Efficient and Fair Radio Resources Allocation for Spontaneous Multi-Radio Wireless Mesh Networks

Author(s) - Institution(s):
Lucio Studer Ferreira, INOV
Luis M. Correia, INOV

Corresponding author email: lucio.ferreira@inov.pt

Corresponding WG group: WG3

Abstract:

Wireless mesh networks are a challenging path for telecommunication networks, building a multi-hop wireless backhaul. A strategy is proposed for efficient radio resources allocation to multi-radio mesh nodes. It is a hierarchical-distributed strategy, combining rate adaptation, power control, and channel assignment mechanisms to efficiently guarantee max-min fair capacity to every node. The typical fat-tree distribution of traffic in mesh networks, where traffic flows between a gateway and aggregating access points, reached through mesh nodes' multi-hop ramifications, is explored. A maximum capacity is allocated to gateway nodes, being reduced as links ramify. This enables to efficiently minimize transmitted power levels, reducing interference ranges and making possible channel reutilization. A flow control mechanism is proposed to guarantee max-min fair throughput to all nodes. The performance of this strategy is evaluated by considering IEEE 802.11a in a challenging spontaneous neighborhood community scenario of 20 mesh nodes with 3 gateways to the Internet. Mesh nodes achieve 100% of their allocated capacity, with throughputs ranging between 5.7 and 11.3 Mbps (depending on the specific propagation conditions), no packet loss, and end-to-end delays below 20 ms. It is shown that, thanks to the proposed strategy, max-min fairness is achieved by every mesh node in the share of capacity, there is no interference between nodes, and resources such as power and spectrum are efficiently used.