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Mesh Topology Synthesis for Interconnected Wireless LANs

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A wireless mesh network provides for the interconnection of wireless local area network systems. The latter are widely implemented today to provide hot spot coverage. The mesh network system incorporates a backbone network that serves to interconnect the access points managing each wireless local area network. The 802.11s working group has been formed recently to recommend an extended service set (ESS) that enables wider area communications among distributed clients, each of which has access to an IEEE 802.11 wireless LAN (WLAN). Such coverage can be provided by the implementation of a mesh backbone network that serves to interconnect the WLAN access points (APs).

In this demo, we present a scalable, fully distributed topology synthesis algorithm for constructing such a mesh backbone network of access points. We demonstrate the operation and features of our network layer topology synthesis and routing algorithms through a cross layer simulation program that includes IEEE802.11 Physical and MAC layer mechanisms. Viewers will see the dynamic election of backbone nodes in a mobile wireless mesh network. Multi-hop communications among distant client stations take place in accordance with three routing algorithms: the Mobile Backbone Network Routing scheme (MBNR), MBNR with Flow Control (MBNR-FC), and MBNR with Flow Control and Distance Awareness (MBNR-FC/DA). These routing algorithms use the Topology Synthesis Algorithm described in our paper for the purpose of on-demand discovery of routes. For this purpose, selective flooding operation is employed by flooding route discovery messages only across the backbone network when the source-destination nodes are at a minimum distance from each other. Flow control procedures are used to ensure guaranteed high quality operation for multimedia flows.

The presented topology construction algorithm and its employment by the presented routing mechanism are shown to improve the robustness and delay-throughput performance of the network. We demonstrate that the topology construction and control algorithm introduced in our paper is highly scalable and efficient. The implementation complexity of the required communications control (and its associated overhead) and its temporal convergence features are noted to be independent of the number of network nodes, as mathematically proven in the paper. The overall delay-throughput performance is demonstrated to yield excellent results, enhancing significantly the performance attained when the system does not incorporate a mobile backbone based networking operation.