The Study of the Masked Node Problem in Wireless Networks

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Abstract

The carrier sense multiple access/collision avoidance (CSMA/CA) mechanism defined in IEEE 802.11 standard has widely adopted to become the medium access control protocol in most wireless ad hoc networks. Several research studies on the issues of CSMA/CA protocol often refer to the hidden node and the exposed node problems which characterize the network performance. The Request-to-Send/Clear-to-Send (RTS/CTS) exchange in IEEE 802.11 solves the hidden node problem, and also reduces the possibility of collision and interference. But this handshaking scheme will give rise to the exposed node problem occurred in the network, and then it severely degrades the network utilization and effectiveness. Since the exposed node may collide with its neighbors in data transmission when it is unable to distinguish the controlling frames, this may result in the neighboring nodes to interpret the received data frames correctly. In the thesis, the exposed node which is unable to distinguish the control frames is named as a masked node. A data frame collides with a control frame from a masked node leading to wasteful data retransmission. Several related works have previously proposed the solutions to the exposed node problem, but they also point out even in a good network environment with less interference. The masked node problem would still happen. In the thesis, we investigate how to distinguish a masked node from others, and propose a framework of medium access control in order to avoid the data frame collisions caused by the masked node. We evaluate the masked node problem to the impact on the network performance including the data throughput, the data collision ratio, and the average data transmission delay of the network. We also present experimental results that suggest our approach is able to improve the masked node problem.

Keywords: Wireless ad hoc network, Collision, Exposed Node, Hidden Node, Masked Node

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