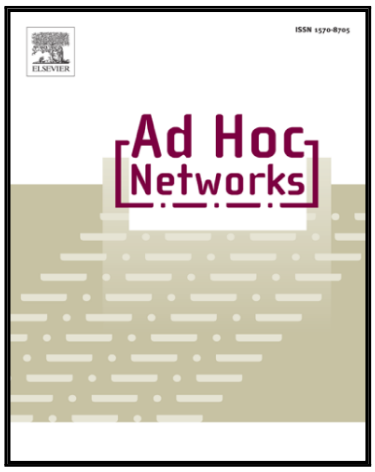

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Abstract

The ability to perform traffic differentiation is a promising feature of the current Medium Access Control (MAC) in Wireless Local Area Networks (WLANs). The Enhanced Distributed Channel Access (EDCA) protocol for WLANs proposes up to four Access Categories (AC) that can be mapped to different traffic priorities. High priority ACs are allowed to transmit more often than low priority ACs, providing a way of prioritising delay sensitive traffic like voice calls or video streaming. Further, EDCA also considers the intricacies related to the management of multiple queues, virtual collisions and traffic differentiation. Nevertheless, EDCA falls short in efficiency when performing in dense WLAN scenarios. Its collision-prone contention mechanism degrades the overall throughput to the point of starving low priority ACs, and produce priority inversions at high number of contenders.

Carrier Sense Multiple Access with Enhanced Collision Avoidance (CSMA/ECA) is a compatible MAC protocol for WLANs which is also capable of providing traffic differentiation. Contrary to EDCA, CSMA/ECA uses a contention mechanism with a deterministic backoff technique which is capable of constructing collision-free schedules for many nodes with multiple active ACs, extending the network capacity without starving low priority ACs, as experienced in EDCA. This work analyses traffic differentiation with CSMA/ECA by describing the mechanisms used to construct collision-free schedules with multiple queues. Additionally, evaluates the performance under different traffic conditions and a growing number of contenders. Furthermore, it introduces a way to eliminate Virtual Collisions (VC), which also contributes to the throughput degradation in EDCA WLANs. Simulation tests are performed using voice and video packet sources that emulate commonly used codecs. Results show CSMA/ECA outperforming EDCA in different commonly-found scenarios with high number of users, including when both MAC protocols coexist in the same WLAN.

Keywords: Wireless LAN, Multiaccess Communication, Collision-Free, QoS, EDCA

1. Introduction

Wireless Local Area Networks (WLANs or WiFi networks [1]) are a popular solution for wireless connectivity. Ranging from computers to wearable devices, it has widespread adoption. Unlike other wireless technologies, the medium in WLANs is shared. Every user having a packet to transmit must join a contention for the channel, whose winner will gain access and attempt a transmission. The Distributed Coordination Function (DCF) is based on Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA)[1], it coordinates access to the wireless channel in a completely distributed way by deferring each contender's transmission for a random backoff period.

WiFi's increasing adoption coupled with the envisioned multi-media, real-time, and bandwidth-hungry future use cases push the need for mechanisms to prioritise traffic in order to ensure Quality of Service (QoS) in dense scenarios with many nodes [2, 3]; i.e., to provide advantageous conditions for

[1] DCF and CSMA/CA will be used interchangeably throughout the rest of the text.