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Performance Evaluation of Wlan by Varying Pcf, Dcf and Enhanced Dcf Slots To Improve Quality of Service

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Abstract :. *Researchers have proposed a number of co-ordination functions in literature for improving quality of service. Each one is based on different characteristics and properties. In this paper, we evaluate the performance of wireless network using PCF, DCF & EDCF. We perform simulations using OPNET IT GURU Academic Edition simulator. In the performance evaluation of the co-ordination function, the protocols are tested under the realistic conditions. Tests are performed for various parameters (Delay, Data Dropped, Throughput) in wireless Networks. This OPNET simulation shows the impact of co-ordination function for wireless networks for different parameters.*
Keywords - *Data Dropped, Delay, DCF, EDCF, PCF, Throughput, Traffic Sent, Traffic Received.*

I. INTRODUCTION

WLAN applications are mainly data centric; there is growing demand for real time services over WLAN [1]. IEEE 802.11 is the most popular standard used in Wireless Local Area Networks (WLANs). The IEEE 802.11 standard has defined two different access mechanisms in order to allow multiple users to access a common channel, the distributed coordination function (DCF) and a centrally controlled access mechanism called the point coordination function (PCF) [2]. The following three basic access mechanisms have been defined for IEEE 802.11: the mandatory basic access method based on CSMA/CA, an optional method avoiding hidden terminal problem, and finally a contention-free polling method for time bounded services. The first two methods are also summarized as Distributed Coordination Function (DCF); the third method is called Point Coordination Function (PCF) [3]. In DCF, data frames are transmitted via two mechanisms, i.e., basic access mechanism and request-to-send/clear-to- send (RTS/CTS) mechanism [5]. In Basic Access Mechanism, Channel remains idle for a period of time Distribution Inter Frame Space (DIFS). The Station generates random backoff interval. It employs discrete-time backoff scale. The Transmission takes at beginning of time slot. Backoff time is chosen between (0, w-1). Backoff time counter decremented to 0.

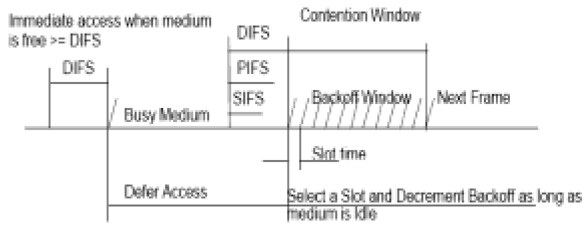

Fig 1: The Timing Relationship of DCF [7]

The RTS/CTS mechanism reserves the medium before transmitting a data frame by transmitting an RTS frame and replying with a CTS frame [6]. The original 802.11 MAC defines another coordination function called the Point Coordination Function (PCF): this is available only in "infrastructure" mode, where stations are connected to the network through an Access Point [4]. The PCF is located directly above the Distributed Coordination Function (DCF), in the IEEE 802.11 MAC Architecture. In this time is divided into contention period (CP) and contention free period (CFP). During CP, transfers used DCF, i.e., Data-ACK, or RTS-CTS-Data-ACK, with exponential back-off etc. During CFP, the AP controls all transmissions. That is, the AP controls which station transmits to the AP and which station receives packets from the AP. All stations can receive packets during the CFP. But the ability to transmit during the CFP is optional. During CFP all durations are set of 2^15, so station set their NAVs accordingly. The CFP ends with an explicit end of CFP frame from the AP. EDCF is designed to provide prioritized QoS by enhancing the contention-based DCF. It provides differentiated, distributed access to the wireless medium for QoS stations (QSTAs) using 8 different user priorities (UPs).

Priority	Access Category(AC)	Designation
1	**0**	**Background**
2	**0**	**Standard**
0	**1**	**Best Effort**
3	**1**	**Excellent Effort**
4	**2**	**Streaming Multimedia**
5	**2**	**Interactive**
6	**3**	**Interactive Voice**
7	**3**	**Reserved**

Table 1: User Priorities

Before entering the MAC layer, each data packet received from the higher layer is assigned a specific user priority value. The EDCF mechanism defines four different first-in first-out queues called access categories (ACs). Each data should be mapped into a corresponding AC Access Classes.

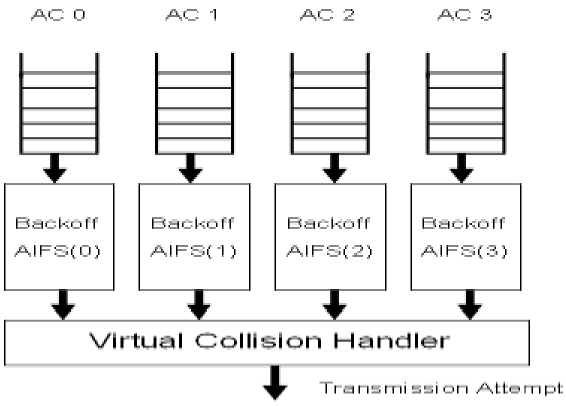

Fig 2: The Timing Relationship of EDCF [7]

After mentioning the introduction in section 1, our approach, scenarios and settings is discussed in section2. In section 3, we have described the result and discussion and finally in section 4, conclude the paper.

II. APPROACH, SCENARIOS AND SETTINGS

OPNET IT Guru Academic Edition is a utility designed with educational purposes in mind, specifically to help users be introduced to the domain of networking. The user can also develop projects by choosing a network scale, then choosing the model family and then making use of an object palette that includes items such as servers, routers, switches and others. Our scenario has eighteen wireless LAN-based workstations in a simple network configuration (Infrastructured BSS) which demonstrates the PCF access method used by the Wireless LAN. PCF provides a contention-free (CF) frame transfer. The medium access during the CF is regulated by the Point Coordinator (PC) which resides in the access point (AP). The traffic flows between the stations have been configured as,

PCF_wkstn 1 <--------> PCF_wkstn 2
PCF_wkstn 3 <--------> PCF_wkstn 4
PCF_wkstn 5 <--------> PCF_wkstn 6
PCF_wkstn 7 <--------> PCF_wkstn 8
PCF_wkstn 9 <--------> PCF_wkstn 10
PCF_wkstn 11 <--------> PCF_wkstn 12
PCF_wkstn 13 <--------> PCF_wkstn 14
PCF_wkstn 15 <--------> PCF_wkstn 16
PCF_wkstn 17 <--------> PCF_wkstn 18

All the PCF related configuration parameters are grouped into a single compound attribute "PCF Parameters". The stations can participate in frame transfers during CF period by enabling the “PCF Functionality" attribute on the work stations.

Fig 3: SCENARIO I

This scenario has eighteen wireless LAN-based workstations in a simple network configuration (Infrastructured BSS) which demonstrates the DCF access method used by the Wireless LAN. DCF provides a contention-Period (CP) frame transfer. The traffic flows between the stations have been configured as,

DCF_wkstn 1 <--------> DCF_wkstn 2
DCF_wkstn 3 <--------> DCF_wkstn 4
DCF_wkstn 5 <--------> DCF_wkstn 6
DCF_wkstn 7 <--------> DCF_wkstn 8
DCF_wkstn 9 <--------> DCF_wkstn 10
DCF_wkstn 11 <--------> DCF_wkstn 12
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DCF_wkstn 15 <--------> DCF_wkstn 16
DCF_wkstn 17 <--------> DCF_wkstn 18

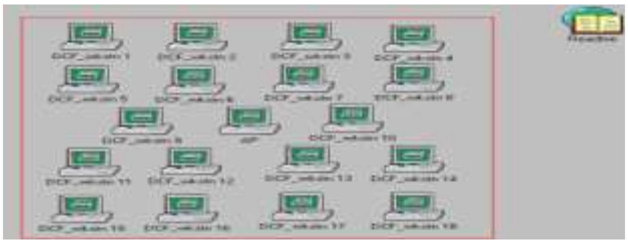

Fig 4: SCENARIO 2

This scenario has eighteen wireless LAN-based workstations in a simple network configuration (Infrastructured BSS) which demonstrates the EDCF access method used by the Wireless LAN. The traffic flows between the stations have been configured as,

EDCF_wkstn 1 <--------> EDCF_wkstn 2
EDCF_wkstn 3 <--------> EDCF_wkstn 4
EDCF_wkstn 5 <--------> EDCF_wkstn 6
EDCF_wkstn 7 <--------> EDCF_wkstn 8
EDCF_wkstn 9 <--------> EDCF_wkstn 10
EDCF_wkstn 11 <--------> EDCF_wkstn 12
EDCF_wkstn 13 <--------> EDCF_wkstn 14
EDCF_wkstn 15 <--------> EDCF_wkstn 16
EDCF_wkstn 17 <--------> EDCF_wkstn 18

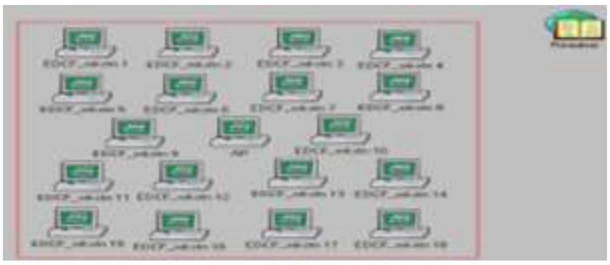

Fig 5: SCENARIO 3

Application	Parameters	Units
WLAN	Channel Reservation	Sec
	Data Traffic Received	Bits/Sec
	Data Traffic Sent	Bits/Sec
	Dropped Data Packet	Bits/Sec
	Retransmission Attempts	Packets
	Load	Bits/Sec

Table 2: Simulated Parameters

III. SIMULATION EVALUATION & RESULT ANALYSIS

Six graphs are selected after simulating our models. All graphs show a combination of the three scenarios. In figure 6, it has been noticed that Channel reservation is better in case of EDCF. Channel reservation with EDCF varies from 33ms to 34.7ms, with DCF and PCF it is 10ms.Therefore it is concluded that the results are better with EDCF.

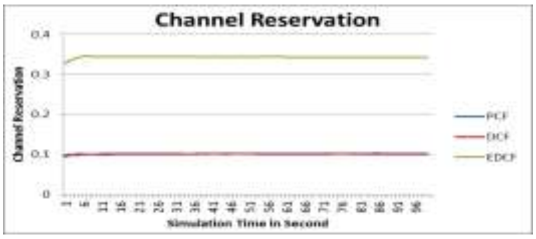

Fig 6: Average Wireless LAN Channel Reservation

In figure 7, it has been noticed that the traffic sent for PCF varies from 659 kb/sec to 677 kb/sec, DCF 662 kb/sec to 675 kb/sec and EDCF 613 kb/sec to 685 kb/sec. Therefore it is concluded that the results are better with EDCF.

Fig 7: Average Wireless LAN Traffic Sent

In figure 8, it has been noticed that the Traffic Received for PCF varies from 27 kb/sec to 10 kb/sec, DCF 139 kb/sec to 149 kb/sec and EDCF 269 kb/sec to 279 kb/sec. Therefore it is concluded that the results are better with EDCF**.**

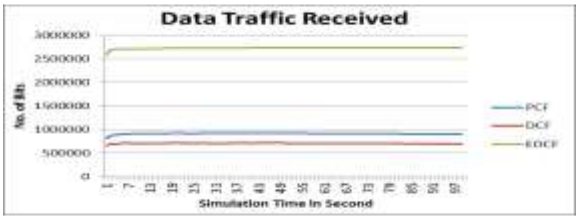

Fig 8: Average Wireless LAN Traffic Received

In figure 9, it has been noticed that the Data Dropped for PCF varies from 0 bits/sec to 2761 bits/sec, DCF 0bits/sec to 625bits/sec and with EDCF varies from 0bits to 397bits and then to149bits. Therefore it is concluded that the results are better with EDCF.

Fig 9: Average Wireless LAN Data Dropped

In figure 10, It have been noticed that the Retransmission Attempts for PCF is 20Packets/Sec, DCF is 17 Packets/Sec and of EDCF is 30 Packets/Sec

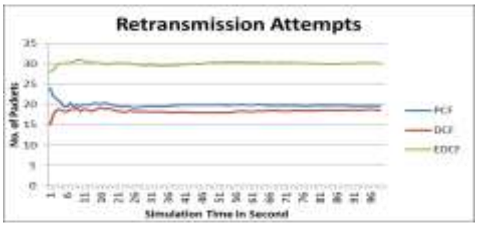

Fig 10: Average Wireless LAN Retransmission Attempts

In figure 11, It have been noticed that the scenario where PCF is used can handle load of the order of 1125kb/sec. that the scenario where DCF is used can also handle load of the order of 1125kb/sec. But with EDCF, It can handle Load upto 1319kb/sec.

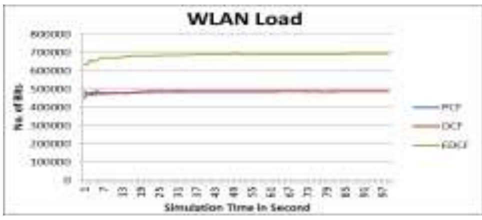

Fig 11: Average Wireless LAN Load

IV. CONCLUSION

This paper investigates campus environment Hybrid Network. In this paper we have checked the performance of wireless Network using PCF, DCF & EDCF co-ordination functions for different parameters like Channel Reservation, Data Traffic Received, Data Traffic Sent, Dropped Data Packet, Retransmission Attempts, and Load. Our investigations have revealed that Network having EDCF co-ordination functions is useful to improve the Quality of Service. Channel reservation with EDCF varies from 33ms to 34.7ms, with DCF and PCF it is 10ms. It has been noticed that the traffic sent for PCF varies from 659 kb/sec to 677 kb/sec, DCF 662 kb/sec to 675 kb/sec and EDCF 613 kb/sec to 685 kb/sec. It has been noticed that the Traffic Received for PCF varies from 27 kb/sec to 10 kb/sec, DCF 139 kb/sec to 149 kb/sec and EDCF 269 kb/sec to 279 kb/sec. it has been noticed that the Data Dropped for PCF varies from 0 bits/sec to 2761 bits/sec, DCF 0bits/sec to 625bits/sec and with EDCF varies from 0bits to 397bits and then to149bits. It have been noticed that the Retransmission Attempts for PCF is 20Packets/Sec, DCF is 17 Packets/Sec and of EDCF is 30 Packets/Sec. It have been noticed that the scenario where PCF is used can handle load of the order of 1125kb/sec. that the scenario where DCF is used can also handle load of the order of 1125kb/sec. But with EDCF, It can handle Load up to 1319kb/sec. Hence Wireless Network having EDCF co-ordination functions is very useful to improve the Quality of Service.

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