On Robust Neighbor Discovery in Mobile Wireless Networks

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Summary

The objective of the paper is to design a robust beacon-free neighbor discovery protocol despite noisy channels with interference. The drawback of using beacons and decode the identity of devices in neighbor discovery is that there is a high chance of collisions of beacon packets due to interfering signals from other background devices in the wireless network. Short message length and low duty cycle make the wireless networks prone to interference. To overcome such problems, the authors have proposed ReCorder, a scheme that makes use of correlation property of pseudo-random preamble to discover neighbors in which each node has a distinct signature. RCover preamble with a fixed pseudo-random symbol sequence distinguishes the message from other packets according to the RMix algorithm. ReCord is the 2-level unique signature of the sender which are gold code and a randomly generated sequence to exclude duplicates. A table of the discovered neighbor information is maintained and updated periodically. The simulation results comply with their estimation by achieving resilient neighbor discovery at a much lower SINR of about 10 dB in comparison to other beacon based protocols.

This scheme has comparatively less loss of neighbor discovery messages which thereby decreases the latency and enhances energy efficiency. The length of the message is also shorter as compared to that of beacon based protocols and hence consumes lesser transmission energy. The CPU overhead due to beacon decoding is eliminated. ReCorder and Wi-Fi control and management frames can exist together while not interfering with the regular functions of the Wi-Fi network. Bandwidths of the messages and OFDM packets must be approximately equal to avoid co-existence problem. The issue of different frequency offset in wireless networks is overcome by setting a shorter preamble.

One of the neighbor discovery problems of accidental or deliberate Denial of Service upon request could have been attended. Another question that may arise is that when two nodes that operate in different duty cycle length, how will they wake up at an overlapping time interval to discover each other. The delay that may be introduced due to mobility of device may decrease the robustness of the protocol. Security issues during neighbor discovery can be resolved by adding a new field with a certificate of the inviting neighbor in the ReCorder's packet. A development to this work can be to transmit multiple ReCorder to enable multiple neighbor discovery.

Conclusion

We see that there is a need for an entirely new frame with a unique preamble and signature. There is also the need for a new look up table. This induces an overhead as we now need more memory and additional computation power generating the signatures and the preamble. On the other hand, if we use a beacon frame we can use the existing MAC address. The paper also talks about the case of failure of the 2 level system making it a single level algorithm thereby reducing the robustness. We are not clear about the frequency of such an error but if such an error occurs very often then it might be preferable to use Becon decoding. Therefore we cannot say that the proposed algorithm is completely robust but it can be improved to make it one.

Reference

Tong Mengy, Fan Wuy, Aijing Lix, Guihai Cheny, Nitin H. Vaidya. *On Robust Neighbor Discovery in Mobile Wireless Networks, CoNEXT '15, Dec. 01-04, 2015, Heidelberg, Germany.*