Ph.D. in Information Technology
Thesis Defense

May 14th, 2026
At 9:30 p.m.
Sala Schiavoni - Building 20A

Marcello MORINI – XXXVIII Cycle

RAN AWARENESS: ANALYSIS, EXPERIMENTATION AND RESOURCE ALLOCATION IN DISAGGREGATED RADIO ACCESS NETWORKS
Supervisor: Prof. Ilario Filippini

Abstract:

The evolution of modern Radio Access Networks demands unprecedented flexibility to accommodate diverse frequency bands, rigorous transport constraints, and intensive computational requirements. This dissertation presents a comprehensive framework for the holistic analysis and orchestration of Radio Access Networks (RANs), addressing the critical interplay between radio, transport, and computing resources. First, we provide an empirical evaluation of novel spectrum bands, specifically Upper-6 GHz and millimeter-wave,assessing propagation challenges and macro-cell deployment feasibility. Subsequently, we rigorously model the physical layer processing chains, focusing on code block length evolution and Low-Density Parity Check decoding latency across accelerated platforms. Building upon these foundations, the thesis tackles major architectural bottlenecks. We propose a mathematical framework for fronthaul dimensioning and develop fronthaul adaptation strategies to guarantee service continuity under wireless transport link impairments, including atmospheric attenuation. Finally, these insights are integrated into a novel, RAN-aware cross-layer optimization framework that jointly manages resource assignment, fronthaul capacity, and computational load in a processor sharing architecture. This system is a key enabler to operate in RAN-constrained scenarios. Extensive system-level simulations demonstrate that the proposed flexible architecture significantly outperforms static baselines in both transport- and compute-constrained scenarios, paving the way for highly adaptive next-generation cellular networks.

PhD Committee

Prof. Antonio Capone, **Politecnico di Milano**

Prof. Xavier Costa Perez, **ICREA, Catalan Institution for Research and Advanced Studies**

Prof. Michela Meo, **Politecnico di Torino**