Enhancing the MAC backoff mechanism in WLANs

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***Abstract*—Carrier Sense Multiple Access with Enhanced Collision Avoidance (CSMA/ECA) is a totally distributed, collision-free MAC protocol for WLANs capable of achieving greater throughput than the current contention mechanism in WLANs. It does so changing to a deterministic backoff after successful transmissions, ensuring an empty slot for each successful contender on every cycle. This work details a first hardware implementation of CSMA/ECA using commercial hardware and OpenFWWF. Results reveal the increase on the achieved throughput due to the better collision avoidance mechanism.**

***Index Terms*—CSMA/ECA, WLAN, MAC, Collision-free, OpenFWWF.**

I. Introduction

Carrier Sense Multiple Access with Enhanced Collision Avoidance (CSMA/ECA) is a totally distributed and collision-free MAC protocol for WLANs. It manages to build a collision-free schedule by instructing successful contenders to pick a deterministic backoff, B_d, after successful transmissions. Collisions are handled as in the Distributed Coordination Function (DCF, which is the current MAC for WLANs):

- If the transmitter does not receive and *ACK*nowledgement (ACK) from the receiver of an specific transmission, a collision is assumed.
- The colliding node(s) increment its(their) backoff stage in one ($k \in [0, m]$, where m is the maximum backoff stage of typical value $m = 5$) and pick a random backoff, $B \in [0, CW(k)]$; where $CW(k) = 2^k CW_{\min}$ is the Contention Window at backoff stage k, and $CW_{\min}$ is the minimum contention window with typical value $CW_{\min} = 16$.

In Figure 1, four *STA*tions (STA) are involved in a contention to access the channel using CSMA/ECA. The horizontal line is a time abstraction composed of empty slots and transmissions. Each empty slot decrements the backoff in one, so the numbers indicate how many empty slots are left for the expiration of the corresponding STA's backoff. The red outline points out that STA 3 and STA 4 picked the same random backoff and will eventually collide. Upon collision, these two stations will recompute a random backoff.

It is not until a node is able to make a successfull transmission that it changes to a deterministic backoff. In Figure 1, STA 4 is able to successfully transmit after the random backoff expires, and then it generates a deterministic backoff ($B_d = 7$) for further transmissions. This way CSMA/ECA builds a collision-free schedule for successful transmitters.

References

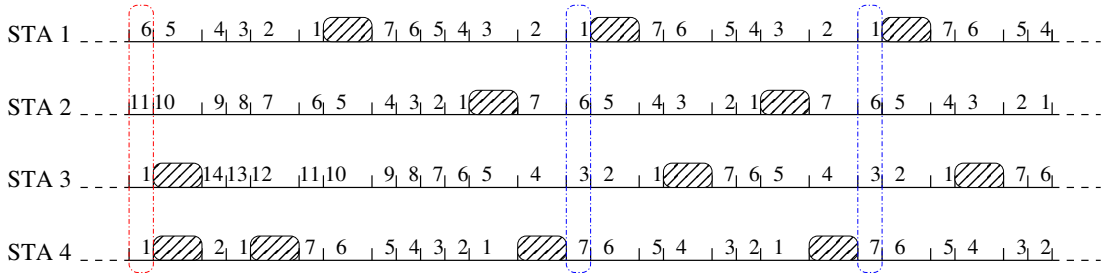

Fig. 1. CSMA/ECA with four stations in saturation. ($B_d = 7$.)