Performance Analysis of IEEE 802.11ad in Large Scale Deployments Through Experiments and Simulations

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Motivation

• Extend the WLAN IEEE 802.11ad Model in ns3 to support scheduled access, spatial reuse, clustering, and relaying.
• Performance analysis of first COTS 802.11ad devices in large scale deployments.

802.11ad Model and Capabilities in ns-3

Channel Access:
• Supports CSMA/CA Channel Access, Service Period Channel Access, and Dynamic Allocation of Service Period as defined in IEEE 802.11ad amendment.
• Allocation of service periods for either isochronous or asynchronous traffic type.
• Customized admission control and resource allocation for traffic stream allocation.

DMG Relay Operation:
• Supports Half Duplex Decode and Forward (HD-DF) and Full Duplex Amplify and Forward (FD-AF) Relay operation modes for coverage area extension, improved link resilience against interruptions, and persistent multi-gigabit throughput.
• Incorporate frame exchange rules during a service period allocation as defined in the amendment for both FD-AF and HD-DF relay modes.

Relay Network Topology:

Comparison Channel Access Schemes:

Spatial Sharing:
• Supports interference and channel assessment procedure to allow concurrent transmissions.

Evaluation Results:

Large Deployment Testbed

• A test bed of large number of TP-Link TALON 7200AD routers with custom LEDE OS.
• The custom LEDE OS allows TALON routers to work in monitor mode, station mode, or access point mode.
• Study MAC layer efficiency, interference, spectrum sharing, spatial sharing, and multi-AP deployment issues.

References


Spatial Sharing Example and Results

Decentralized Clustering:
• Allows co-channel APs to coordinate beaconing to avoid interference and enhance operation in dense environments.
• Support cluster formation and maintenance procedures.