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论文与技术报告

认知无线电网络中基于协作中继的资源分配算法

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摘要：

在认知无线电网络的协作中继机制下,中继节点利用其和源节点以及目的节点的不同公共信道为二者的通信转发数据,可以有效解决次用户的通信需求和可用带宽之间的矛盾,提高频谱利用率和系统吞吐量。基于协作中继的认知无线电网络中,不同通信链路上可能存在公共可用信道,使信道和中继的分配问题变得复杂。本文研究了公共信道存在的情况下系统的资源分配问题,基于网络最大流理论提出了两种算法：并行算法和贪婪算法,并分析了算法复杂度。仿真结果表明,两种算法都能够更有效地分配资源,提高频谱利用率,改善网络吞吐量。并行算法可以得到最优解,但其复杂度随信道公用程度的上升增长迅速,受节点并行处理能力的限制,只适用于信道公用程度较低的情况。贪婪算法不一定能得到最优解,但其复杂度较低,并且信道公用程度高时接近最优解,因此超出节点的并行处理能力后,可以选择贪婪算法。

关键词： 认知无线电网络；资源分配；协作中继；最大流；并行算法；贪婪算法

Resource Allocation Algorithm based on Cooperative Relay in Cognitive Radio Networks

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Abstract:

Cooperative relay scheme has been proposed to deal with the heterogeneity of spectrum availability and traffic demand of secondary users in cognitive radio networks. According to this scheme, relay node can bridge the source and the destination using its common channels between those two nodes, as a result, spectrum resource can be better matched to traffic demand of secondary users and efficient spectrum allocation can be achieved. Two algorithms—parallel algorithm and greedy algorithm—are proposed based on maximum flow theory to solve the problem of relay selection and channel allocation in cognitive radio networks, in which the scheme of cooperative relay is used and common available channels probably exist. The complexity of both algorithms is analyzed. Simulation results show that both algorithms are able to allocate the resources more effectively, so as to improve the spectrum efficiency and the throughput of the network. Parallel algorithm can achieve the optimal solution, but its complexity grows rapidly with the channels' common available degree. Limited by the parallel processing ability, it can only be applied when this degree is not high. Otherwise if the parallel processing ability is exceeded, the greedy algorithm should be selected, which may not necessarily be the optimal solution, but has low complexity and is closer to the optimum solution when there are more common channels.

Keywords: cognitive radio networks resource allocation cooperative relay maximum flow parallel algorithm greedy algorithm

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