Application-Aware User Association Strategy for 5G and beyond networks: A URLLC perspective

(contact: Akshay Jain akshay.jain@upc.edu and Suzan Bayhan s.bayhan@utwente.nl)

Abstract: 5G and beyond networks will be extremely dense in terms of both the number of access points that serve the users, as well as the number of users/devices [1]. In addition, they will support a multitude of new application types, i.e., enhanced Mobile Broadband (eMBB), massive Machine Type (mMTC), and Ultra reliable low latency communications (URLLC). A major challenge will then be to perform resource allocation as well as user association in such complex and demanding network environments. As shown in [2], the AURA-5G framework performs the challenging task of finding an optimal resource allocation and user association solution in the presence of multiple application types quite well. While multiple resource and QoS constraints make it incredibly challenging for the AURA-5G framework to determine a feasible solution, it still provisions a formal framework for a real-time optimization-based solution.

Hence, the next stage of research is now to introduce the URLLC services with strict latency and reliability requirements to the existing optimization framework [2]. This will involve:

1. Develop the mathematical framework, wherein the objective function and constraints for the URLLC services is established.
2. Combine the optimization frameworks for eMBB and mMTC services with the URLLC service as a multi-objective optimization framework, or a joint-optimization framework with a more unified objective function and constraint list.
3. Update the user association code base with the new mathematical framework and perform the necessary simulations.
4. Analysis of results which will lead to a potential journal publication.

This MS project will be in collaboration with Universitat Politècnica de Catalunya BarcelonaTech and Dr. Akshay Jain will be the daily supervisor from UPC.

[1] Jain, Akshay, Elena Lopez-Aguilera, and Ilker Demirkol. "Are mobility management solutions ready for 5G and beyond?." Computer Communications (2020).

[2] Jain, Akshay, Elena Lopez-Aguilera, and Ilker Demirkol. "User Association and Resource Allocation in 5G (AURA-5G): A Joint Optimization Framework." arXiv preprint arXiv:2003.10605 (2020).