Simulation and Performance Evaluation of Tone-Based Directional MAC Protocol in Ad Hoc Networks

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ABSTRACT

The installation of the directional antenna system in a wireless ad hoc network can substantially assist in reducing the co-channel interference and improving the data transmission efficiency as well. The benefits of using directional antenna are that the network system can be able to increase the spatial reuse, coverage range and subsequently network capacity. The use of directional antenna in an ad hoc network requires new approach in design of a MAC protocol to fully exploit these benefits. Among several IEEE 802.11 based MAC protocols designed for an ad hoc network equipped with directional antenna system, the Directional-MAC (DMAC) is the most prevalent and noticeable mechanism of all. However, when we implement DMAC protocol in such an ad hoc network with directional antenna, and it may lead on the occurrence of the deafness problem to limit the network performance. In this thesis, we focus our research on Tone-based DMAC (ToneDMAC) schemes as a means to reduce the effect caused by the deafness problem. ToneDMAC utilizes out-of-band signaling way to broadcast a channel-release tone to alleviate the deafness problem and greatly improve the network performance. Every node in the current ToneDMAC system is designed to operate with both directional and omni-directional antenna modes. The network node uses directional antenna to transmit or receive data, but it switches to omni-directional antenna when it has to broadcast the channel-release tone to its neighbors. However, this way degrades the level of transmission throughput. In this research, we propose a novel ToneDMAC scheme operated with directional antenna only, and compare its performances with other schemes under different environments and topologies. We conclude that our scheme consistently outperforms others in terms of fairness and throughput.

Keywords : Deafness ; ToneDMAC ; Sweeping

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