MPR MAC Protocol for Distributed WLANs: A Review

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***Abstract*—**Wireless LANs are facing increasing demands for higher data rates and greater spectral efficiency. Asynchronous MPR (Multi-Packet Reception) refers to the capability of networking nodes for decoding signals from a number of source nodes concurrently. MAC (Medium Access Control) protocols incorporated acknowledgements in it which acts as a reference model. Enhanced protocol with changes on the back off timer control to reduce the acknowledgement delays and increase system throughput. An accurate analysis includes expressions for the saturation throughput, packet dropping probability average head-of-line packet delay. The problem of acknowledgment delays arises when multiple nodes transmit without the channel becoming idle in asynchronous MPR. Nodes independently access the channel so long as the number of ongoing transmissions. In this paper, we analyze protocols for distributed wireless LANs.

***Keywords*—**Medium Access Control, Multi-Packet Reception, Wireless LANs

I. INTRODUCTION

The Medium Access Sub layer (MAC) considers broadcast networks and their protocols is how to determine who gets the channel when many users want to transmit over it and their occurrence in order to benefit from MPR. The MAC should keep the distributed manner in which nodes access the medium at the same time, as this is a key reason behind the success of the IEEE 802.11 MAC.

Code division multiple access (CDMA), successive interference cancellation (SIC), or multiple antennas supports signal processing techniques. Wireless receivers are capable of decoding multiple simultaneous transmissions. This has been referred to as thematic-packet reception (MPR) capability [2]–[9].

The problem of overlapping is overcome by use of MPR in an asynchronous set up can; in fact, delay the transmission of an ACK by the AP. Different nodes can start packet transmission at different time slots as well as overlap without any idle period. Now, the AP will have to continue transmission and receive packets even after a particular node completes its transmission. So that, the transmission of an ACK byte AP, which is a half-duplex node, can get significantly delayed. The availability or absence of an ACK makes a node update its back off parameters and ACK delays can degrade system throughput and increase packet transmission delays. In MPR, increase the system throughput and reduce the transmission delays we propose a novel acknowledgment-aware protocol.

II. LITERATURE

A. Review

Author suggested, MPR was first considered in [8], [10] for slotted ALOHA. Time is divided into discrete intervals. A computer is not permitted to send whenever it has data to send. Instead it is required to wait for the next available slot. But CSMA was not modeled. In Non-persistent CSMA (Carrier Sense Multiple Access), a station senses the channel before sending. If no one else is sending, the station begins doing so itself. In case the channel is already in use, it waits a random time and then repeats the algorithm. In 1-Persistent CSMA/CD (Carrier Sense Multiple Access with Collision Detection), a station wants to transmit listens carrier sense. If it is busy then waits until it goes idle, otherwise it transmits. In case two or more stations simultaneously begin transmitting on an idle cable they will collide. They detect a collision stations abort their transmission. This is very important enhancement. By doing this, saves time and bandwidth. After stations wait for a random time and repeat the whole process. CSMA/CD is widely used on LANs in MAC sub layer such as Ethernet, Token Ring, Token bus etc. An adaptive MAC protocol for MPR that maximizes the expected number of transmitted packets per slot successfully and also takes into account quality of service requirements was proposed in [5]. A simpler variant based on collision resolution was proposed in [11]. A similar objective was achieved in [4] for space division multiple access systems (SDMA) that use multiple antenna APs. Advantage of this process supports MPR which results in increased throughput when compared conventional single packet reception. Drawback of this process requires a central controller which can't handle the system when more and more nodes are added.

MPR with CSMA was analyzed in [12]. A node uses channel sensing to determine whether the channel can support more ongoing transmissions and then transmits accordingly.

Advantage of this process improved transmission rate and reduced probability of collision due to channel sensing. Drawback of this process is delay due to the absence of ACKs and timer-based back off mechanism.

CDMA (Code division multiple access (CDMA) is a channel access method and used by various radio communication technologies. It is an example of multiple accesses, where transmitters can send information simultaneously over a single communication channel. It allows several users to share a band of frequencies. To permit this without undue interference between the users, CDMA employs spread-spectrum technology and a special coding scheme.

Timer-based back off protocols for IEEE802.11 WLANs with MPR were considered. But in asynchronous scenario, transmissions by multiple nodes can only start simultaneously, is assumed and achieved by modifying the request-to-send (RTS) and clear to-send (CTS) handshaking procedure of IEEE 802.11. However, reduced delay due to back off mechanism. There are some limitation on the possible gain from using MPR and limitation on practical adaptability due to overheads of the RTS/CTS.

A distributed asynchronous MPR model allows overlapping packet transmissions to start at different times hence there is no need to maintain the synchronization which exploited the fact that a multiple antenna node can estimate the number of transmissions, was recently analyzed by Babich and Comisso in [16] using Markov chains. Node continues to decrement its back off timer and transmits even when it senses the channel to be busy so long as the number of transmissions is less than or equal to a threshold; else, it freezes its timer. Drawback is significant reduction in throughput and increased delay due to improperly modeled ACKs.

III. MULTI-USER MIMO

MIMO [15], in which an asynchronous MAC protocol that allows starting their transmissions without waiting for the completion of all the ongoing transmissions in multi-user MIMO WLANs by sender. The channel efficiency of multi-user MIMO WLANs can be dramatically improved under this asynchronous channel access protocol, whenever a node notices space that assists more simultaneous packet receptions; it can start a new transmission although transmissions still exist. We provide a Markov chain model for throughput performance of our proposed asynchronous MAC protocol. As a result of simulation demonstrates how the proposed channel access mechanism. So that, mechanism can improves aggregate uplink throughput performance in WLANs with multi-user MIMO technology.

IV. SYSTEM MODEL

The paper first points out that in an asynchronous MPR MAC protocol, ACKs may get delayed. This delay in the reception of ACKs, which is absent unconventional DCF and synchronous MPR protocols, can degrade the system performance. We compare two asynchronous MPR MAC protocols, both of which incorporate ACKs in the single receiver scenario. The first protocol is interpretation of how ACKs can be incorporated in the model analyzed in [16], and serves as a reference. In the second protocol, the MAC rules, which determine when a node should freeze or decrement its back off timer, are modified to reduce the ACK delays and increase system throughput. In it, nodes freeze their bakeoff timers once the number of transmissions in the channel reaches the MPR capability of the AP or once any node completes the transmission of its packet. This ensures that a node, which has just finished transmitting its packet, waits for no more than one packet duration to receive an ACK.

We analyze the scenario where the nodes incorrectly estimate the number of transmissions in the channel. Protocols are quite robust to imperfect estimation. Finally, the paper develops a general; renewal theoretic fixed-point analysis for asynchronous MPR MAC protocol that explicitly takes ACKs into consideration. The analysis can handle the ideal case with perfect estimates.

V. CONCLUSION

On following points we can make enhancement to the proposed technique to achieve better performance. We can extend the concept of protocol to the multiple transmitter-receiver pairs. So that, we can achieve better throughput and reduce the delay. In this paper, we analyzed an asynchronous MPR MAC protocol that uses carrier sensing in conjunction with the back off timer mechanism is inherently distributed in nature and tackles the MPR capability well and a rule that reduces the delays and increases the system throughput. The analysis will be generalized to the practical scenario where a node may incorrectly estimate the number of ongoing transmissions. In the future, we would like to implement the same technique to the multiple transmitter-receiver pairs.

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