Ph.D. in Information Technology:

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Advisor: REDONDI ALESSANDRO ENRICO CESARE

PhD Thesis Title : **"Cloud-empowered DSP Leveraging Big Data Analytics in C-RAN Architecture"**

Short Abstract:

The development of Network Function Virtualization (NFV) technologies, as one of the pillars of emerging 5G and beyond networks, is spreading out to all segments of mobile networks, including both Core Network (CN) and Radio Access Network (RAN). Once virtualized, the network functions become scalable, flexible and could be computed in different parts of the network. This flexibility is supported by the development of powerful Cloud systems that are deployed closer and closer to the end-users, creating in such a way Edge cloud resources and the concept of Multi-access Edge Computing (MEC). From the other side, the generation of enormous amounts of network monitoring data offers an opportunity to improve and optimize any task related to network resource management by analyzing those datasets and extracting meaningful network knowledge.

In this thesis work, we focus on exploiting virtualization techniques within the Cloud-RAN (C-RAN) architecture in combination with outcomes of mobile network monitoring datasets analysis at different levels of the network. We define and estimate computational requirements and constraints of computing virtualized RAN (vRAN) functions in the Cloud, for which we create an experimental platform built out of virtual machines specifically designed for processing vRAN functions. Through the detailed analysis of the C-RAN architecture, we investigate several design solutions by mainly tackling the problem of centralizing Digital Signal Processing functions to be computeFd in the Cloud with General Purpose Processing (GPP) hardware.

Additionally, we perform a big data analysis of realistic mobile network datasets and exploit its outcomes to provide an optimization framework that allocates computational resources of virtualized RAN functions. The developed optimization algorithm tends to jointly reduce the number of allocated virtual resources at the Cloud platform and the number of service interruptions for the end-users. The proposed solution for the allocation of vRAN resources is possible to reach up to 25% of total cost savings in the mobile network compared to traditional mobile network approaches.

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