Ph.D. in Information Technology
Thesis Defenses

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Room ”Schiavoni” and online by Teams

Eugenio Moro– XXXV Cycle

Resource management and optimization for new technologies in future wireless mobile networks

Supervisor: Prof. **Antonio Capone**

Abstract:

The evolution of mobile radio networks has always been characterized by a relentless increase in mobile data rate performance, trying to follow the demands of an ever-increasingly connected society. However, 5G has brought about a design shift by providing modern communications services beyond simple wireless data delivery, such as mission-critical applications, high-bandwidth services, and low-latency applications. However, behind these new use cases are a series of engineering challenges that require developing and adopting new concepts and technologies. These are being studied individually in great depth. However, the success of 5G-and-beyond lies in the fruitful integration of these heterogeneous new components into a cohesive whole. By adopting a system-level perspective, this dissertation aims at acquiring a holistic understanding of the interactions and trade-offs between a set of key enabling technologies and services, with the final goal of informing on effective integration strategies. We first focus on Network Slicing, showing how a resource management framework based on a fusion of technical and economic considerations yields significant performance gains against traditional approaches. Then we switch our focus to Open RAN (O-RAN), a Radio Access Network (RAN) architecture overhaul that offers unprecedented data collection and control capabilities, such as the ones required to enable the management framework described above. Here our contribution is both theoretical and experimental. In particular, we discuss the architecture extension required to integrate Integrated Access and Backhaul (IAB) into O-RAN and the deriving opportunities of enabling dynamic control for this technology. Then, to foster practical experimentation with O-RAN, we have modified a popular 5G software stack implementation making it O-RAN compatible. Additionally, we have designed the first open and accessible large-scale 5G IAB testbed. Finally, we propose our vision about a millimeter wave (mmWave) RAN empowered by Smart Radio Environments (SREs): a groundbreaking communication paradigm shift that had yet to be studied from a system-level perspective. Through purpose-designed network planning tools, we have produced and analyzed a large dataset of optimized network layouts. Our results inform on the opportunities of integrating SREs cinto large-scale mmWave RAN, highlighting the synergies between different technologies and showing how the integration can ultimately increase performance and decrease overall network costs.

PhD Committee
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