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Performance Enhancement Of Conventional Ieee 802.11 Dcf By Improving Contention Window

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Abstract— This dissertation work includes analysis and implementation of conventional DCF protocol and proposed new ENHANCED DCF protocol (EDCF) by improvements in the Binary Exponential Backoff (BEB) algorithm. This Algorithm is as simple as the operation of conventional BEB. In the EDCF, it is try to monitor the performance of network by decreasing the contention window with a backoff factor 1.25 and 1.8. Implementation and simulation is perform by using GLOMOSIM simulator and show the comparision of the performance of EDCF Vs the conventional DCF protocol for different parameters. Simulation result showed that the proposed protocol is performing better than the conventional DCF protocol in terms of throughput and end to end delay.

Key Terms—IEEE 802.11, Multiple Access Control, Binary Exponential Backoff (**BEB**), distributed coordination function **(DCF**).

1. INTRODUCTION

Mobile Ad hoc Networking (MENET) is not a new concept .As a technology for dynamic wireless network, it has been developed in military 1970s.Commercial interest in such networks has recently grown due to the advances in wireless communication. A new working group for MENET has been formed within the Internet Engineering Task Force(IETF)[5],aiming to investigate and develop standard Internet routing support for mobile, wireless IP autonomous segments and develop a framework for running IP based protocol in ad hoc network. Some of the researches that is done in the field of Medium Access Control (MAC) in ad hoc networks.

- IEEE 802.11
- The 802.11 MAC Sub layer
- 802.11 Distributed Coordination Function(DCF)
  a) Conventional DCF
  b) Enhanced DCF
- Inter Frame Spaces Defined In IEEE 802.11

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1.1 IEEE 802.11

The IEEE802.11 MAC protocol is the first international standard for wireless local area networks (WLAN) [6].

The 802.11 logical architecture contains several main components: station (STA), wireless access point (AP), ndependent basic service set (IBSS), basic service set (BSS), distribution system (DS), and extended service set (ESS).

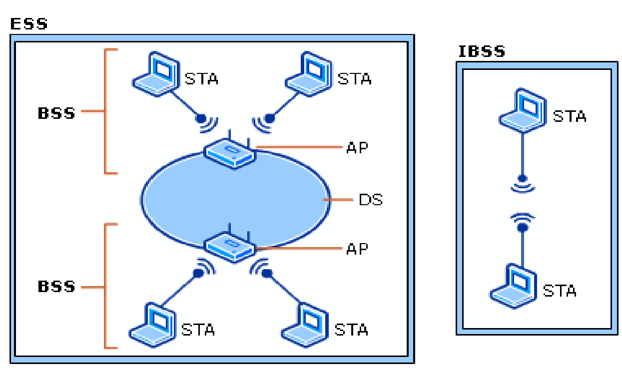

Fig 1: The 802.11 Architecture

1.1.1 IEE802.11 layer Architecture

IEEE 802.11 refers to a family of specifications developed by the IEEE for wireless LAN technology .The protocols used in all the 802 variations ,including 802.3(Ethernet) have certain common features. The physical layer corresponds to the OSI physical layer fairly well .But the data link layer in all the 802 protocols are split into two sub-layers .It is upon the Media access control(MAC) sub-layer to determine how the channel is allocated or who gets to use the channel next. Above it is the Logical Link Control(LLC) sub-layer whose job is to make the 802 variants transparent to the network layer.MAC layer contain the Distributed Coordination Function (DCF) and Point Coordination Function (PCF) as two main component of its architecture.

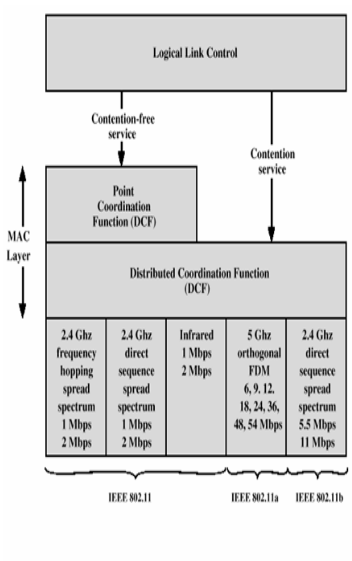

Fig 2: IEE802.11 Layer Architecture

1.2 The 802.11 MAC Sublayer

The characteristics of the 802.11 MAC sub-layer protocols is completely different from that of traditional Ethernet mainly due to the complexity of the wireless environment With Ethernet sensing the medium and detecting collisions is far more easier. The wireless medium has certain inherent problems such as the hidden and exposed nodes problem. Since all stations are not within radio range of each other. In general, the wireless networking can be implemented in two different operating modes: infrastructure and ad hoc modes. The infrastructure mode consists of an access point (AP) co-ordinating the operation of the other nodes in the network with each client station communicating through it. The system can be extended by having a system with multiple access points. In the Ad-hoc mode essentially eliminates the need for an access point. In this mode, the mobile nodes can be connected in a dynamic topology in an arbitrary manner. All nodes of these networks behave as routers and take part in discovery and maintenance of routes to other nodes in the network. The 802.11 defines two modes of operation ,the first is the mandatory Distributed coordination function(DCF) and the second is the optional Point Coordination Function(PCF).The DCF operates in the ad-hoc mode without any central coordination whereas the PCF uses a base station or Access Point to control the activities of its cell.

1.3 802.11 Distributed Coordination Function (DCF):

The basics access method of the IEEE802.11 MAC protocol is the Carrier Sense Multiple Access With Collision Avoidance (CSMA/CD)[4].

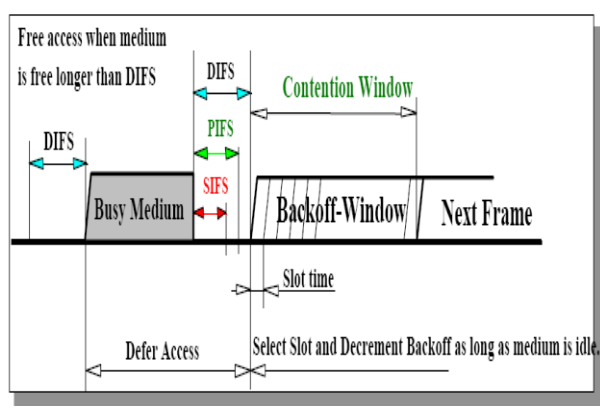

Fig 3: Basic Access Method CSMA/CA

- Stations wait for medium to become free
- Random back-off after a defer period to avoid collisions.
- Exponential back-off window increases for retransmissions.
- Back-off timer elapses only when medium is idle.
- Implement different fixed priority levels.
- Allows immediate responses and PCF co-existence.

Interframe Space (IFS) Values

- **Short IFS (SIFS)**
  Shortest IFS
  Used for immediate response actions
- **Point coordination function IFS (PIFS)**
  Midlength IFS
  Used by centralized controller in PCF scheme when sing polls
- **Distributed coordination function IFS (DIFS)**
  Longest IFS
  Used as minimum delay of asynchronous frames contending for access

This section briefly summarizes the DCF as standardized by the 802.11 protocol. For a more complete and detailed presentation,refer to the 802.11 standard [1].

A station with a new packet to transmit monitors the channel activity. If the channel is idle for a period of time equal to a distributed interframe space (DIFS), the station transmits. Otherwise ,if the channel is sensed busy (either immediately or during the DIFS), the station persists to monitor the channel until it is measured idle for a DIFS. At this point, the station generates a random backoff interval before transmitting (this is the Collision Avoidance feature of the protocol), to minimize the probability of collision with packets being transmitted by other stations. In addition, to avoid channel capture, a station must wait a random backoff time between two consecutive new packet transmissions, even if the medium is sensed idle in the DIFS time.1 For efficiency reasons, DCF employs a discrete-time backoff scale. The time immediately following an idle DIFS is slotted, and a station is allowed to transmit only at the beginning of each slot time. The slot time size, is set equal to the time needed at any station to detect the transmission of a packet from any other station. As shown in Table I, it depends on the physical layer, and it accounts for the propagation delay, for the time needed to switch from the receiving to the transmitting state (RX_TX_Turnaround_Time), and for the time to signal to the MAC layer the state of the channel (busy detect time). DCF adopts an exponential backoff scheme. At each packet transmission, the backoff time is uniformly chosen in the range(0-w-1) . The value w is called contention window, and depends on the number of transmissions failed for the packet. At the first transmission attempt, is set w equal to a value CWmin called minimum contention window. After each un-successful transmission,w is doubled, up to a maximum value $CWmax=2^{m}CWmin$. The values CWmin and CWmax reported in the final version of the standard [1] are PHY-specific and are summarized in Table I.

The backoff time counter is decremented as long as the channel is sensed idle, “frozen” when a transmission is detected on the channel, and reactivated when the channel is sensed idle again for more than a DIFS. The station transmits when the backoff time reaches zero[2].

TABLE I

SLOT TIME, MINIMUM, AND MAXIMUM CONTENTION WINDOW VALUES FOR THE THREE PHY SPECIFIED BY THE 802.11 STANDARD: FREQUENCY HOPPING SPREAD SPECTRUM (FHSS), DIRECT SEQUENCE SPREAD SPECTRUM (DSSS), AND INFRARED (IR).

PHY	Slot Time(σ)	CW_{min}	CW_{max}
FHSS	50μs	16	1024
DSSS	20μs	32	1024
IR	8μs	64	1024

1.3.1 CONVENTIONAL DCF WITH BEB ALGORITHM

The operation of the BEB algorithem can be summarized as follows:

CW = min [2*CW, CW_{max}], upon collision..(1)
CW = CW_{min} , upon success………(2)

1.3.2 EDCF ALGORITHM

In EDCF, the contention window size (CW) is increased by a backoff factor *ri > 1* whenever a packet is involved in a collision, and is decreased by a backoff factor *rD* > 1 if a packet is transmitted successfully.

EDCF backoff algorithm can be expressed as follows:

CW = min[*ri *CW*, CWmax], upon collision,………..(3)
CW = max[CW/*rD*,CWmin] , upon success,…………(4)

where CWmin and CWmax are the minimum and the maximum contention window sizes, respectively.The backoff mechanism of EDCF with **ri = 2 ,rD = 1.8** when CWmin = 31 and CWmax = 1023. Note that for the given CWmin and CWmax these backoff parameters ***ri* = 2** and ***rD* = 1.8**

2. RESULT AND DISCUSSION

The new protocol was tested for different backoff value.It was found that the value 1.25 and 1.8 gave better *performance* as compared to conventional DCF protocol..A series of simulations were performed and the new protocol was tested against the conventional protocol for parameters such as throughput and Average end-to-end delay.

2.1 Throughput Analysis

The graph was plotted between no. of nodes Vs throughput. It shows that Improved protocol with back off factor rD= 1.8 perform better then the conventional DCF and 1.25 protocol for all the values of nodes except 40.The new protocol also gave higher throughput for all the value of nodes greater then 40.Where as throughput for conventional DCF and rD=1.25 shows lower values, as the node density is increases. However new protocol gave highest throughput at node 30.

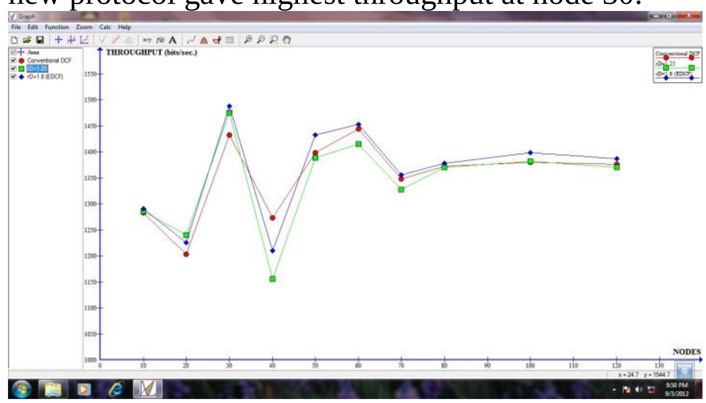

Fig 4: No. Of Nodes Vs Throughput(bits/sec)

2.2 Average End To End Delay Analysis

The graph shows that the new protocol gaves better results by showing lowest ETED for all values of nodes .Though the result of new protocol with backoff factor rD=1.8 shows considerably less delay as compare to backoff rD=1.25 and conventional DCF up to node 20 to 60.The delay is significantly lower at node 70 as compared to 1.25 and conventional protocol. At node 70 the new protocol shows the best result by giving lowest delay as compaired to others.

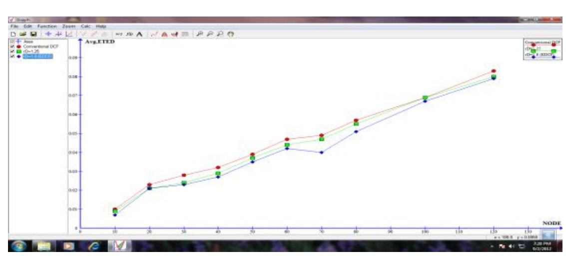

Fig 5: No. of Nodes Vs Avg. End To End Delay

3. CONCLUSION

In this work,a new DCF protocol known as EDCF by modifications in Binary Exponential Backoff algorithm has been proposed. Different values of Backoff factor were tested and compared against the conventional IEEE802.11 DCF protocol. The following conclusion were drawn after analysis of throughput and end to end delay.

- The new protocol gave higher throughput for all the value of nodes .Where as throughput for conventional DCF gave lower values,as the node density is increases.However new protocol gave highest throughput.
- For end to end delay the new protocol gives better results by showing lowest ETED for all values of nodes.

REFERENCE

[1] IEEE Standard for Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Nov. 1997. P802.11.

[2] IEEE Journal on selected areas in communications, VOL. 18, NO. 3,MARCH 2000 ,535 Performance Analysis of the IEEE 802.11 Distributed Coordination Function Giuseppe Bianchi.

[3] G. Bianchi, L. Fratta, and M. Oliveri, "Performance analysis of IEEE.

802.11 CSMA/CA medium access control protocol," in *Proc. IEEE* PIMRC, Taipei, Taiwan, Oct. 1996, pp. 407–411.

[4] The Institute of Electrical and Electronics Engineers, Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) specifications, 20 August 1999.

[5] G.V.S Raju and G. Hernandez, "Routing in Ad hoc network," in proceedings of the IEEE-SMC International Conference, October 2002.

[6] O'Hara, B.and Petrick, A., The IEEE802.11 Handbook A Designer's Companion, IEEE Presss, 1999.

[7] Imrich Chlamtac ,Marco Conti,Jennifer J.N Liu Mobile ad hoc networking: imperative and challenges,school of engineering, university of Texas at Dallas, dallas, TX, USA, b Institute IIT,Consiglio Nazionale delle Ricerche, pisa, Italy, C Department Of Computer Science, University of Texas at Dallas,Dallas, TX, USA. Ad Hoc Networks 1 (2003).