Faculty of Automatic Control and Computers,
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Ciprian DOBRE

Habilitation Thesis

Mobile context-driven applications and services for ubiquitous computing

– SUMMARY –

This habilitation summarizes the works that I had a chance to be involved in the Computer Science Department, Faculty of Automatic Control and Computers, University Politehnica of Bucharest. The main subject of this habilitation is the *mobile context-driven applications and services for ubiquitous computing*. I present here my work in this area, showing various scientific, professional and academic results. The scientific work was successfully defended in different national and international high-prestigious conferences, journals and books. The majority of the papers contain both theoretical and practical results, as much of my work presented herein is closely related to, or motivated by, practical and real-life problems.

The PhD studies followed two research directions: modeling and simulation, and monitoring (of large scale distributed systems). The main topic of the Ph.D. studies (thesis defended in 2008) addressed modeling and simulation of large scale distributed systems. Together with CERN and Caltech, I participated in the development of *MONARC 2*, a generic simulator for modeling and performance analysis of distributed systems. The simulator was later used in simulation experiments that led to the evaluation and assessment of the production systems used in the LHC experiments at CERN. On monitoring, again with CERN, in Europe, and Caltech, in USA, I participated in the development of *MonALISA*, a monitoring framework for large scale distributed systems. Today *MonALISA* monitors and provides a unitary global view of the production infrastructures that support the Large Hadron Collider physics experiments. Even after the Ph.D. studies, I continued the development of the *MonALISA* project towards monitoring and control in networking technologies - with results in the development of high speed networking applications to support large distributed environments.

After my Ph.D. thesis, the primary focus of my research achievements was on mobile wireless networks and pervasive context-aware applications and services. With the proliferation of smartphones and tabletPCs, I am interested in the use of the scientific expertise in monitoring and evaluation, to advance the field mobile computing towards novel applications designed to improve the quality of life for users through their pervasive use of mobile devices. For example, *VNSim* is a simulator designed for evaluation of Vehicular Ad-Hoc Networks (VANET) applications. Applications such as these rely on ad-hoc networks formed between participants in traffic. I scientifically coordinated the development of innovative solutions in this domain, proposing in the national *TRANSYS* project (coordinated by me) methods and techniques to increase of traffic safety, enforce air-pollution control and decrease congestions in urban environments. Today, the researches are continued in several directions: the development of an innovative realistic simulator called Sim^2Car, and of the real-world traffic application *Traffic Collector*, to put in real-life the scientific ideas. At the basis, *CAPIM* is the context-aware platform designed to assist mobile applications make smarter assisted decisions (react to situation, contextually understand their environment).

Today, the Distributed Systems laboratory, that I'm a proud member of, hosts a series of successful activities and projects, focused on the research and development of solutions for collecting and actively

using context data, and augmenting it with social awareness, to deliver better sensing capabilities to mobile services and applications. Currently investigated research issues are at an intersection between the areas of mobile and pervasive computing, context representation and reasoning, and privacy, with direct applications on creating the support for intelligent traffic systems.

Examples of research activities include: the SPRINT protocol is among the most advanced today social-based opportunistic networking routing protocol (presented in IEEE WoWMoM, A-ranked conference), SENSE is a collaborative selfish node detection and incentive mechanism for mobile networks where collaboration among users is a most (presented in IEEE/IFIP IM, A-ranked conference), HYCCUPS is a contextual platform designed to assist smartphones take intelligent decisions to collaborate towards minimizing their energy footprint (presented in MSWim, A-ranked conference, and selected by Elsevier among most promising research result of 2013). We developed various other solutions lately, where we combined social aspects of mobile devices with context information towards advanced wireless networking aspects (with results published in IEEE AINA, ADHOC-NOW, top-ranked conferences, and high-IF journals). Also, the team coordinated by C. Dobre classified second place (world-wide) on the IETF/IFIP MANIAC 2013 challenge ‑ where the team demonstrated advanced algorithms for data offloading in mobile challenged networks.

I believe sincerely that *mobile context-driven applications and services for ubiquitous computing* is the key to solving many societal challenges. I can only hope that ideas presented in this thesis will someday find their way and, when applied to real-world problems, will potentially make a difference and advance humanity's technological limits…