B. J. Tyler*

School of Science and Technology, Nazarbayev University, Astana, Kazakhstan; *btyler@nu.edu.kz

Introduction. The demand for increasingly complex yet robust software and hardware systems has posed serious challenges to today's system developers. As the number of components rise, and the complexity of the system increases, the potential for error unfortunately increases as well. Finding and fixing these problems early on in the development process saves both time and money, and prevents costly rework later on.

A common approach to help catch potential errors early in development is the creation and evaluation of system models that are expressed using specialized *design languages*. Before any implementation takes place, these models can be evaluated for functional correctness, as well as performance characteristics. If we are satisfied with the results, we may then use these models to drive subsequent steps in the development and fabrication of the system under consideration. The proposed work involves the completion of the current iteration of such a design language, Rosetta, and the development of new modeling and evaluation tools for the language. Rosetta (www.rosetta-lang.org) is a systems design language that has been under development since the late 1990's, but has recently undergone several significant changes which have greatly enhanced its ability to capture real-word systems, and make it unique among other design languages.

Methodology. While completing the IEEE DASC specification of the Rosetta language is an important step [1], the main effort of this project will be to develop software tools that will allow users to create and evaluate Rosetta models using verification and validation techniques. The main challenge lies in the fact that Rosetta can very much be seen as a meta-language, where modelers can define different *domains* which impact the semantics of different elements of a system, and the *interactions* between elements of different domains. These two features distinguish Rosetta from other systems-level modeling languages [2], and are critically important to creating realistic, high-fidelity models.

Discussion. In the initial phase of this project, we plan on completing the current Rosetta specification, and developing an Interactive Development Environment for the language. We will also develop an *elaboration* capability for Rosetta models (i.e., the resolution of domains and interactions), as well as a simulator which will facilitate test-based validation of models. At this point, we will be able to examine and prioritize other verification and validation techniques, including formal methods such as model checking, to pursue for future development [3].

Conclusions. This project will result in design tools and technologies that will facilitate the creation of complex, heterogeneous systems that meet requirements. From a more pure-research perspective, this project will also lay the foundation for further work into modeling language development and the application of verification and validation techniques to system design.

References.

1. P. Alexander, "Rosetta: Standardization at the System Level," *IEEE Computer* 42(1): 108-110, 2009.
2. C. Kong, P. Alexander, C. Menon, "Defining a Formal Coalgebraic Semantics for The Rosetta Specification Language," *Journal of Universal Computer Science,* 9(11):1322-1349, 2003.
3. B. Tyler, A. Langdon, P. Chawla, "Formal Verification of Layered Sensing Architectures," *2010 IEEE National Aerospace & Electronics Conference (NAECON).* pp. 41-44.