PERFORMANCE STUDIES OF 802.11 MAC BASED ON ORDER DEPENDENT CAPTURE CAPABILITY AT PHY

by

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Submitted

in fulfillment of the requirements for the degree of

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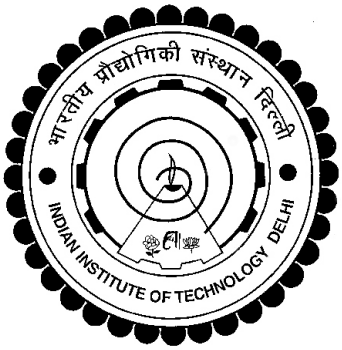
to the



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To

Rev. Pandurang Shastri Athavale (Dadaji)

who could cultivate Applied Philosophy of Life in millions!

and

Rev. Dhanashree (Jayashree) Shreenivas Talwalkar (Didiji)

whose pursuit of Dadaji's footsteps helps uphold the whole Swadhyayee family!

Certificate

This is to certify that the thesis titled "**PERFORMANCE STUDIES OF 802.11 MAC BASED ON ORDER DEPENDENT CAPTURE CAPABILITY AT PHY**" being submitted by **VEGAD MAYUR MANSUKHLAL** to the Department of Electrical Engineering, Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy, is a record of bona-fide research work carried out by him under our guidance and supervision. In our opinion, the thesis has reached the standards fulfilling the requirements of the regulations relating to the degree. The results contained in this thesis have not been submitted to any other university or institute for the award of any degree or diploma.

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Date: _____ Vegad Mayur Mansukhlal

Abstract

Collision avoidance and spatial reuse enhancement continue to be critical mechanisms for wireless network performance. Many schemes have been proposed for mitigating the hidden and exposed terminals problems, the key reasons for collisions and poor spatial reuse, respectively. In this work we evaluate the performance of such protocols in light of a recent physical layer capability, viz. order dependent capture. During the process we propose two novel medium access schemes and also propose an updated medium access model.

The basis of our work is the analysis of the impact of order dependent capture on carrier sense threshold. Our study revealed that consideration of order dependent capture, while choosing the carrier sense range, results in improved performance characteristics of wireless networks. A scheme we propose exploits this to mitigate the hidden terminals problem without impacting the exposed terminals issue. We exploit the order dependent capture capability further to tackle the exposed terminals issue by enabling increased spatial reuse. This scheme which allows nodes to communicate concurrently has aptly been termed as liberal carrier sensing.

An interesting outcome of this study is a new nodal model for the medium access scheme that we have proposed. The new model takes into account the order dependent capture capability and updates an existing model. New states have been proposed and all state and transition probabilities have been recalculated to obtain a more realistic model. Extensive simulations have been performed by making appropriate updates in ns2 to check the validity of the proposed model and also to check the enhancement in performance measures due to the proposed updates in the access mechanism.

The capability of the proposed access mechanism has been demonstrated by reviewing the basic power control in light of the enhancements. Analysis and simulations show that if one uses the new access mechanism, gain in power usage can be achieved even while using the basic power control scheme. This result not only highlights the potential of the proposed access

mechanism, but also provide capability to save power (hence increase battery life) without using complex power control schemes. Of course, use of complex power control schemes along with the proposed access mechanism has the potential to provide even more power saving.

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