

Ph.D. in Information Technology: Thesis Defense

September 30th, 2021

**Sala Conferenze “Emilio Gatti” and online by Webex
at 11.00**

Daniele MORO – XXXIII Cycle

Network Function Offloading and Prototyping on Heterogeneous Networks with Programmable Data Planes

Supervisor: Prof. Antonio Capone

Abstract:

Network operators who have embraced Software Defined Networking (SDN) in the past have discovered that their interest in programmability does not stop at the control plane. Programmability at the data plane prevents the ossification of the network by enabling the development of new protocols at the speed of the software development. It also allows network operators to offload and accelerate Virtual Network Functions (VNFs), usually implemented as virtual machines or containers. Indeed, the increase of traffic demands due to new applications and user requirements poses issues on scaling VNFs that treat user-generated traffic. In this thesis work, we analyze how heterogeneous programmable networks can be exploited to accelerate network functions and how developers can experiment with new offloading use cases without dealing with expensive hardware testbeds. First, we demonstrate how traffic classification in Internet Service Provider (ISP) networks can be offloaded and accelerated, exploiting programmable stateful data planes. We then investigate how to exploit maximally the heterogeneous resources exposed by nowadays programmable networks. We propose a framework to deploy and allocate decomposed network functions, called microVNFs (uVNFs), on networks comprising programmable hardware and software counterparts. We then investigate how prototyping platforms and libraries can reduce the turnaround time and help programmers develop new offloading use cases. We build a prototyping platform to experiment with programmable heterogeneous networks. We show how developers can experiment with new and innovative offloading use cases using a virtual prototyping platform. Finally, we analyze another offloading use case from ISP's networks, proposing a disaggregated Broadband Network Gateway (BNG). We also analyze the API requirements between the control and user plane and propose a solution based on data-center technologies to allow interoperability between different vendor solutions.

PhD Committee

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