ICT PHD

Research project for a PhD curriculum in ICT – Computer Engineering and Science

Tutor:
Riccardo Lancellotti

Proposed Title of the research:
Management techniques for edge computing platforms

Keywords – (5)
Distributed Systems, Cloud Computing, Edge Computing, Load Balancing, Optimization Problems

Research objectives: – (max 10 rows)
The research aims at proposing innovative techniques for the management of an Edge computing platform (also called Fog computing). In this research we consider a distributed scenario where a set of sources produce data to be processed by an intermediate layer of edge computing nodes before being forwarded to one or more Cloud computing data centers.
The research aims at tackling the problems of managing such infrastructure considering multiple aspects ranging from computing load to network characteristics and up to power efficiency.

Proposed research activity – (max 10 rows)
The research activity concerns several main aspects of infrastructure management.
A first approach, operating at a coarse-grained time scale, is to formulate an optimization problem where sources are connected to one or more edge computing nodes.
The problem mainly considers static or stationary (i.e. slowly changing) scenarios where the guarantees in terms of Quality of Service (considering both network delays and processing times) must be combined with other goals such as reducing power consumption. A different point of view on the problem focuses on dynamic scenarios, where a given deployment must evolve, for example, to cope with changes in the incoming load, minimizing the change with respect to the original deployment. The problem may be further enriched by considering that tasks can be dynamically deployed on the edge layer, on the cloud layer or on both, depending on the QoS/energy requirements.
A different approach is to focus on a fine-grained time scale, analyzing dynamic load balancing cooperative algorithms to distribute on-the-fly data across the platform and evaluating their performance.
All these research topics should be analyzed combining multiple techniques ranging from mathematical models (e.g., performance models, energy models, optimization problems) to simulation-based performance evaluation and up to prototype development and testing.

Supporting research projects (and Department)
This project will be carried out at the Department of Engineering "Enzo Ferrari" and will be supported by research funds provided by Prof. R. Lancellotti.

Possible connections with research groups, companies, universities.
The research may involve the undergoing collaborations with research groups at:

- Roma "Tor Vergata" (Prof. Chiaraviglio)
- Politecnico di Milano (Prof. Ardagna)
- Roma "Sapienza" (Prof. Beraldi)
- Unimore – DISMI (Prof. Iori)