Enabling Spatial Reuse in Future Wireless Local Area Networks: a Machine Learning & Game Theoretic Proposal

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Acknowledgments

Abstract

The Spatial Reuse (SR) operation is gaining momentum in the newest IEEE 802.11 family of standards due to the overwhelming requirements posed by next-generation wireless networks. In particular, the increasing traffic capacity and number of concurrent devices compromise the efficiency of Wireless Local Area Networks (WLANs) and throw into question their decentralized nature. The SR operation, initially introduced by the IEEE 802.11ax-2020/21 amendment and further studied in IEEE 802.11be-2024/25/26, is aimed at increasing the number of concurrent transmissions in an Overlapping Basic Service Set (OBSS), thus improving spectral efficiency.

The SR operation has been initially defined as a distributed mechanism, but it is evolving towards coordinated schemes. Nevertheless, coordination entails communication and synchronization procedures that have not been defined yet. The necessary overhead to carry out coordination has implications on the WLANs' performance and remains unknown. Moreover, the coordinated scheme is not compatible with IEEE 802.11 devices not implementing it.

As a result, it is ...

Resum

List of Publications

1. Wilhelmi, F., Muñoz, S. B., Cano, C., Selinis, I., & Bellalta, B. (2019). *Spatial Reuse in IEEE 802.11 ax WLANs.* arXiv preprint arXiv:1907.04141.

2. Wilhelmi, F., Barrachina-Muñoz, S., & Bellalta, B. (2019, October). *On the Performance of the Spatial Reuse Operation in IEEE 802.11 ax WLANs.* In 2019 IEEE Conference on Standards for Communications and Networking (CSCN) (pp. 1-6). IEEE.

3. Wilhelmi, F., Bellalta, B., Cano, C., & Jonsson, A. (2017, October). *Implications of decentralized Q-learning resource allocation in wireless networks*. In 2017 ieee 28th annual international symposium on personal, indoor, and mobile radio communications (pimrc) (pp. 1-5). IEEE.

4. Wilhelmi, F., Cano, C., Neu, G., Bellalta, B., Jonsson, A., & Barrachina-Muñoz, S. (2019). *Collaborative spatial reuse in wireless networks via selfish multi-armed bandits.* Ad Hoc Networks, 88, 129-141.

5. Wilhelmi Roca, F., Barrachina Muñoz, S., Bellalta, B., Cano Sandín, C., Jonsson, A., & Neu, G. (2019). *Potential and pitfalls of multi-armed bandits for decentralized spatial reuse in WLANs.* Journal of Network and Computer Applications, 2019, 127.

6. Barrachina-Muñoz, S., Wilhelmi, F., Selinis, I., & Bellalta, B. (2019, April). *Komondor: a wireless network simulator for next-generation high-density WLANs.* In 2019 Wireless Days (WD) (pp. 1-8). IEEE.

7. Wilhelmi, F., Barrachina-Munoz, S., Bellalta, B., Cano, C., Jonsson, A., & Ram, V. (2020). *A Flexible Machine-Learning-Aware Architecture for Future WLANs. IEEE Communications Magazine, 58(3), 25-31.*

8. Wilhelmi, F., Carrascosa, M., Cano, C., Ram, V., & Bellalta, B. (2020). *Usage of Network Simulators in Machine-Learning-Assisted 5G/6G Networks.*

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