Overview

In the future, we expect wireless communications to be in widespread use. We imagine a future where many people own wireless devices running information sharing or other network hungry applications in large highways, conference halls or office buildings, yielding networks with very large number of active nodes. Vehicular networks in particular impose harsh conditions for wireless communications due to high mobility levels and rapid topology changes. Such factors make efficient Medium Access Control (MAC) a high priority.

Contest-based MAC protocols have been proven well suited for such conditions but in order to support such extreme demands, the collision resolution algorithm needs to be highly efficient to minimize the collision probability for all network sizes, impose a low overhead to maintain high throughput and, ideally, be network topology independent.

Multi-Carrier Burst Contention

We propose a high performance solution termed MCBC, based on active contention through node elimination, with the following main components:

- **Tweaked OFDM PHY.** With minor modifications to the standard IEEE 802.11a PHY, a subset of the 52 OFDM subcarriers set can be used by the MAC to send and sense very short and unmodulated bursts of energy, forming the basis of the active contention algorithm.

- **Synchronization.** To further reduce contention overhead, contention sessions are synchronized through an external source (e.g. GPS clock) or using MAC control frames (e.g. beacons).

- **Active contention algorithm.** A node elimination algorithm lies at the base of the contention scheme where contender nodes are eliminated by referee nodes by activating and sensing subcarrier bursts (i.e. non-modulated subcarriers).

Characteristics and Advantages

- **Low contention overhead.** The modified PHY ensures that no data encapsulation is needed at the MAC and no symbol modulation is needed at the PHY, thus drastically reducing the global turnaround time.

- **Low collision probability.** The contention scheme using both the time and frequency domains is able to finish with a unique contention winner with a very high probability, as the number of contenders decrease exponentially.

- **Hidden node handling.** The protocol inherently deals with hidden nodes as early as the contention session due to its feedback nature.

- **Fairness.** All nodes use the same contention parameters so fairness and no-starvation are statistically ensured.

Other Applications

- Since hidden nodes are handled before any MAC frames are transmitted, the throughput can be increased by as much as 30% (depending on the bitrate) by dropping the RTS/CTS scheme.

- Adaptive versions to maintain an even lower collision probability can be implemented with little increase in hardware complexity.

- Strict and relaxed QoS can be achieved by mapping the traffic categories and statistical round-robin schemes onto the subset of OFDM subcarriers used for contention.

- The fast convergence and lack of message exchange allow the proposed contention algorithm to be used in fast leader election protocols.

Based on


http://www.cl.cam.ac.uk/research/dtg