

## Channel Bonding in Evolving Wireless LANs

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ith the wide deployment of the IEEE 802.11n standard and with the upcoming 802.11ac, WLANs now have the option to operate over wider channels that achieve higher capacity. Increasing channel width increases capacity, but at the cost of decreased transmission range and greater susceptibility to interference. However, the incorporation of multiple-input, multiple-output (MIMO) smartantenna technology into 802.11n devices mitigates the problems that single-input, single-output (SISO) systems typically face, and devices can exploit the increased transmission rates from wider channels with minimal sacrifice to signal quality and range.

The 802.11n standard itself gives no guidelines or recommendations on how to benefit from channel bonding, so researchers Lara Deek, Eduard García-Villegas, Elizabeth Belding, Sung-Ju Lee, and Kevin Almeroth set out to evaluate and understand the tradeoff between higher transmission rates and susceptibility to interference created by 40-MHz channels in 802.11n networks ("Intelligent Channel Bonding in 802.11n WLANs," *IEEE Trans. Mobile Computing*, vol. 13, no. 6, 2014, pp. 1242–1255).

In their article, the authors identify the usage conditions for channel bonding in 802.11n WLANs that allow for more efficient utilization of available spectrum. To this end, they first characterize the behavior of channel bonding through experimental studies. These experiments demonstrate how network conditions and interference patterns impact throughput performance with channel bonding. Naive channel-bonding decisions degrade performance. Intelligent channel-bonding decisions require not only knowledge of a link's signal quality but also knowledge of the neighboring link's transmissions: their strength, channel distance, load, and physical rates. Intelligent decisions based on this knowledge enable up to a 7x increase in achieved throughput.

Using their findings, the authors designed and implemented a network detector that successfully identified the interference conditions affecting channel-bonding decisions in 100 percent of their test cases. In addition, they predicted the impact of network conditions on performance and made channel-bonding decisions that maximize throughput. The authors argue that their detector can form the foundation for more robust and accurate algorithms for adapting bandwidth to variations in channel conditions. Their work is a foundation on which to build channel management solutions for 802.11n networks-according to the authors, it will also apply to the upcoming 802.11ac standard that supports up to 160-MHz bonding channels.

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