

Doctorat de l'Université de Bretagne-Sud sous le sceau de l'Université Européenne de Bretagne à l'UMR IRISA, site de Vannes

Title: Architectural Analysis of Software-intensive Systems-of-Systems
Analyse architecturale de systèmes-de-systèmes à logiciel prépondérant

Department: D4 – Language & Software Engineering

Team: ArchWare

Context:

In the last two decades, Software Architecture has emerged as an important sub-discipline of Computing, especially related to the fields of Language and Software Engineering. More importantly, Software Architecture has been playing a key role in this new decade for enabling the next generation of software-intensive systems, whose architecture evolve on-the-fly, during operation.

Definitely, a key facet of the design of any software-intensive system is its architecture, i.e., the fundamental organization of the system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution (as defined by the Standard ISO/IEC/IEEE 42010). Modelled according to different viewpoints, it includes a precise specification of the structure, behaviour, and qualities of a system.

Indeed, software architecture forms the backbone for taming the complexity of software systems, where architecture descriptions provide the framework for designing, constructing, and dynamically evolving such systems.

Even more, it became the heart of the new generation of complex software-intensive systems, the so-called 'Systems-of-Systems' (SoS), especially in the case of critical applications.

Therefore, a rigorous approach is needed that does concentrate on the architecture of evolving systems and SoS: its description, analysis, construction, and evolution, blurring the boundary between design-time and run-time.

SoS architecture descriptions, by their formal nature, will support automated analysis with a view in particular to evaluating and predicting non-functional qualities of the modelled SoS.

Objective:

In this thesis, the aim is to make progress beyond the state-of-the-art on SoS architectural analysis by developing techniques and tools supporting verification of different sorts of properties and interleaving of these properties, including structural, behavioural, and quality properties.

It will focus on different complementary analysis techniques combining model checking and testing. The aim is to enable analysis and validation of a SoS architecture anytime along the whole SoS life-cycle by means of automated verification.

The research to be carried out will benefit of achievements from mainstream European projects and will build upon the baselines provided by the ArchWare Team. The strength of this baseline provides a high-quality asset environment for the PhD candidate.

The results of the thesis will be validated in a relevant case study drawn from a real industrial case. It will combine, in a spiral way, a rigorous approach with concrete applications for making relevant high quality contributions to the state-of-the-art.

Bibliography:

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Context of Work :

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