TECHNISCHE UNIVERSITÄT
ILMENAU

Prof. (Jun.-Prof.) Dr. Florian Klingler
IoT Engineering
Website: www.tu-ilmenau.de/iot

RESEARCH PROJECT

Comparative Study and Evaluation of 5G or 6G and IEEE 802.11 WLAN (WiFi 6 and beyond) Wireless Networks

Motivation and Background

Wireless communication technologies, including 5G and Wi-Fi 6 (IEEE 802.11ax), can be tailored for specific applications, aiming to achieve low latency and reliable wireless connections – URLLC (Ultra Reliable and Low Latency Communication). Individual investigation of the two technologies pertaining to latency performance in critical applications has been done in [4, 3]. In the work of Roberto et. Al [2], communication capacity of 5G and Wi-Fi is compared. To address the differences between the two radio technologies, a fairness was achieved by optimizing both for maximum communication capacity, while ensuring critical application requirements were maintained. The investigation was conducted in the context of a wireless Industrial Internet-of-Things (IIoT) network scenario, specifically referring to the 3GPP-defined Indoor-Factory sparse-clutter (InF-SH) model. Communication systems involving high mobility (for e.g., vehicular networking), have handover scenarios as common cases with 5G technology deployment. Different 5G handover types surveyed in [1] identifies problems which are tackled by briefly discussed algorithms. IEEE 802.11ax WLAN featuring reliable and low latency connections can be a potential investigation area for mobile network systems. Yet, a more detailed study about how to scale such wireless networks for particular application domains, e.g., vehicular networks, or Industrial IoT Systems, is missing. Work in this Research Project will be done in collaboration with Weidmüller in context of their 5G work.

Research Project Goals

IEEE 802.11ax WLAN featuring reliable and low latency connections can be a potential investigation area for mobile network systems. In IIoT scenarios, examining metrics such as latency, reliability, and jitter in both technologies is essential. This research work will focus on a comparative study; and quantitative and qualitative evaluation of above metrics between 5G or 6G and IEEE 802.11ax WLAN technologies. To ensure fairness in the comparative study; for instance, a comparison between 6G and WiFi 6 technologies should be avoided.

Milestones

- Read through scientific literature and standards for comprehensive understanding of IEEE 802.11ax (and beyond) WLAN and 5G or 6G radio technologies.
- Get familiar with a simulation tool and framework (e.g., based on OMNeT++) and statistics software (e.g., R).
- Use built INET models and orchestrate the same for simulating IEEE 802.11ax WLAN and 5G or 6G.
- Evaluate and compare the metrics of the two technologies with respect to different industrial settings and scenarios.
- Detailed report on results of the performed study.

Required knowledge (or willing to learn)

- A programming or scripting language (e.g., Python, R)
- Basic knowledge of C++ for handling OMNeT++ simulations.
- Scientific literature review, and writing.

References

[1] M. M. Elsayed, K. M. Hosny, M. M. Fouda, and M. M. Khashaba. Vehicles communications handover in 5g: A survey. *ICT Express*, 9:366–378, 2022.

[2] R. Maldonado, A. Karstensen, G. Pocovi, A. A. Esswie, C. Rosa, O. Alanen, M. Kasslin, and T. Kolding. Comparing wi-fi 6 and 5g downlink performance for industrial iot. *IEEE Access*, 9:86928–86937, 2021.

[3] M. Mhedhbi, M. Morcos, A. Galindo-Serrano, and S. Elayoubi. Performance Evaluation of 5G Radio Configurations for Industry 4.0. In *WiMob 2019 - 15th International Conference on Wireless and Mobile Computing, Networking and Communications*, Barcelone, Spain, Oct. 2019.

[4] D. Weller, R. D. Mensenkamp, A. v. d. Vegt, J.-W. v. Bloem, and C. d. Laat. Wi-fi 6 performance measurements of 1024-qam and dl ofdma. In *ICC 2020 - 2020 IEEE International Conference on Communications (ICC)*, pages 1–7, 2020.

Contact:
Florian Klingler: <florian.klingler@tu-ilmenau.de>

Website:
www.wnc-labs.org