

# Robust rate adaptation for 802.11 wireless networks.

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Rate adaptation is a very important mechanism used by 802.11 standards to match the Wi-Fi physical layer bitrate to the capacity of the wireless channel. So, selecting the appropriate bitrate is critical for the performance of a Wi-Fi system. This paper investigates five design guidelines adopted by most existing algorithms to see whether these guidelines work in real world networks. The author has two observations: 1, guidelines that use packet drops as signal for rate adaption cannot work when packets are lost due to hidden terminals; 2, guidelines that use packet statistics over a long period of time cannot work due to rapid wireless channel variations. Based on the observations from the experimental evaluation, the author proposes their own rate selection algorithm. The proposed algorithm has two key design ideas: 1, use a shorter time window to calculate the packet statistics to cope with the fast-varying wireless channel; 2, turn on the rts/cts adaptively to prevent hidden terminal from happening.

The first thing we discussed a lot is about why we need rate adaptation at the physical layer and why we cannot just use TCP congestion control to achieve this goal. Many students have answered this question from different aspects. First, the wireless channel varies at millisecond level which require fast rate adaption which is very difficult for congestion control algorithms. Second, the Wi-Fi physical layer needs a coding rate and modulation scheme to correctly send a packet out. Third, the Wi-Fi physical layer determines the upper bound of the achievable throughput of the whole connection and the congestion control determines the final achieved throughput. In summary, we need both, one at the physical layer and one at the transport layer.

We also discussed the five guidelines the paper investigates. We have two conclusions: 1, the Wi-Fi sender should not decrease its sending rate if it observes packet drops that are not caused by the decreasing channel quality; 2, we should use a shorter time window to cope with the fast channel variations. We also summarize the key contribution of this paper: 1, use a short-term loss ratio to assess the channel and opportunistically adapt the runtime transmission rate to dynamic channel variations; 2, leverage the RTS option in an adaptive manner to filter out collision losses with small overhead.

We discussed the drawbacks of the rate adaptation algorithm proposed by the author and we concluded that a rate adaptation algorithm based on channel quality (SNR or CSI) that are directly estimated by the receiver and then feeded back to the sender could perform better than algorithms using packet drops as rate adaptation signals. The algorithm proposed by the author works because the Wi-Fi system in 2005 is still very simple, without OFDM-MIMO. When MIMO is introduced, the rate options will increase significantly, and we believe the proposed algorithm may not be able to handle such a much more complicated problem.