

Performance Analysis and Enhancement of IEEE 802.11 DCF Contention Window Backoff Scheme in the Presence of Noise *

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Abstract: The paper presents an in-depth analysis on IEEE 802.11 DCF in the presence of noise. Based on the analysis, the Back to back Retransmission (BR) scheme is proposed. The main idea of the new scheme is to adopt different MAC protocol behaviors to the failures caused by collisions and those by channel errors. Based on the mathematical models, system saturation throughputs and maximum achievable throughputs of DCF and BR are analyzed using numerical methods. Then, ns-2 simulations are performed to study the impact of such factors as bit-error-rate, number of contending nodes on the performance of BR and DCF. Both the numerical calculation results and simulation results have shown that the proposed BR scheme outperforms DCF in the presence of noise.

Keywords: IEEE 802.11, Wireless Local Area Network (WLAN), Noise Aware Schemes, Stochastic processes

1. INTRODUCTION

Wireless LAN has gradually become a preferred technology for wideband wireless local access to the Internet because it is both cheap and convenient when compared with the 3G technologies. As a dominating wireless LAN protocol at present, IEEE 802.11 has aroused much interest among both industrial and academic researchers since its birth in 1999. DCF is a random access CSMA-based scheme and is the basic access method of IEEE 802.11. It realizes the adaptive asynchronous multi-access by contention window binary exponential backoff (BEB). However, the limited adaptive capacity of BEB is recently found to operate far from optimal in heavy contention condition and will degrade the system performance^{[2][3]}.

* Research Fund for National Nature Science under Grant No. 90204003 and No. 60432010; the National High Technology Development 863 Program of China under Grant No.2001AA112071 No.2001AA121052 and No. 2002AA103063, 973 Program of China under Grant No.2003CB314806; Research Fund for the Doctoral Program of Higher Education (RFDP) of China under Grant No.20010013003.

