Job Title	Multiple Analysis of Embedded Critical Real-Time Systems with AADL
Main Research Field	Information Science and Engineering (ENG)
Sub Research Field	Software engineering
Key words	Embedded system, real-time system, architecture language, model-based software engineering
Job Description	AADL [1] is an international standard architecture description language that was first published by the SAE in 2004. Today, the current status of the standard (AADL V2.2) provides a complete and high quality framework to design, generate code and perform various early verifications of critical embedded real-time systems. The AADL is dedicated to precise modeling of complex embedded systems, covering both hardware and software concerns. Its definition relies on a precise set of concepts inherited from industry and academics best practice: clear separation of concerns among layers, rich set of properties to document system metrics and support for many kind of analysis: scheduling, safety and reliability, performance, but also code generation. The AADL leads to the development of numerous tools such as editors, analysis tools and code generators. OSATE [2], Ocarina [4], MASIW [3], Stood [7], AADLInspector/Cheddar [5,6] are examples of them. The language and the associated tools have be used to design and run/analyze many case studies and real-life applications. Several experiments have proved that interoperability between those tools can be achieved. However, it stays difficult to master AADL tool chains for end users. Each tool requires skills to understand how it may be used. Tools may have some restrictions, i.e. all the tools do not cover all the concepts/aspects of the AADL standard. Furthermore, tools may have different readiness levels. The overall limits the use of AADL tools by practitioners. This Marie-Curie fellowship proposes to address these challenges in order to leverage the use of AADL tools. The object of this project is to enhance the AADL community/AADL ecosystem, by improving robustness of AADL tools and their ability to interact. It also aims to provide an AADL cook-book to AADL users, i.e. a set of materials showing how to design and use AADL models for typical needs. All the material (i.e. AADL models, tools, documentation) composing this cook-book will be made available in a public repository, [1] Feiler, P. H., Lewis, B. A., and Vestal, S. The SAE Architecture Analysis & Design Language (AADL) a standard for engineering performance critical systems. In Computer Aided Control System Design, 2006 IEEE International Conference on Control Applications, pp. 1206-1211. [2] Feiler, P. (2004, October). Open source aadl tool environment (osate). In *AADL Workshop, paris* (pp. 1-40). [3] Khoroshilov, A., Albitskiy, D., Koverninskiy, I., Olshanskiy, M., Petrenko, A., & Ugnenko, A. (2012). AADL-based toolset for IMA design and integration. *SAE International Journal of Aerospace*, *5*(2012-01-2146), 294-299. [4] Hugues, J., Zalila, B., Pautet, L., & Kordon, F. (2008). From the prototype to the final embedded system using the Ocarina AADL tool suite. *ACM Transactions on Embedded Computing Systems (TECS)*, *7*(4), 42.

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Supervisor(s)	Frank Singhoff (UBO/Lab-STICC, Brest, France) is Professor of Computer Science in the Lab-STICC laboratory, UMR CNRS 6285 and in the Computer Science Department at the Université de Bretagne Occidentale, France. He received his engineering degree in Computer Science from the CNAM/Paris in 1996 and his PhD from Télécom-Paris-Tech in 1999. His current research focuses on real-time scheduling analysis and architecture description languages on multi and many cores. In 2002, he started Cheddar, a toolset designed to perform analysis with the real-time scheduling theory. Frank Singhoff is also a member of the SAE AS-2C committee working on the AADL. He received an ACM SIGAda "Outstanding Ada Community Contri-butions Award" in 2010. Webpage : http://beru.univ-brest.fr/~singhoff Main publications : • Cheddar : a Flexible Real Time Scheduling Framework. F. Singhoff, J. Legrand, L. Nana and L. Marcé. ACM SIGAda Ada Letters, volume 24, number 4, pages 1-8. December 2004. • Scheduling and Memory requirement analysis with AADL. F. Singhoff, J. Legrand, L. Nana and L. Marcé. ACM SIGAda Ada Letters, volume 25, number 4, pages 1-10. November 2005. • Multi-objective design exploration approach for Ravenscar real-time systems. R. Bouaziz, L. Lemarchand, F. Singhoff, B. Zalila, M. Jmaiel, Journal of Real Time Systems. Springer. February 2018.
Department/Resea	This project will be hosted by the Lab-STICC (France, UMR CNRS 6285), standing for "Information and Communication Science and Technology Laboratory", which is a research mixed unit of the National Centre for Scientific (CNRS) in collaboration with two universities and three engineering institutes. CNRS is the largest governmental research organization in France and the largest fundamental science agency in Europe. The Lab-STICC is composed of more than 600 (260 academic staff) researchers organized in 11 teams including the MOCS team. The researchers involved in this project belong to the MOCS team. The MOCS team is composed of about 35 permanent researchers and 50 Phd students where the research interests are the design methodologies and CAD tools for both hardware and software architectures of embedded systems. Since 2002, the MOCS team has built strong skills around real-time scheduling analysis. One of the results of the team in this area is the open source Cheddar tool. Cheddar is one of the leading real-time scheduling analysis tools and is used by numerous organizations. It is also integrated into several toolsets such as TASTE (a toolset of the European Space Agency) or AADLInspector. Lab-STICC is a member of the SAE AS-2C standar-dization committee.

Suggestion for interdisciplinary / intersectoral secondments	Collaboration with the Software Engineering Institute/Carnegie Mellon University : This project will be driven by a steering committee proposed by the SAE AS-2C AADL standard committee. The SAE AS-2C committee is leaded by the Software Engineering Institute/Carnegie Mellon University and the applicant to this fellowship will have to participate to the AS-2C committee for project reporting. The steering committee will be in charge to define, for example, the set of tools, case study or analysis covered by the AADL cook-book.
Skills Requirements (optional) :	Fluent in English Publications: at least 1 per year since the Ph.D. completion, as 1st author.