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HABILITATION THESIS
– SUMMARY –

Interconnectivity and Optimization in Heterogeneous Networks: The Impact of Software-Defined Networking (SDN) and the Internet of Things (IoT)

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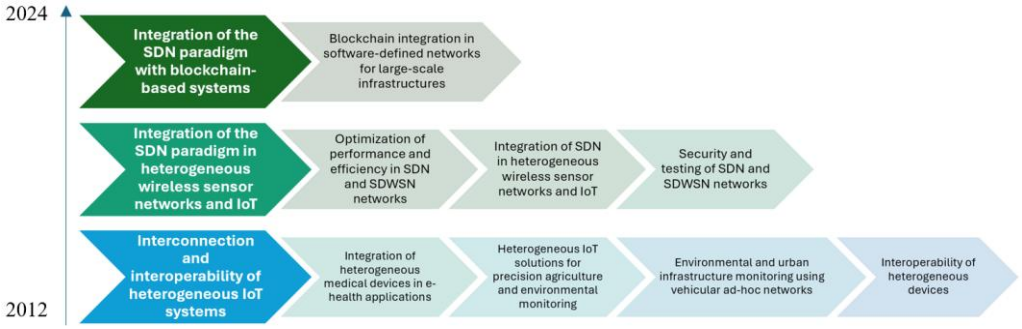
The habilitation thesis titled "Interconnectivity and Optimization in Heterogeneous Networks: The Impact of Software-Defined Networking (SDN) and the Internet of Things (IoT)" presents my scientific, professional, and academic achievements from the defense of my doctoral thesis in 2011 until now. The thesis focuses on highlighting my scientific accomplishments in the field of interconnectivity and optimization of heterogeneous networks, as well as my professional and academic achievements, including teaching activities, mentoring, and involvement in administrative tasks. Additionally, it outlines my perspective on the evolution of my career, encompassing future research activities and my academic development plan.

My activity has taken place at the Technical University of Cluj-Napoca, within the Department of Computer Science and the Communication Networks and Protocols (CNP) research laboratory (https://cnp.utcluj.ro/). My research activity began in 2005 with my bachelor's thesis in the field of computer science, focusing on the development of software routers. I obtained my master's degree in 2008 in Software Engineering, with research focused on improving Quality of Service (QoS) in computer networks. As a natural development, I pursued a Ph.D. in Computer Science, specializing in enhancing QoS in heterogeneous computer networks. After defending my Ph.D. in 2011, I contributed to the introduction and development of research directions in the field of heterogeneous communication networks, including Software-Defined Networking (SDN), Internet of Things (IoT), interconnection and optimization of heterogeneous systems, with applications in multiple related fields (medical, environmental, educational, etc.). To this end, I have contributed to the development of solutions for interconnecting and ensuring interoperability of heterogeneous IoT systems, applying them in medical and environmental domains. I have also worked on integrating the SDN paradigm into heterogeneous IoT and wireless sensor networks to enhance efficiency, scalability, security, and applicability in various fields such as healthcare, environmental monitoring, and network resource management. Additionally, I have explored the integration of SDN with blockchain-based systems for Internet Service Providers (ISPs).



The main research directions

My contributions to these research fields are reflected in the list of publications obtained after defending my Ph.D., summarized as follows:

- 9 papers published in WOS-indexed journals with impact factors, ranked in Q1 and Q2 quartiles
- 28 papers published in international journals and conferences indexed in major databases (WOS, IEEE, ACM, SCOPUS)
- 2 book chapters

As a member of the Communication Networks and Protocols (CNP) research laboratory, I have been involved in various research projects. I have contributed to the

writing and submission of European project proposals and national research project proposals. After my PhD, I have participated in three research grants as a coordinator and in three others as a project team member. For my research activity, I was presented with a Best Paper Award at an international conference and five awards at international invention exhibitions. Additionally, I have served as a program committee member for several international conferences (RoEduNet, ICCP, ISPDC, MIKE, etc.) and act as a reviewer for international journals (Sensors, IJERPH). I have also been involved in organizing scientific events and have served as a supervisory committee member for several Ph.D. students in Computer Science, as well as a Ph.D. defense committee member both nationally and internationally.

Regarding my teaching activities, I have been involved in the preparation and delivery of both lectures and practical sessions (laboratories and projects) for several fundamental and specialized courses, including: Analog and Digital Circuits (Bachelor level, 2nd year), Computer Networks (Bachelor level, 3rd year; Master level, 2nd year), Protocols and Communication Networks Project (Bachelor level, 4th year), Wireless Technologies and Mobile Devices (Bachelor level, 4th year), Security Elements in Computer Systems and Network Configuration (Master level, 2nd Year). I have contributed to the updating of course and laboratory materials and co-authored four books and three teaching materials. Additionally, I have been responsible for coordinating associated teaching staff and ensuring the continuous update of laboratory equipment. Every year, my teaching activity has included supervising undergraduate thesis projects, and since 2012, also master's theses, with an average of 10-15 students supervised annually. As a recognition of the quality of my teaching activity, I have had the honor of receiving three international CCNA Instructor Excellence Expert awards, one CCNA Instructor Excellence Advanced award, and the Students' Choice Award for Best Professor distinction ten times from the student communities of the Computer Science department.

In addition to my research and teaching activities, I am actively involved in university management at the departmental, faculty, and university levels, including: member of the admissions committee (since 2007) and coordinator of the admissions activities (since 2020), student internship tutor (2012–2019), member of the UTCN high school outreach team (since 2008), academic advisor (since 2024), member of the Erasmus mobility scholarship selection committee (since 2020), coordinator of the VUB-UTCN dual-degree master's program, member of the internal quality evaluation committee (since 2024), member of the Faculty Council of Automation and Computer Science (since 2020) and member of the Computer Science Department Council (since 2024).

Regarding future scientific and research activities, these will follow two major directions: fundamental research and applied research. A key objective of future research is to expand international collaboration in partnership with VUB University in Belgium, focusing on wireless mesh networks with QoS constraints in industrial collaboration scenarios. A crucial application in this context is to achieve low latency to

facilitate fast and reliable communication between devices, ensuring real-time data exchange and control in critical industrial processes. Within the field of heterogeneous computer networks, the design and development of new end-to-end QoS-sensitive communication techniques based on the concept of Software-Defined Networking (SDN) represent a fundamental research goal. Another major research direction is the development of communication technologies for efficient data acquisition and management in smart networks. Research efforts are directed towards applications in the energy, medical, environmental, and precision agriculture sectors. An applied research focus is studying the impact of IT&C technology on strategic communication, as well as the development and evaluation of new technology acceptance models in the field of assistive technologies. Another primary objective of future scientific research is the application for national and European research projects as a project coordinator, supervising doctoral students, and providing financial support through research assistant positions while involving doctoral students in teaching activities to ensure their comprehensive training. Furthermore, cooperation with research groups from EuT+ (European University of Technology) is a strategic objective, as it promotes innovative and interdisciplinary approaches, increases the visibility of scientific results, offers opportunities for collaborative projects funded by European programs, and strengthens institutional reputation.

Regarding future teaching activities, I aim to remain updated on the latest industry trends and to integrate modern topics into my classes, employing best practices for knowledge transfer and student motivation. To ensure students develop skills that meet industry demands, laboratories and projects will incorporate high-performance equipment and simulators that comply with international academic programs and prestigious IT certifications. I will continue to implement and refine blended-learning methods, effectively combining traditional teaching with digital learning technologies to address students' needs and diversity. Additionally, I will maintain my supervision of undergraduate and master's theses, designing engaging, research-oriented topics and supporting the dissemination of their results through conferences and other publications. Moreover, I intend to actively involve students in research projects, providing them with as many development opportunities as possible.

Furthermore, I plan to continue my involvement in university management activities and expand my contributions at the Department, Faculty, and University levels.

By pursuing these career development objectives, I believe I can contribute to maintaining a high standard of quality in teaching, research, and administration within the Department of Computer Science while also upholding the prestige of the Technical University of Cluj-Napoca.