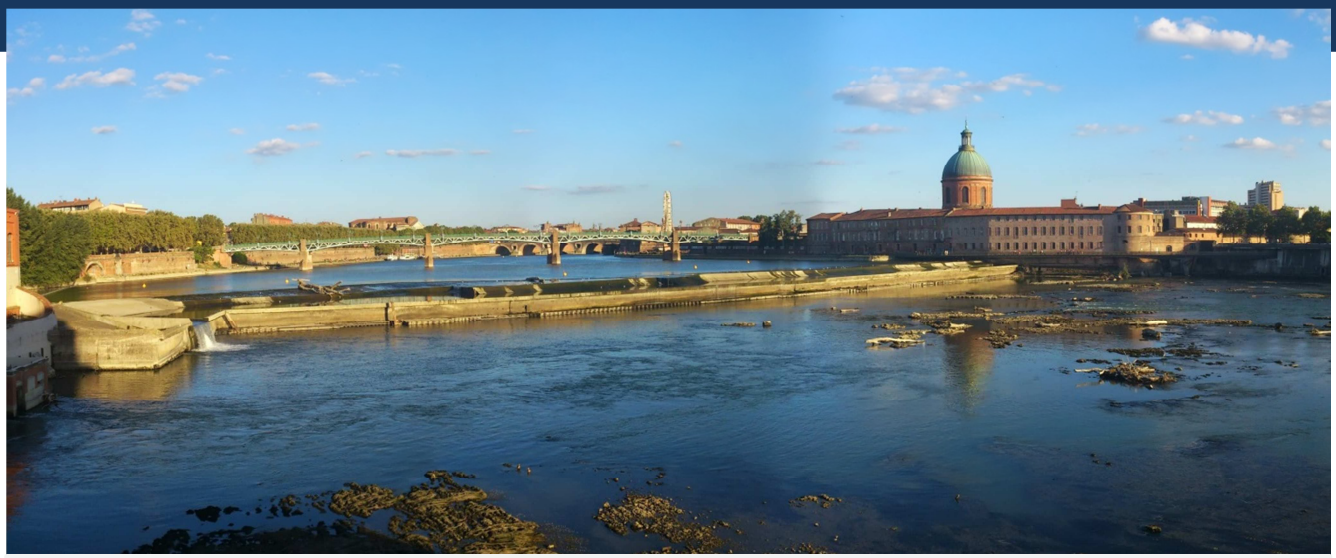

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Functional Architecture Optimisation in a Model-Based Approach

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Content

The high modularity and complexity of avionics systems make it difficult to use document-based methods to deal correctly and effectively with the systems design and validation. Yet model-based approaches are nowadays widely deployed to improve systems architecture design quality. While vast design space is encountered in the early stage of system design, it helps that the optimisation process is integrated in the Model-Based Systems Engineering (MBSE) to aid with trade-off analysis and automation of system architecture design. The objective is to improve system performance and reliability while respecting constraints such as weight, cost and energy consumption. European Component Oriented Architecture (ECOA) attracts architects' attention for its top-down and bottom-up characteristic which allows both functional analysis and the reuse of existing modules. Indeed, ECOA is component-based and enables the modularity of the system. Nowadays, a wide system is hardly ever developed by a single contractor, the principle of modularity of ECOA eases then the modeling of such a system with several stakeholders.

The optimisation process is not yet taken into consideration in the ECOA framework. Furthermore, some literature has demonstrated that conducting trade-off analysis by solving constraint satisfaction problem is feasible in MBSE using SysML language. We propose to include trade-off analysis in the process of system development. This process is demonstrated through a case study on a search and rescue mission system. From an ECOA description of the system, we propose to adapt the model into a SysML model in order to conduct analyses on this model. After the design of a meta-model, we use Time4Sys, an open-source software toolkit for modeling in SysML and UML, to model the ECOA architecture. Also, by using an optimization tool, we conduct a trade-off analysis to determine the best logical architecture taking into account the temporal properties and the quality of service (QoS) of ECOA operations and components.

Afterwards, we aim to include other requirements, such as non functionnal properties in the ECOA language. Today, the ECOA language is able to model temporal triggers and priorities, real-time properties for implementation but there are not enough attribute to determine the schedulability of the system such as a real-time functionnal chain representing the data flows in the system. In the future, we propose to enrich the ECOA language to include these data flows in the modelisation and conduct schedulability analysis and other optimisation methods like period affectation on operations to reduce the end to end time on a data flow.

Keywords : Model-based architecture design, Task scheduling, Safety analysis, Other