

Capacity Bounds of Deployment Concepts for Wireless Mesh Networks

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Abstract

Local area wireless networks are like cellular systems: Stations associate to one out of several access points (APs), which connect to a wired backbone. Due to signal attenuation and transmission power limitations, radio connectivity is available only sufficiently close to an AP. In scenarios with a dense deployment of APs the wired backbone causes unprofitably high costs.

A Wireless Mesh Network (WMN) serves to extend the coverage of APs by means of Mesh Points (MPs) that forward data between a station and an AP. This concept reduces deployment costs, but reduces also network capacity, owing to multiple transmissions of the same data packet on its multi-hop route.

This paper analyzes how the capacity of a cost-limited WMNs can be optimized. A layered model of a WMN specifying the typical characteristics of the network is used to calculate the upper capacity bound. Based on the heuristics developed, networks of more than 150 nodes (APs, MPs, stations) can be handled.

We apply the method to investigate the combination of three measures for improving the WMN capacity: (i) concurrent scheduling of transmissions, (ii) application of directional antennas and (iii) variable number of MPs per AP. The capacity bounds for different combinations of the measures mentioned is computed and compared. Combined with a simple cost model, these results are useful to provide insight into the economical feasibility of WMNs for wireless Internet access.

Key words: Wireless Mesh Network, Capacity Bound, Deployment Concepts, Simultaneous Transmission, Directional Antenna

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