

Tuesday October 7

EIS seminar with Professor Jörgen Hansson from Carnegie Mellon University and Linköping University

Title: Validation of Quality Attributes of Embedded Real-Time Systems using a Model-Based Engineering Approach and AADL.

Abstract: Engineering and developing embedded systems with stringent real-time and safety-critical requirements calls for rigorous technical solutions, and since real-time and safety-critical behavior are system properties, they crosscut the system architecture design and the development life-cycle. A majority of all system defects are being introduced prior to implementation and they are related to problems in architectural design, mismatched assumption, and unclear requirements. Most of these defects are not detected until the integration phase of development, and the cost of handling these defects late in the development life-cycle is substantial (often 15-30 times higher). Thus, the inability to detecting defects early, i.e., prior to the system implementation and realization, often leads to projects exceeding their budget as well as project delays. At the same time, real-time safety-critical embedded systems (RTSCE) continue to grow in scale and complexity, becoming increasingly distributed and dependent on other systems, while still operating under end-to-end requirements.

The SAE Architecture Analysis & Design Language (AADL), created by SEI, is an international standard developed to support model-based engineering (MBE) of embedded, real-time, and software-intensive systems. In this presentation we give an overview of AADL and SEI's approach to MBE, and we discuss how MBE engineering provides a means to validate and evaluate architectural design candidates in their ability to satisfy quality attributes requirements, as well as to conduct impact and trade-off analysis among quality attributes. MBE enables engineers to make architectural decisions using a common and precise model and quantifiable analysis tools to virtually integrate designs to provide confidence in the system architecture. This validation can occur early and be repeated throughout the system lifecycle. We will illustrate some of these concepts using examples from the performance and security domain.

Indeed, architectural description languages in general have successfully been applied to prove system properties, often with a propensity toward task- or component-centric perspectives. In addition, architectural models can also provide significant value when validating that systems are provided with data of sufficient quality and consistency (given application requirements), especially if the data properties can be annotated to a single-source architectural model. We will conclude by discussing our initial results and progress in this area.*

Short Biography: Dr. Jörgen Hansson is a Senior Member of Technical Staff at the Software Engineering Institute (SEI) of Carnegie Mellon University and a Professor of Computer Science at Linköping University, Sweden. At SEI he leads the Performance-Critical Systems Initiative, which focuses on developing, maturing, and transitioning of analysis-based assurance and model-based engineering tools and practices for predicting the dependability and performance of software intensive systems, especially embedded real-time systems. He is the author of two books and 80 technical papers published in conferences, journals, and books that cover embedded real-time systems, architectural design and validation, real-time data management data, security, and resource and QoS management. The current and primary focus of his work is on developing techniques for validating system behavior using model-based engineering and architectural models. He has served as a member of several international program committees for leading conferences in the area of real-time systems, e.g., IEEE Real-Time Systems Symposium (RTSS) and IEEE Real-Time Technology and Application Symposium (RTAS), member of the steering committee for IEEE International Conference on Real-Time Computing Systems and Applications (RTCSA), and he is a frequent reviewer for journals in the area of real-time and software engineering.

Welcome!