

802.11ad Sector Selection for Vehicular Networks based on Fine-Grained Geolocation

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IEEE 802.11ad is a WiFi standard aimed at leveraging the large 2.16 GHz-wide channels available in the 60 GHz frequency band. It uses highly directional beamforming to mitigate the high propagation loss inherent to the high frequencies used, and thanks to constructive multipath it has been shown to achieve indoor ranges up to 50 m. It has been shown that 802.11ad links can be used outdoors for vehicular communications, but ranges tend to be very short when few or no reflectors are present. However, while carrying out vehicular experiments with mobility, we consistently observed communication ranges of up to 30 m. In this work, we observe in detail the sector choice in vehicular environment.

We conducted a series of V2I experiments, using two vehicles and COTS 802.11ad equipment. Our analysis of the data reveals several 802.11ad sector selection inefficiencies that emerge in a V2I scenario: (1) an unnecessarily high amount of Sector Level Sweeps (SLSes); and (2) a 'ping-pong' sector selection pattern, in which one or both peers oscillate between the same two sectors in consecutive SLSes, during relatively large periods. Our trace-based simulations show that these inefficiencies can lead to a loss of throughput.

In order to mitigate these issues, we explore a sector selection algorithm for vehicular networks based on fine-grained geolocation and feeds off past data collected on the same location to further improve sector selection. We evaluate two simple proposals and show that SLS-based sector choice can be improved upon for vehicular communications.