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Delay Analysis of Improved Bi - Directional PCF Algorithm in Wireless Local Area Network

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Abstract— In recent years, the IEEE 802.11 based wireless LANs (WLANs) have gained great popularity. The WLAN uses the two mechanisms to access the medium in 802.11 distributed coordination function (DCF) and point coordination function (PCF). To improve the PCF large work is performed by different researchers and new methods were proposed. In this work the Improved BDPCF algorithm is proposed to enhance the WLAN. The scheme is designed and implemented. The results are obtained by performing different experiments. The obtained results are analysed.

Keywords— *WLAN, DCF, PCF, BDPCF, Advanced BDPCF, Improved Bi - Directional PCF Algorithm*

I. INTRODUCTION

Wireless Technology has become one of the important parts of our day to day life. Wireless Technology has influenced the various aspects of the world in many ways. Wireless computing is a fast-growing revolutionary technology which providing users with network connectivity without a wired network. Wireless local area network is today becoming increasingly popular in corporate, residential and hotspot environments [1]. A wireless local area network (WLAN) links two or more devices using wireless distribution method [2]. The basic building block of the WLAN network is the Basic Service Set (BSS). A BSS is defined as a coverage area where all stations within the BSS remain fully connected [3]. Wireless network permits its nodes to communicate with each other wirelessly. It can be designed in two ways [4]: - Infrastructure less Mode or Independent BSS (IBSS) Networks and Infrastructure BSS Networks or Infrastructure Mode [5].

Wireless LAN standard IEEE 802.11gives two modes for wireless channel access [6]–

1. Distributed coordination function (DCF)

2. Point coordination function (PCF)

DCF and PCF based channel access is used in WLAN during the CP and CFP, respectively [7]. 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 [8].

During early years of WLAN deployment, mainly DCF mode was supported in WLAN devices, but in these years, the PCF mode is also recognized and the PCF mode is also supported in new devices like laptops, personal digital assistants (PDAs).

IEEE 802.11 standards define the rules and regulations for communication on wireless local area networks (WLANs). The IEEE 802.11 was the original standard in this family, introduced in 1997. IEEE 802.11 defined for WLANs that operate at 1-2 Mbps. Each extension to the original IEEE 802.11 appends a unique letter to the end of the name. Primary goal of the IEEE 802.11 standard was the specification of a simple and robust WLAN that offers time-bounded and asynchronous services [9]. The IEEE 802.11 standard only covers the two layers - Physical layer PHY and Medium Access Layer (MAC) [10]. The MAC layer is open for the researcher. The medium access techniques are used at the MAC layer.

This paper is divided in five sections. Section I contains the basic introduction of the WLAN, IEEE 802.11, etc. The Section II gives the literature survey which describes the work performed by different authors. The Section III describes about the proposed algorithm for the accessing medium. Section IV contains the results and their comparison with existing work. Section V describes the conclusion of work and future work.

II. LITERATURE SURVEY

Different techniques were proposed by different authors to improve the PCF. These are as following - In [11] authors

proposed an M–M scheme can pick up the VoIP capacity by close to 100%. In [12] authors presented a customized PCF protocol, M-PCF, in this paper to maintain multimedia services and also enhance network performance. In [13] authors proposed a modified PCF which uses a distributed polling protocol (DPP) for sustaining real-time traffic as a substitute of the centralized polling scheme as used in the standard PCF. In [14] authors proposed a modified PCF scheme, called DPCF, which overcomes most of the disadvantages of the current PCF scheme with regards to VoIP, without changing the IEEE 802.11 standard. In [15] authors proposed the Isochronous Coordination Function (ICF) for transmitting the voice packets over IEEE 802.11 WLAN. In [16] authors proposed the Modified ICF is based on the notion of M-M format. The M-M format is used in the downlink stream. In [17] authors proposed a Power-Saving and Robust Point Coordination function (PSR-PCF) for the transmission of VoIP over 802.11. In [18] authors proposed an energy-efficient multi-polling mechanism which merges power management policy with a low operating cost Medium Access Control (MAC) protocol. In [19] authors proposed Distributed Point Coordination Function (DPCF) which extends the process of the Point Coordination Function (PCF) defined in the IEEE 802.11 Standard. In [20] authors proposed a new methodology of bidirectional transmissions in the PCF and DCF in IEEE 802.11 MAC standard in infrastructure WLAN networks. In [21] authors proposed a MAC protocol having bi-directional transmission of fixed duration in PCF (BD-PCF). In [22] authors proposed the Advanced BD-PCF algorithm that is improved version of bidirectional PCF. In [23] authors proposed a network model and an interference model for multiple APs co channel deployment and propose a channel assignment mechanism which formulates the channel assignment problem into a time slot allocation problem. In [24] authors proposed the new scheme, called TOPCF scheme which checks the load of the traffic.

III. Proposed Work

In the Advanced BDPCF [22] some of the problems observed that are as following –

1. All the station nodes are considered with the equal.
2. No priority will be used for the stations.
3. Algorithm uses the transmission of two packets simultaneously. When there are large numbers of packets then this number will be small.

To solve these problems a new algorithm is required.

To remove the limitations of the Advanced BDPCF, a new approach Improved BDPCF is proposed in this work. It is improved version of the Advanced BDPCF.

The network has access point AP and number of station nodes. There is bidirectional communication between these. They communicate using the time clock. In Improved BDPCF packets come from higher layers. Each station node has the priority. The station node will be marked as important or normal node. The priority '1' indicates that the station node is important node. The priority '0' indicates that the station node has no important data and if required, it can be discarded.

Now the proposed scheme uses three packets for the transmission. The AP sends the packets to the station. Three packets transferred to station as shown in fig 3.1. The polled station can then acknowledge the reception of the data packet, by sending three data packet of equal duration of the downlink data packet to the AP. If the polled station has no data to transmit, it only acknowledges (ACK) the data packet, or replies with a null packet whether the AP sent poll packet because of no data for the station. Therefore, the polling overhead can be minimized when the AP has downlink data for the stations in the polling list.

The improvement which is done in the work is that in every time slot assigned to AP, it sends three packets in downlink packet to the stations. The slots are separated by SIFS. The same happens in downlink traffic the station after getting time slot for transmission, the station sends three packets in one time slot to the AP.

IV. Simulation and Result Analysis

A. *Improved BDPCF Algorithm*

Improved BDPCF simulated and the result is obtained. The experiments performed for the station nodes 10 to 100. The size of packets is taken 1500 byte and 3000 bytes. As the nodes increased, the total number of packets increased in the network that increased the delay. The delay ranges from 829 µs to 5520 µs for packet size 1500 bytes. The delay ranges from 1183 µs to 5754 µs for packet size 3000 bytes. The graph for the delay is shown fig. 1.

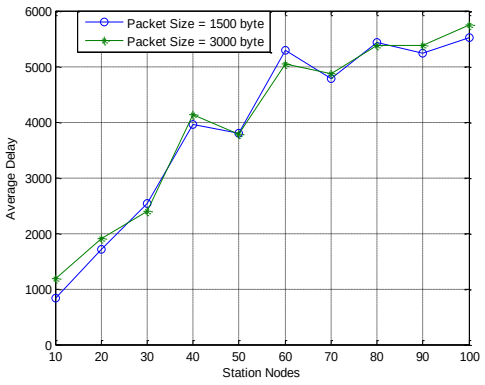

Fig. 1 Average Delay Graph for Improved BDPCF at Packet Size =1500 and 3000 bytes

B. Comparative Analysis

The comparative analysis of delay of Advanced BDPCF and proposed Improved BDPCF is shown in fig 2 and fig. 3 for packet size 1500 byte and 3000 bytes respectively. By observation of fig 2 it is seen that the delay reduces for the proposed algorithm. The same thing is looking in the fig. 3. The proposed algorithm gives the less delay than the present Advanced BDPCF.

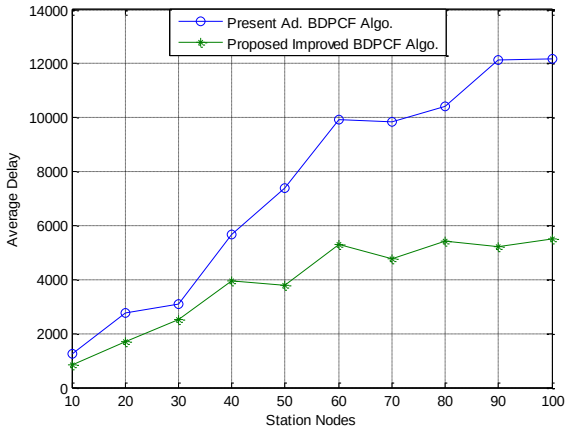

Fig. 2 Comparative Average Delay Graph at Packet Size =1500 byte

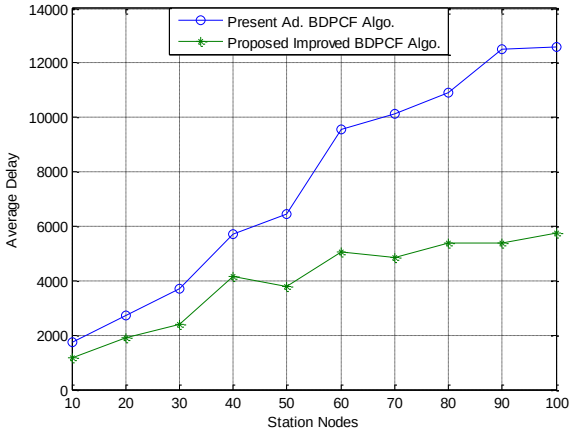

Fig. 3 Comparative Average Delay Graph at Packet Size = 3000 byte

V. CONCLUSION AND FUTURE SCOPE

In this dissertation the Improved BDPCF algorithm is proposed to overcome the limitations of Advanced BDPCF algorithm. The proposed Improved BDPCF algorithm checks the station node priority. It transfers three packets when the time slot is allotted to the station and AP. So, algorithm decreases the delay. The delay reduces from 17.99% to 56.9% for the various nodes for Packet Size = 1500 bytes. The delay reduces from 27.37% to 56.97% for the various nodes for Packet Size = 3000 bytes. The results show that the proposed Improved BDPCF algorithm gives the better results than the existing algorithm. In future the new power saving mode can be added and the network can be improved further.

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