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A MODEL TO SUBJUGATE TCP STARVATION FOR WIRELESS MESH NETWORKS

Sk.MANSOOR RAHAMAN[1] , B.RAMESH BABU[2], A.VENKAIAH NAIDU[3], K.RAJASEKHARA RAO[4]

[1]Student, Department Of CSE, K.L.university
[2]Assoc.Prof, Department Of CSE, K.L.university
[3]Student, Department Of CSE, K.L.university
[4]Principal, K.L.university

ABSTRACT

wireless mesh networks is an emerging technology in wireless communications, it provides high speed internet access at low cost. In basic topology of wireless mesh network the node which is two hop away from the gate way will starves compared to the nodes which are in direct contact with gate way node. The nodes which are one hop away from gateway node will have high through put compare to the nodes which are two hops away. So in this bandwidth is utilized by all the nodes efficiently so we are proposing an algorithm known as fair binary exponential backoff algorithm, to reduce starvation and utilization of bandwidth efficiently by all the nodes irrespective of their position and hop distance from the gateway.

KEYWORDS: *FBEB, MAC, WIRELESS MESH NETWORKS, TOPOLOGY, GATEWAY*

I. INTRODUCTION:

Coordination of medium access:

This is the key component of a MAC protocol, which involves many different tasks depending on what type of MAC protocols need to be designed. for a reservation based MAC protocol, the key task is to assign resources such as codes, time slots, subcarriers or channels, to users such that the network throughput is maximized, but their QOS is also satisfied. To this end, many other algorithms in the physical layer need to be considered, for example, power control, adaptive coding and modulation, etc. in addition, functions in the network and transport layers also need to be considered. for example, a TDMA MAC may impact slow start performance of TCP owing to the significant differences of round trip time (rtt) before and after resource allocation these demands imply that cross-layer design between MAC and other protocol

Layers are important.[12][1]

II. Random Access MAC:

for a random access MAC protocol such as csma/ca, the key issue is to find out the best solution for minimizing collision and fast recovery from collision in case it still happens. Since no reservation is available, collision becomes severe when the number of users increases, and thus significantly degrades the throughput performance. No QOS can be guaranteed. However, random access MAC protocols have two main advantages. First is their simplicity. No separate signaling and reservation schemes are needed in the protocol. Second is the compatibility with connectionless (datagram) networks such as the internet.[3]

On the contrary, a reservation-based MAC protocol always has the problem of how to do integration with a connectionless network. for example, if a TDMA MAC is used, whenever a tcp session starts, it has to wait for the allocation to be done. such a delay is not tcp-friendly, because tcp assumes that the network is congested before even resource allocation is completed. Another example is when video traffic is sent through a TDMA MAC into the internet; the MAC has no way of knowing its bandwidth and QOS requirements. Without such information, reservation cannot be correctly done, unless adaptive resource

Estimation and dynamic time slot allocation are designed interactively. however, a random access MAC protocol does not have any of these problems, because a packet starts its transmission process as it arrives.[4]

Network formation and association. This component is actually the network management part for a MAC protocol. it takes care of network formation and association/

Disassociation of a node to/from the network when a node joins/leaves the network. This is particularly important for WMNS. Without network formation and association, network nodes cannot recognize each other and accordingly start their MAC protocol. A MAC protocol can be implemented in two types of architecture. In the classical implementation architecture, a MAC protocol is implemented in software (MAC driver), firmware, and hardware. Usually, packet queuing, network formation, node association, and so on, are done in the driver. Timing critical functions, e.g., time slot generation, back off procedures, etc., are performed in the firmware. The actual real-time operation of the MAC protocol is done in the hardware. for example, when a back off counter is determined, the exact decrement of this counter is done in the hardware in order to achieve high accuracy. thus far, many companies have tried to pull more functions in the firmware into the driver level so that the driver has more freedom to control/modify the MAC protocol. this type ofme thod is usually called a “soft MAC” implementation. However, since many key functions are still located in firmware, the timing critical part of the MAC protocol is hard to modify. owing to the mesh networking topology, the design of a MAC protocol for WMNS is more challenging than that for a single-hop wireless network such as cellular networks or infrastructure based wireless LANS. Thus, a lot of research has been carried out to develop new MAC protocols for WMNS. In parallel with these efforts, several standards groups, in particular, IEEE 802 standard committees are driving the standardization of the technologies for WMNS in all areas ranging from personal area networks, local area networks, and metropolitan area networks, to even larger scale networks. the MAC protocols for WMNS can be classified into two categories: single-channel and multichannel MAC protocols which we will cover in the next sections is zero, then transmission can be started from this node, since the destination node will still be able to receive a packet correctly.

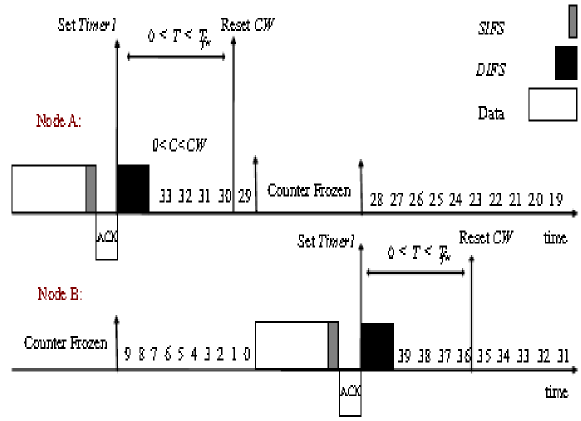
Improve virtual carrier sense. Virtual carrier sense can effectively reduce hidden nodes, but also cause more exposed nodes. In order to reduce the number of exposed nodes, directional virtual carrier sense is needed. a directional virtual carrier sense is proposed in to ensure that the operation of virtual carrier sense based on request to send/clear to send (rts/cts) matches the scenarios when both directional and Omni-antennas exist in the same network. However, when all nodes use Omni directional antennas, directional virtual carrier sense schemes similar to directional backoff needed to be developed. Such schemes rely on the availability of topology information, and cooperation between neighboring nodes.

• Dynamic tuning of backoff procedure. The backoff procedure can be modified in different ways. First of all, a different backoff instead of binary exponential backoff can be used. However, it is not preferred, since it is not compatible with csma/ca specified in IEEE 802.11. Another scheme is to assign different minimum and maximum contention windows for different nodes in the network. However, how effective this scheme can be to improve throughput performance is questionable. a scheme that dynamically tunes the contention window is proposed . in this scheme, the backoff is approximated by p-persistent backoff. Based on this model and also the estimated number of active stations in the network, the optimal persistence factor pmin is determined. With pmin, the contention window is computed as 2/pmin − 1. Simulations showed that this scheme could effectively improve throughput performance of csma/ca. in this scheme, each node is assumed to have packets to send following the poison process. In addition, the active stations can be estimated. Moreover, the optimal persistent factor can be calculated based on the estimated number of active stations, estimated collisions, estimated idle periods, and so on. all these assumptions do not really match a real network, in particular in a WMN environment. We establish the existence of, and analyze the extent of, starvation in two-hop and three hop scenarios where a node is at most two or three hops from the GW. Specifically, we consider the interference model where some adjacent nodes are within carrier sensing range but are not within transmission range of each other. This is a common situation when a WMN is employed to provide network connectivity in dense environments such as a university campus. The contributions we propose a simplified Markov chain model to analyze WMNS with linear topology and numerically compute the degree of unfairness between nodes.

III. Fair Binary Exponential Backoff Algorithm:

We propose a fair binary exponential backoff (FBEB) algorithm to reduce the extent of starvation. Our proposed algorithm uses the intuition that, to improve fairness, Mesh nodes that have successfully transmitted a data packet should not be permitted to eagerly transmit more data packets. By delaying the transmission of successive packets we are able to reduce the degree of starvation. This effect is achieved by adapting the contention window

For transmissions in the IEEE 802.11 protocol.[12]



Algorithm 1 Fair Binary Exponential Backoff (FBEB) algorithm: Executed by each node $n \in \mathcal{N}$ in the network.

```
T_fw = 5;
K_succ = 4;
DIFS = 2 timeslots + SIFS;
CW_min = 31;
CW_max = 1023;
CW_n = CW_min;
k_n = 0;
while node n has packet to send do
  repeat
    Sense the channel continuously;
  until (The channel is idle for a DIFS)
  Choose C randomly in (0, CW_n);
  while (The channel is idle) do
    Decrease C;
  end while
  Send packet;
  flag = 1;
  while flag do
    if ACK received then
      Choose T randomly in (0, T_fw);
      Set Timer1 to T;
      k_n = k_n + 1;
      if k_n > K_succ then
        Reset Timer1
      end if
      flag = 0;
    else if ACK timeout then
      k_n = 0;
      if CW_n < CW_max then
        CW_n = 2 × CW_n;
      else
        CW_n = CW_min;      //Reset CW_n
        Drop the packet;
      end if
      flag = 0;
    end if
  end while
end while
Timer1 Reset Procedure:
CW_n = CW_min;      //Reset CW_n
```

Fig: Fair Binary Exponential backoff Logarithm[12]

IV. CONCLUSION:

Since many data transmission sessions in the Internet do not last very long, short-term starvation can dramatically degrade the quality of service provided by the network. We proposed a simple MAC layer technique, called FBEB algorithm, which was shown to alleviate the starvation in short-term sessions. Our proposed FBEB algorithm can increase the channel usage by the nodes farther to the GW about 7 times at the expense of losing 20% in total throughput. The proposed FBEB algorithm also resulted in a higher fairness index when compared with the CSP and Idle Sense schemes.

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[12] Flow Starvation Mitigation for Wireless Mesh Networks Keivan Ronasi, Sathish Gopalakrishnan, and Vincent W.S. Wong Department of Electrical and Computer Engineering The University of British Columbia, Vancouver, Canada e-mail: {keivanr, sathish, vincentw}@ece.ubc.ca

Sk.Mansoor Rahaman received b.tech degree from affiliated college of JNTU Hyderabad in 2010 and he is currently pursuing his master's degree in computer networks and security from K.L.University (2010-2012). His research interest are wireless mesh networks and wireless sensor networks.

Venkaiahnaidu.Adapa received b.tech degree from JNTU kakinada affiliated college of JNTU Kakinada in 2009 and he is currently pursuing his masters degree in computer networks and security from K.L.University (2010-2012). His research interest are cognitive wireless mesh networks.