Ph.D. in Information Technology
Thesis Defense

January 27th, 2022
at 15:30
online by Teams

Michele ZANELLA – XXXIII Cycle

Post-Cloud Computing: Addressing Resource Management in the Resource Continuum

Supervisor: Prof. **William Fornaciari**

Abstract:

Due to the massive amount of data generated by very pervasive IoT and mobile devices combined with a high transfer rate and real-time requirements of emerging scenarios, Cloud computing is showing some limitations.
In this sense, post-cloud computing solutions (e.g., Edge and Fog computing) move part (or all) of the computation closer to the data source, making them a very hot research topic.
Even if there are some tentative frameworks and standardization proposals, there are no homogeneous architectural models to integrate the various paradigms or, in many cases, they are based on proprietary solutions.
Moreover, current solutions implement in part (or not at all) fine-grained resource management techniques, which are necessary to deal with energy-constrained devices.
For these reasons, this thesis proposes the BarMan framework as a cooperative approach to integrate different run-time managed levels of resources from the Cloud to Edge continuum.
However, dealing with the aforementioned distributed and multi-level systems means having different kinds of resource heterogeneity.
In this sense, this research aims to propose a novel resource-aware and task-based programming model to overcome the current state-of-the-art limitations.
Thus, since the correlation between heterogeneity and post-cloud scenarios, the programming model has also been extended for developing and integrate distributed applications.
The programming model can integrate applications with the BarbequeRTRM, which monitors and manages devices resources.
Furthermore, in the Fog scenario, mobile devices become part of the computing system because they can be exploited by lower-level or nearby devices to perform part of the computation. On the other hand, mobile devices increase their computational power, still being affected by their energy budget limitation.
In this regard, the rest of this research work aims to enable efficient integration of mobile devices at the Fog level through the run-time management of the application's execution, device's resources allocation, and energy consumption while considering the application's performance and requirements.

Finally, to meet the research community demand for real use-cases and hardware test-beds, we applied our approach to a developed video surveillance application and to a large-scale emergency scenario, evaluating them on self-built Fog test-beds and through simulation tools.

PhD Committee

Prof. **Giovanni Agosta**, Politecnico di Milano
Prof. **Davide Bertozzi**, Universita' degli Studi di Ferrara
Prof. **Maria Fazio**, Universita' degli Studi di Messina