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Performance Improvement In MANET By Using A Modified BEB Algorithm

Aparna S. Mankar[1], Mangla S. Madankar[2]

[1]ME Student, Wireless Communication & Computing, GHRCE Nagpur
[2]Assistant Professor, Department Of Computer Science and Engineering, GHRCE, Nagpur

Abstract: ***IEEE 802.11 MAC protocol is the de facto standard for wireless local area networks (LANs), and has also been implemented in many network simulation packages for wireless multi-hop ad hoc networks. MANET is a bound of movable nodes in point to point manner tide by wireless link. IEEE 802.11 medium access MAC used the binary Exponential backoff (BEB)which doubled backoff value for every collision which results in large variations in backoff counter, ultimately leading to unfairness problem and low throughput. This algorithm is used to monitor the stations where how many nodes try for accessing the wireless link. Therefore here we are using the new algorithm called as modified BEB algorithm that uses the logarithmic increment rather than exponential extension of window size. Modified BEB algorithm provides high priority traffic separation, and also guarantees values for both the average access delay and the contention window size and also achieves higher throughput in a mobile ad hoc environment. So this modified Binary Exponential Backoff (M-BEB) algorithm which will improve channel access fairness and channel throughput and also covered the contention window mechanism. In which nodes based on number of transmission that is on successful and unsuccessful transmission.***

Keywords: 802.11; DCF (Distributed Coordination Function), MAC (Medium Access Control), BEB (Binary Exponential Backoff), CSMA/CA, modified BEB algorithm

1. Introduction

To provide an efficient and robust network in a wireless environment for a collection of Stations, the IEEE 802.11 working groups have chosen the Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA) protocol as the standard protocol for wireless local area networks (LANs). The CSMA/CA protocol is a random access protocol that is subjected to collisions. In the case of a collision, each mobile station executes the Binary Exponential Backoff (BEB) retransmission algorithm to resolve the collision and maintain the stability of the CSMA/CA channel. Armed and commercial applications can be greatly benefited by efficiently using WLANs. In a WLAN, Transmission of packets takes place in an unsynchronized fashion. Conflicts are minimizing & the shared channel is properly coordinated if MAC access control (MAC Layer) employs the protocol..There for the need for an effective mac protocol is adamant. In WLAN all connecting nodes are communicating via a shared transmission channel (medium). The MAC layer provides two mechanisms (DCF & PCF) for controlling the access of shared channel, PCF is an option mechanism but DCF is mandatory. Due to the common transmission channel collision of packets is the very common in WLAN. The carrier sensing multiple access/collision avoidance (CSMA/CA) protocol and the binary exponential backoff (BEB) algorithm are two main components of DCF that are used to avoid collisions of packet

A. Operational mode of conventional DCF

In 802.11, DCF can be named as a fundamental access method which is working in order to facilitate asynchronous data transfer on best effort basis. As specified in the standards [1] that the DCF must be tolerable and enforceable to all the workstations within a Basic Service Set (BSS). DCF is primarily based upon CSMA/CA. The station is unable to listen to the channel while transmitting, that is the reason why CSMA\CD is not used. In 802.11 CS is performed at Physical Layer also called as Physical Carrier Sensing and MAC layer also termed as Virtual Carrier Sensing. [5] [10]. DCF allows medium sharing between nodes using CSMA/CA protocol. Two channel access mechanisms are used in DCF: Basic Access Mechanism & RTS/CTS Mechanism. In basic access mechanism, on successful transmission, after a receiving of packet, the receiver node transmitted a positive MAC acknowledge (ACK) to sender. It is also known as two way handshaking mechanism. In RTS/CTS, before sending a packet, the sender node tries to reserve the channel. If the channel is idle, the sender sends an RTS frame first after receiving the RTS receiver send back CTS frame after the SIFS. After that actual packet is transmitted & ACK response occurs. [1][7]. (For more details about DCF please use following reference [1][2][7].

2. Comparative Analysis

A. BEB ALGORITHM: In BEB algorithm it is used for displaying nodes temporally. At particular interval it works but after that it leads to problem of unfairness.

B. I-BEB ALGORITHM: It is improved BEB and it improves the quality of service in less amount of traffic. It has a problem of higher delay and jitter.

C. E-BEB ALGORITHM: It is enhance BEB algorithm and work on throughput. But in this case it creates the complexity between communications.

Table 1: Comparative Analysis

Types of algorithms	*Advantages*	*Limitations*	*Conclusion*
BEB Algorithm	Display nodes temporally.	Leads to problem of unfairness	Less efficient
I-BEB algorithm	Improve quality of service in less amount of traffic.	Higher delay and jitter	More efficient than BEB algorithm
E-BEB algorithm	High throughput as well as stability between all traffic in MANET.	E-BEB takes higher complexity stems.	More efficient than I-BEB algorithm.

3. Binary Exponential Backoff Algorithm

DCF adopts an exponential backoff scheme. The back-off time for every packet transmission is chosen within the range of 0, CW-1 and in a uniform fashion. The value "CW" is termed as Contention Window and it drastically depends upon the number of unsuccessful transmission for the chosen packet. For the first transmission initially put the value of CW to CWmin. Also termed as minimum contention window and after every transmission that becomes unsuccessful the value of "CW" is doubled reaching to a maximum limit of: CWmax = 2m * CWmin. The back off time counter continually gets decremented until the channel is sensed in an "Idle" state. It goes in "Frozen" State when a transmission is catched the channel and when the channel is shows its path idle it goes to the reactivated state for more than a DFIS. As soon as the back-off time reaches zero the station starts the transmission [1][2][3][7]. Back off time for basic DCF is Random ( ) * (Slot Time) where Random ( ) is given by the following mathematical formula: Random ( ) =2i+k -1. Where i (initially equal to 1) is the transmission attempt number and k depends on the PHY layer type and Slot Time is a function of physical layer parameters. When the value of "i" ranges to the upper limit, the random range (CWmax) remains the same and when a packet is successfully transmitted, the CW is reset to CWmin. Value of CWmin=31 and CW max=1023. With 802.11 standard, the chosen value for CW is CWmin = 31, CWmax =1023 and for k we took the value 4 because the min value of CW is equal to 31 (i.e. 2i+4 for i=1) the value become 31,and i takes values from 1 to 6 (i = {1, 2, 3, 4,5, 6}) (i.e. i=6 gives the CW=1023), So after each collision the possible CW is {31, 63, 127, 255, 511,1023}.

4. Problems with Existing Architecture

DCF is used in order to resolve collision through Contention Window and backoff time. As stated in the original standard, if there occur successful transmission the BEB stage set the initial value again, that is 0 and ultimately the size of CW will also resume to CWmin regardless of network conditions such as the number of nodes which tries to accessing the medium". Substantial performance deprivation occurs when the number of competing nodes rises & causes a new coalition between the nodes. For example, let us assume that the current backoff stage is „i‟ with contention window CW(i) = 2i * CWmin, and after a successful transmission, the next backoff stage will be stage 0 with contention window CW(0) = 31 according to the specification. But if the number of competing nodes is large enough (>>31), the new collision will likely occur at the backoff stage 0. The main argument is that since the current backoff stage is „i‟ some collision must have occurred recently at the previous stage. Now if the number of current competing nodes is larger than or close to CW(i), and if the backoff stage is set to 0, there is a high probability that new collisions will happen. So resetting the contention window after every successful transmission is an inefficient approach if the number of nodes is large. The workings of BEB algorithm are as:

Contension window = Min [2*CW,CWmax]…….collision
Contension window = CWmin ………………… success

The operation of the existing DCF protocol can be summarized from the following figure.

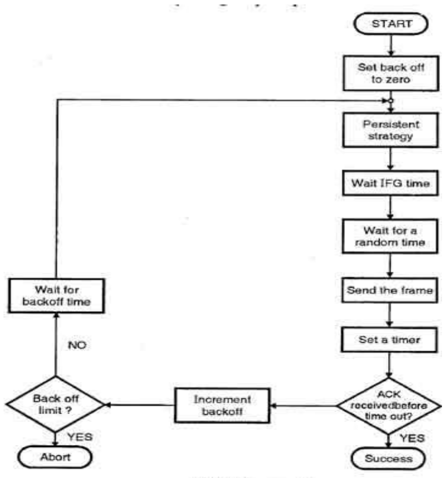


Figure 1: Flow of BEB algorithm

5. Modification in BEB Algorithm

The IEEE 802.11 DCF is based on CSMA/CA (carrier sense multiple access with collision avoidance) technique and adopts a slotted BEB (binary exponential backoff) as a stability strategy to share the medium. But its contention window resetting mechanism degrades the performance of a network. (Already described in section IV). In this section, we propose four schemes to modify the CW size after a transmission & Collision to investigate the performance of the IEEE 802.11 DCF. On collision we use the shift schemes (i.e. left shift and right shift) to increase the CW size & on successful transmission we modify the default resetting scheme of 802.11 to according to the code shown below. We explore our simulation using following schemes.

Scheme 1 Description:

Our first Scheme is based on adding 3 to two bits left shift of the variable CW, where the number 3 replaces the two bits equal to zero after shift operation. So for this scheme Random ( ) becomes Random ( ) =2(2i+3) -1. By using this scheme the number of retransmissions attempts decreases from six to four as compared to BEB. Number of retransmission after each calculation is {i=1, 2,3,4}.When i becomes 1 the value of CW will 31(i.e. the min value of CW),and when i becomes greater than 3,CW will reset to 1023(i.e CW max).So after each collision, possible CW values are {31,127,511,1023). Scheme 1: Adding 3 to two bits left shift Voi-d inc_cw ( ) { CW = (CW << 2) +3 If (CW > CW max CW = CW min; { } On a Collision……

Scheme 2 Description:

In our second scheme is based on adding 3 to 2 bits right shifts of the variable CW, where the number 3 is used to replace the 2 bits equal to one after shift operation. The rest of the procedure is similar as described in scheme 1. Scheme 2: Adding 3 to two bits Right shift Void inc_cw ( ) { CW = (CW >>2) +3 If (CW > CW max CW = CW min; } On a Collision……

Scheme 3 Description:

In our third Scheme we have added 7 to three bits left shift of the variable CW, where the number 7 is used to replace the three bits equal to zero after shift operation and Random( ) becomes. Random ( ) =2 (3i+5) -1. The number of retransmissions attempts after each calculation decreases by this scheme. Number of retransmission is (03) (i= {0, 1, 2}), and when i become greater than 1, CW is reset to 1023. So after each collision, possible CW values are: {31, 255, 1023}.

Scheme 4 Description:

In our fourth scheme is based on adding 7 to 3 bits right shift of the variable CW, where the number 7 is used to replace the 3 bits after shift operation. The rest of the procedure is similar as described in scheme 3. Scheme 4: Adding 7 to three bits Right Shift Void inc_cw ( ) { CW = (CW >> 3) +7 If (CW > CW max) CW = CW min; } On a Collision… Code for Resetting CW since the transmission was successful: This code will remain same for all Schemes from Scheme 1 to 4.

Void Dec_cw( ) { If (CW>CW max) CW=CW/2; } On Success...

Where CW=Current Contention Window. CW min= Minimum Size of contention window. CW max=Maximum size of contention window.

6. Result

A. MANET scenario: This is the MANET scenario, in this nodes are arranged in peer to peer wat and there is no centralized administrator or base station. It has unpredictable topology because it can join or leave the network and also has autonomy that is it can be self organized.

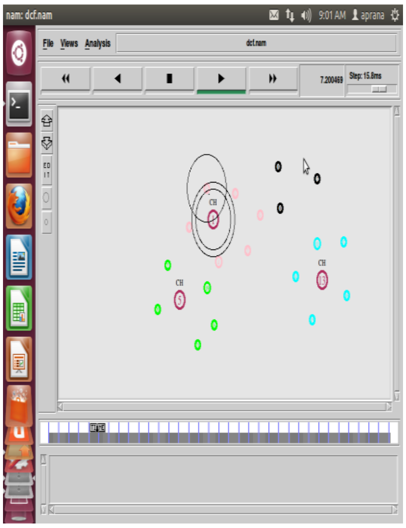


Figure 2: MANET scenario

B CLUSTER:

Clustering is a grouping of similar or identifiable area such as contiguous area which leads to similar services.

1. Clusters have common challenges and opportunities.
2. Similar level of technology and structures.

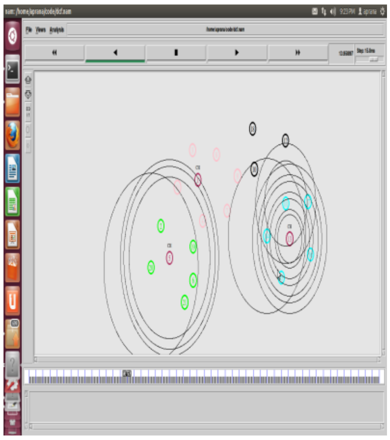


Figure 3: Cluster Formation

C BEB algorithm: Here the rate of packet collision is more which results into more delay and less throughput of system. Here the size of contension window is increased for every collision.

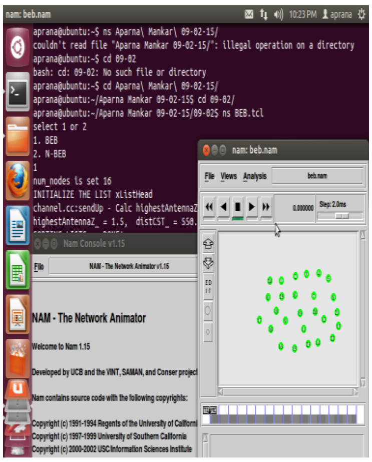


Figure 4: BEB algorithm

D Modified BEB algorithm: Here in BEB algorithm, which backoff value for every collision which results in large variations in backoff counter, ultimately leading to unfairness problem and low throughput so to overcome this a new algorithm called as modified BEB algorithm is used. Here used the logarithmic mechanism to reduce the window size.

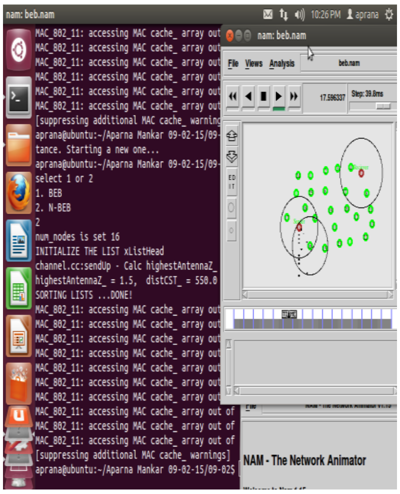
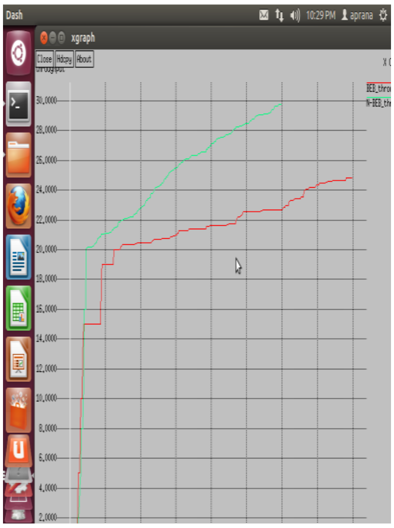


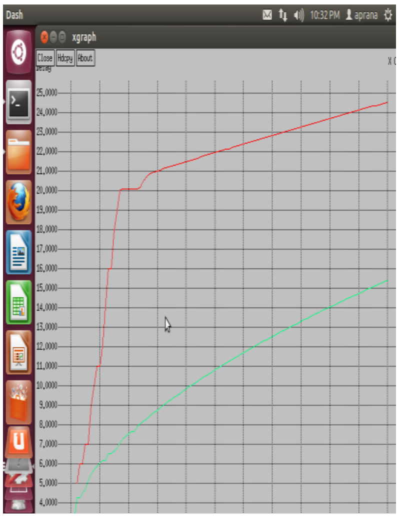
Figure 5: Modified BEB algorithm

E Graph of throughput of BEB AND N-BEB algorithm:



Graph 1: Throughput Graph

F Graph of delay of BEB AND N-BEB algorithm:



Graph 2: Delay Graph

7. Conclusion

Our aim is to improve the throughput in more amount of traffic and also to reduce the delay time in wireless communication by using the BEB algorithm. we also analyze some parameters such as packet sent, packet drop, and average throughput under the mobility and number of nodes which trying the accessing the same channel with compared to DCF that is distributed co-coordinating.

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