电子与信息学报
JOURNAL OF ELECTRONICS & INFORMATION TECHNOLOGY

电子与信息学报 » 2010, Vol. 32 » Issue (6) :1520-1524 DOI: 10.3724/SP.J.1146.2009.01092

研究简报

基于多Agent强化学习的Ad hoc网络跨层拥塞控制策略

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Research on Cross-layer Congestion Control Strategy Based on Multi-agent Reinforcement Learning in Ad hoc Network

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摘要 该文首先证明基于MAC层竞争造成的网络拥塞模型中存在纳什均衡点。其次，基于WOLF-PHC学习策略提出了一种跨层拥塞控制(WCS)机制。它在路由层中选择一对去耦合节点作为转发节点，同时在MAC层对源节点的发送数据进行分流，从而提高链路的空间重用性。仿真结果表明：在不需要交互任何信息的情况下，通过节点之间的相互博弈以后，采用WOLF-PHC算法能够找到每个节点的最佳分流概率进而使整体网络吞吐量达到最大值；同时当外界环境发生改变时，该算法能够较快地找到新的最佳分流概率从而实现对环境的自适应能力。

关键词： Ad hoc 拥塞控制 跨层设计 博弈论 WOLF-PHC

Abstract： In the paper, the existence of an Nash equilibrium in the network congestion mode induced by MAC layer competition is proved firstly; Secondly, a cross-layer congestion-control mechanism named WCS is proposed based on WOLF-PHC learning strategy. WCS selects a couple of decoupled node as next-hop nodes at routing layer; Meanwhile, source's traffic is spitted and forwarded at MAC layer, which improves the space reusing efficiency of link. Simulation result shows that: without any exchanging information, optimum split-flow point of source node will be sought by WOLF-PHC in order to maximize the network throughput; Furthermore, WOLF-PHC will discover new optimum split-flow point in order to adapt to new network environment.

Keywords： Ad hoc Congestion control Cross-layer design Game theory Win-Or-Lose-Fast Policy Hill Climbing (WOLF-PHC)

Received 2009-08-17;

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引用本文:

邵 飞; 伍 春; 汪李峰.基于多Agent强化学习的Ad hoc网络跨层拥塞控制策略[J] 电子与信息学报, 2010,V32(6): 1520-1524

Shao Fei[①]; Wu Chun[①]; Wang Li-feng[②].Research on Cross-layer Congestion Control Strategy Based on Multi-agent Reinforcement Learning in Ad hoc Network[J] , 2010,V32(6): 1520-1524

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