Retransmission-based Available Bandwidth Estimation in IEEE 802.11-based Multihop Wireless Networks

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ABSTRACT

Estimating the available bandwidth in IEEE 802.11-based multihop wireless networks is a very difficult task due to the medium sharing among contending nodes and collisions between hidden stations. Several methods have been proposed so far for these networks to compute the available bandwidth on wireless links. If some recent solutions such as ABE and IAB now take into account collisions and their impact on the mean backoff, none considers the packet retransmissions due to collisions although these retransmissions have an impact on the available bandwidth. In this article, we propose a new available bandwidth estimation for multihop wireless networks called RABE (Retransmission-based Available Bandwidth). This method integrates the average number of retransmission attempts in the available bandwidth estimation. RABE is evaluated by simulation and the obtained results show that RABE can achieve a mean error ratio of 17% in comparison with the real measurement. Furthermore RABE is at least two times more accurate than ABE and ten times more accurate than IAB.

Categories and Subject Descriptors

C.2.1 [**Computer-Communication Networks**]: Network Architecture and Design—*Wireless Communication*; C.2.5 [**Computer-Communication Networks**]: Local and Wide-Area Networks; C.4 [**Performance of Systems**]: Measurement Techniques

MSWiM'11, October 31–November 4, 2011, Miami, Florida, USA.

General Terms

Measurement, Performance

Keywords

Available bandwidth estimation, Multihop wireless networks, IEEE 802.11, Quality of service

1. INTRODUCTION

Multihop wireless networks can be deployed in environments where networking architectures with fixed and wired infrastructure are costly and/or difficult to deploy. Mesh wireless networks are such multihop wireless networks that can be considered as an alternative to access networks [2]. In order to offer applications with good performance, similar to traditional access networks, QoS mechanisms often require an estimation of available resources, like for instance the available bandwidth. The available bandwidth of a wireless link can be defined as the maximal throughput that can be transmitted from the sender to the receiver of the link without disrupting ongoing close flows [7].

Several solutions have been proposed for estimating available bandwidth in multihop wireless networks. Many solutions assume that the used wireless technology is IEEE 802.11 with the distributed access mode (DCF - Distributed Coordination Function) [6], because 802.11 wireless cards are very popular and easy to use. We make the same assumption in our work: all the nodes are equipped with a single 802.11 wireless interface card communicating with the DCF mode.

Active estimation methods, like the ones described in [1, 4], use probing packets to derive available bandwidth on paths. Such an approach can take time because it requires to send probing flows before sending data flows and can also impact the rates and the traffic profiles of on-going flows. Passive methods, like the ones proposed in [3, 7, 8], estimate the available bandwidth without sending extra packets but