Characterisation and Application of Idle Period Durations in IEEE 802.11 DCF-based Multihop Wireless Networks

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ABSTRACT

Multihop wireless networks are used to provide internet connectivity to the users and the level of performance and quality expected by these users are increasing. In order to meet these performance and quality requirements, wireless communications should be enhanced. Previous works from the literature show that the performance and quality provided by an IEEE 802.11-based multihop wireless network are far from optimal and that there exist different ways to increase the efficiency and the quality of service of such a network. Some studies show that using the medium state as a parameter to tune the behaviour of an IEEE 802.11-based multihop network is an appropriate way to proceed. A station in a IEEE 802.11-based multihop wireless network senses the medium either busy or idle. The durations of idle periods and busy periods and their distributions have a clear impact on the network and nodes performance. The understanding of the relationship between these indicators, namely idle and busy periods, the network topology and the traffic, would give new insights to enhance the performance and quality of multihop wireless networks. Due to its multihop and distributed nature, the characterisation of idle period durations is difficult in such a network. This paper explores the characterisation of idle period distribution by proposing a new analytical model and provides an application of this characterisation with the design of an adaptive backoff algorithm based on idle periods.

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Categories and Subject Descriptors

C.2.1 [**Computer-Communication Networks**]: Network Architecture and Design—*Wireless Communication*

General Terms

Measurement, Performance

Keywords

Idle Periods, Multihop wireless networks, IEEE 802.11, Quality of service

1. INTRODUCTION

A station in a IEEE 802.11-based multihop wireless network senses the medium either busy or idle. The durations of idle periods and busy periods have a clear impact on the network and nodes performance. The characterisation of idle period durations is an important issue in wireless and mobile networks. For example, in cognitive radio networks, a secondary node must be able to adapt its behavior based on observations of the radio medium and on its experience in the past. The cognitive process is composed of the analysis of conditions observed on the network, of the decision-making and of the learning based on its experience. Under these conditions, the observation and the analysis of idle period durations and their statistical parameters are important for the proper functioning of this approach [9]. It is also possible to rely on observed idle periods to estimate the number of active nodes in the network, when all nodes are in the same carrier sense area [2]. Observation of idle period durations are also used in QoS solutions, like in [10] that describes an available bandwidth estimation between two nodes based on the nodes' average idle time durations. It is also the authors point of view that it should be possible to improve efficiency and fairness of MAC solutions for multihop wireless networks thanks to a knowledge of idle period durations.