Research engineer position: Development of an Extension of RAMSES to Generate Code for ROS-based Robotic Applications from AADL Models

Institute: LTCI Lab, Telecom Paris, Institut Polytechnique de Paris, Palaiseau, France

Contacts:

Dominique Blouin (dominique.blouin@telecom-paris.fr)

Eric Senn (eric.senn@univ-ubs.fr)

Disciplines: Software engineering, robotics, ROS, AADL, model-based engineering, cyber-physical and embedded systems

Context:
The design of cyber-physical systems requires models to specify, analyze and synthesize the systems to detect design errors early in the development cycle and to reduce development efforts. In this context, the Architecture, Analysis & Design Language (AADL) has been developed for the modeling of cyber-physical and real-time embedded systems. Among the different modeling activities such as design analysis and verification, automatic code generation is an essential ingredient by allowing to translate a verified architecture model into implementation programming code. To achieve this, we have developed the Refinement of AADL Models for the Synthesis of Embedded Systems tool (RAMSES), which proceeds by first refining an AADL model to add details specific to the desired operating system platform, and then generate code from this refined model, from which more accurate analyses can also be performed.

Objective:
The position consists of developing an extension of RAMSES to automatically generate code for robotic systems based on the Robot Operating System (ROS). This work is a collaboration with researchers from the Lac-STICC who have developed an approach to model and analyze ROS-based systems using an AADL component library, where components are characterized from measurements on real platforms[1]. Developing a RAMSES extension includes using the Atlas Transformation Language (ATL) to specify model refinement patterns for ROS, the Eclipse Modeling Framework (EMF) to model RAMSES itself and the Java programming language to contribute to the code generator generating C code from refined AADL models. The engineer will co-supervise interns who will contribute to some of the tasks below.

Tasks:
> ➢ Specify and implement new model refinement transformations targeting ROS and using the Lab-STICC AADL library. Those transformations would likely be implemented with the ATL language.
> ➢ Extend the actual C code runtime environment and corresponding code generator to generate C code for ROS from the refined AADL models.
> ➢ Develop tests for the above.

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[1]Senn, E., Bourdon, L. W., & Blouin, D. "Multi-paradigm modeling for early analysis of ROS-based robotic applications using a library of AADL models". In Proceedings of the 25th International Conference on Model Driven Engineering Languages and Systems: Companion Proceedings.
https://dl.acm.org/doi/pdf/10.1145/3550356.3563129

- ➢ Develop Eclipse plugins to integrate the developed extensions in RAMSES
- ➢ Collaborate on validating the extension on real robotic systems.
- ➢ Participate in writing technical documentation and scientific publications

Skills:
- ➢ C and Java programming languages
- ➢ Robotics and ROS
- ➢ Knowledge in model-based engineering, AADL, model transformations and EMF would be a plus. Otherwise, training will be provided for those topics.

Work conditions:
- ➢ The duration of the contract is one year with potentially renewable.
- ➢ Work can be in English (it is not required to speak French).
- ➢ Traveling to our partner Lab-STICC located in Lorient, Brittany may be required.