Radio Resource Management for Wireless Mesh Networks

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Abstract:

Wireless mesh networks are an efficient solution for Internet access provision in areas without fixed infrastructure. A self-organised energy-efficient and load-aware strategy is proposed for the unified allocation of radio resources of multi-radio nodes, by combining rate adaptation, power control, gateway rate-control and channel assignment mechanisms. An analysis of various hexagonal deployments and scenario sizes shows that the strategy exploits 100% of the system's capacity and extends coverage, guaranteeing a fair throughput to nodes, and minimizing spectrum and power usage. Various scenarios are evaluated. For a neighborhood scenario of 100 m radius with a gateway in the centre, using 802.11a for mesh links and 11b/g for access ones, the maximum theoretical throughput is achieved with a hexagonal deployment of 19 mesh access points, using 4 channels for mesh and 3 for access, and with adapted rates and transmission power levels; for a typical urban subscriber density of 10 000 users/km2 where 5% are simultaneously active, a capacity of 3.6 Mbps per user is offered. It is concluded that, independently of the system in use, wireless mesh networks with the proposed radio resource allocation mechanisms enable to explore the maximum system capacity and extend the coverage as desired. System improvements (MIMO, higher modulations and receiver sensitivities of, e.g., IEEE 802.11n), which result in higher system physical data-rates and ranges, will enable higher performance levels reached using the proposed strategy.