

Research internship: Contribution to the Development of an Extension of RAMSES to Generate Code for ROS-based Robotic Applications

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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 internship consists of contributing to the development of 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 platforms¹. The intern will be mainly supervised by an experienced research engineer dedicated to the project and will contribute to the different steps of the development of the extension. Developing in RAMSES may include using the Atlas Transformation Language ([ATL](#)), the Eclipse Modeling Framework ([EMF](#)) and the Java programming language.

Tasks:

- Develop 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.

¹Senn, 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>

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

Skills:

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

Work conditions:

- A stipend (tax free) of 550 Euros per month is paid including a return flight to Paris.
- Different housing options are available at low cost (for Paris) near Telecom Paris
- The duration of the internship should be between 4 to 6 months.
- 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.