to 28.36%.

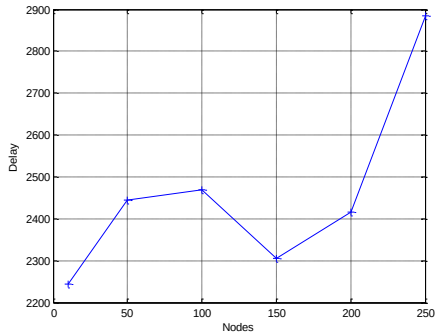


Fig. 1 Delay Graph for MP-DCF Algorithm

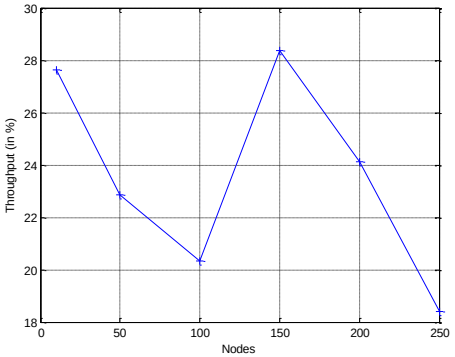


Fig. 2 Throughput Graph for MP-DCF Algorithm

 

*B. Comparative Analysis*

The comparative results for delay are shown in fig. 3. It is observed that there is reduction in the delay in new proposed MP-DCF Algorithm in comparison to the MDCF Algorithm. The proposed algorithm uses the multiple priorities of the nodes. So the large size packets transferred first and delay reduced for such nodes. This also increases the throughput of the network.

The comparative results for throughput are shown in fig. 4. It is observed that there is improvement in throughput in new proposed MP-DCF Algorithm in comparison to the MDCF Algorithm. The proposed algorithm uses the multiple priorities of the nodes. This increases the throughput of the network.

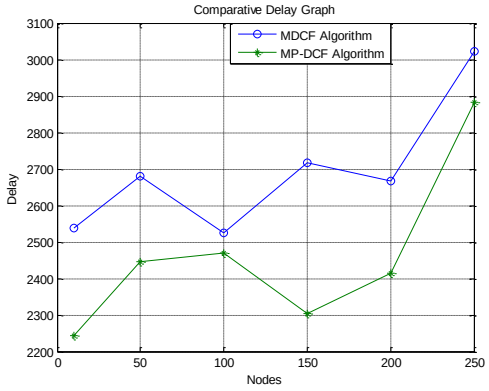


Fig. 3 Comparative Delay Graph for MDCF and MP-DCF Algorithm

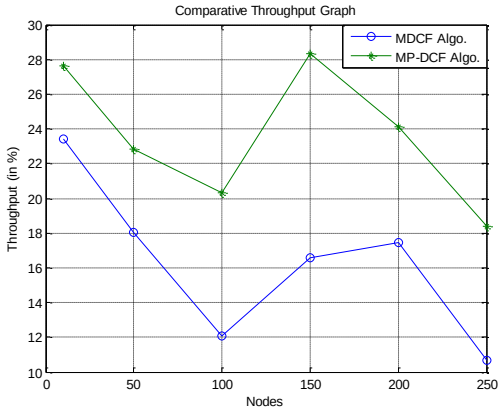


Fig. 4 Comparative Throughput Graph for MDCF and MP-DCF Algorithm

## V. CONCLUSION AND FUTURE SCOPE

In the IEEE 802.11 standard, the Medium Access Control mechanism, responsible for wireless medium access control. This work focuses on deeper and more accurate performance evaluation methodologies required for the DCF in the contention period. In this paper the Multi Priority DCF algorithm is proposed to remove the drawbacks of MDCF. The throughput of MP-DCF algorithm ranges from 17.93 % to 72.03%. The delay reduction varies 2.18% to 15.20%. All results show that there is enhancement in the QoS of WLAN by the MP-DCF Algorithm. The hidden station problems, channel noise, power saving etc. will be considered in future work. The network can be improved.

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## Authors Profile

*Mrs Savitri Sharma* is pursuing his M.Tech from Y.I.T., Jaipur in Computer Science and Engineering. He completed his B.Tech. from Rajasthan Technical University, Kota. His area of interest is VANET, DTN, etc.

*Mr.Vishnu Sharma* pursed B.Tech. and M.Tech. from RTU Kota. Presently he is working as Lecturer(Computer Science) in GPC, Dausa. His area of interest is Wireless network.

*Mr.Ankur Goyal* pursed B.E. from University of Rajasthan, Jaipur and M.Tech. from RTU Kota. Presently he is working as Associate Professor in Y.I.T., Jaipur. His area of interest is Wireless network.

 