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IEEE 802.11无线网络的两步指数退避算法

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Two-step Backoff Algorithm for IEEE 802.11 Based Wireless Networks

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摘要 IEEE 802.11标准引入二进制指数退避(Binary Exponential Backoff, BEB) 算法以降低节点发送数据包碰撞的概率。然而，BEB存在着不足之处，当数据包碰撞概率较大时，节点的竞争窗口长度会出现振荡，即节点每次发送数据包之前，需要多次加倍扩大竞争窗口长度，而在发送成功之后又把竞争窗口长度缩小到最小值，这个过程反复出现。为了克服竞争窗口振荡问题以增加吞吐量，该文提出两步指数退避(Two-step BEB, TBEB)算法，利用2维马尔可夫链进行建模，导出TBEB算法中节点的退避状态概率分布、平均竞争窗口长度、平均退避次数、每发送一个数据帧所耗时间以及吞吐量等指标，并通过仿真进行验证。通过求解一个简单的优化问题，TBEB可以获得最优竞争窗口长度复位值，使吞吐量达到最优。

关键词： 无线网络 IEEE 802.11标准 竞争窗口 退避算法

Abstract： To reduce packet collision probability, Binary Exponential Backoff (BEB) algorithm is presented in IEEE 802.11 standard. The BEB, however, exhibits the shortcoming that Contention Window (CW) oscillation occurs when packet collision probability is large. That is, it repeats frequently that the CW size has to be doubled several times from its minimum value so that the node is able to transmit a frame successfully and then the node resets the CW size to the minimal value again. To overcome CW oscillation, a Two-step BEB (TBEB) algorithm is proposed in this paper. Additionally, the statistics of the TBEB, such as the probability distributions of backoff, the average CW size, the average number of backoffs, the time needed by the node for transmitting a frame, and throughput, are all derived from a two-dimension Markov model, and they are validated by simulations. The TBEB is able to maximize the throughput by resetting its CW to the best size obtained from solving the simple optimization problem proposed in this paper.

Keywords： Wireless network IEEE 802.11 standard Contention Window (CW) Backoff algorithm

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