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Revealing the problems with 802.11 medium access control protocol in multi-hop wireless ad hoc networks

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Abstract

The IEEE 802.11 medium access control (MAC) protocol is a standard for wireless LANs, it is also widely used in almost all test beds and simulations for the research in wireless mobile multi-hop ad hoc networks. However, this protocol was not designed for multi-hop networks. Although it can support some ad hoc network architecture, it is not intended to support the wireless mobile ad hoc network, in which multi-hop connectivity is one of the most prominent features. In this paper, we focus on the following question: can IEEE 802.11 MAC protocol function well in multi-hop networks? By presenting several serious problems encountered in transmission control protocol (TCP) connections in an IEEE 802.11 based multi-hop network, we show that the current TCP protocol does not work well above the current 802.11 MAC layer. The relevant problems include the TCP instability problem found in this kind of network, the

severe unfairness problem, and the incompatibility problem. We illustrate that all these problems are rooted in the MAC layer. Furthermore, by revealing the in-depth cause of these problems, we conclude that the current version of this wireless LAN protocol does not function well in multi-hop ad hoc networks. We thus doubt whether the current WaveLAN based system is workable as a mobile multi-hop ad hoc test bed. All the results shown in this paper are based on NS2 simulations, and are compatible with the results from the OPNET simulations.



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Keywords

802.11; MAC; Multi-hop; Ad hoc networks; TCP

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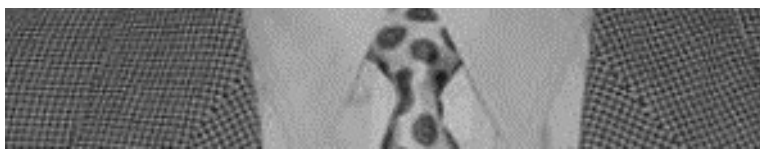
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