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HABILITATION THESIS
-ABSTRACT-

Contributionsin System Dependability

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This habilitation thesis entitled ***Contributions in System Dependability***, presents my academic, scientific and professional activity as a member of the Department of Automation, Faculty of Automation and Computers, Technical University of Cluj-Napoca, since obtaining my PhD degree in 2011.

System dependability refers to the ability of a system to fulfill its intended functions in a reliable and trustworthy manner, even in the face of challenging or unexpected circumstances. Dependability is particularly important in critical systems such as healthcare, transportation, and industrial automation, where system failures can have serious consequences on people's lives and safety.

Ensuring system dependability requires a comprehensive approach that takes into account various attributes of the systems. Among these attributes are availability, reliability, safety, confidentiality, integrity, and maintainability, each playing a critical role in ensuring that systems can effectively and efficiently perform their intended functions.

At the core of ensuring system dependability lies systems engineering, which represents the process of designing, developing, and testing complex systems. Systems engineering plays a crucial role in creating reliable systems by providing a framework for designing and testing systems that can effectively and efficiently perform their intended functions, even in the face of unexpected challenges. Systems engineering adopts a holistic approach to system design, considering the various interdependencies and interactions among different subsystems and components. By considering the system as a whole rather than a collection of individual components, systems engineering contributes to ensuring that the system is designed to meet the desired performance requirements while also taking into account potential failure modes and ensuring that the system can operate safely and reliably.

The habilitation thesis consists of three chapters, plus the bibliography section. In the first chapter, a summary of achievements obtained from 2011 until the present is presented. This includes publications in journals, conferences, books, research project

experience, accumulated mentoring/coordination capacity, main original contributions, and teaching experience. Specifically, this chapter focuses on the scientific, professional, and academic achievements of the author in the field of system dependability. The thesis begins with a general overview of academic activities, highlighting student supervision for the completion of their studies and other collaborative activities undertaken with them.

In Chapter 2, a detailed presentation of a selection of important contributions in system dependability is provided. At the end of the thesis, in Chapter 3, a plan is discussed and proposed to ensure further development in the academic career.

In fact, Chapter 2 begins with the presentation of the attributes of dependability, providing a solid theoretical foundation for subsequent study. The author's contributions are structured into three main categories: contributions in medical information systems, contributions in systems with Cloud-Fog-Edge architectures, and the exploitation of machine learning to overcome challenges related to class imbalance.

Among the contributions in medical information systems, a reliable architecture developed for the Romanian medical system is presented, as well as contributions to resource availability for non-urgent services and challenges in achieving GDPR compliance in Blockchain-based applications for the healthcare system. These contributions demonstrate the importance of dependability in ensuring the quality, reliability, integrity, and security of medical information systems, which are essential for providing safe and efficient medical services.

Another important aspect discussed in the thesis relates to the dependability of systems with Cloud-Fog-Edge architectures. The author proposes a method of direct and secure communication between devices to manage resources more efficiently in these systems. Additionally, a method of integration and continuous implementation using an automatic stream generation system is presented, along with contributions regarding the automatic scaling of a microservices cluster on a single-board computer. Furthermore, the prevention of data loss and its protection through the use of authentication tokens is examined.

Another aspect addressed in the thesis concerns the use of machine learning to overcome challenges related to class imbalance in ensuring system dependability. The author proposed the use of an adaptive fuzzy algorithm for classifying imbalanced data and conducted experiments to evaluate the effectiveness of this approach.

In addition to specific contributions in the field of system dependability, the thesis pays attention to career evolution and development plans. Plans for the development of educational activities and scientific career, as well as the correlation between teaching and scientific research activities, are presented. The thesis falls within the field of systems engineering, which deals with modern concepts used for the development, analysis, implementation, and testing of systems. The content demonstrates the author's ability to conduct future research through the supervision of doctoral activities with students in the field of Systems Engineering.