

Technology: NAOMI

Modeling—A Development Tool for Large Integrated Software Systems

Imagine a vehicle assembled from the best available parts from various year models around the world. Maybe a Mercedes engine, integrated with a Chrysler transmission, supporting a GM drive shaft/differential and a Ford chassis.

Typical large, integrated software system-of-systems are analogous to the vehicle described above, in that they are made up of subsystems comprised of legacy software of varying ages, commercial-off-the-shelf software, and newly written code—all written in different programming languages for different purposes.

The Challenge

Next-generation software systems will be even larger and more complex than today's systems—too complex to be understood by humans using current approaches. The goal of model-based systems development (MBSD) is to use models as the foundation of all development activity to manage this complexity. For example, MBSD promises to expose design flaws early in the development when the costs of design changes are minimal. To comprehensively model all aspects of a system, however, multiple models are needed to precisely model each specific

aspect of a system, e.g., behavior, reliability, cost, etc. Each model is a discrete entity, written in a domain-specific language (DSML). A collection of different models representing properties of the same system forms a multi-model.

In a multi-model (1) each model can be independently modified, (2) models are interdependent—changes to one model may require changes in other models—and, (3) changes to the different models may need to occur in a specific order to achieve development goals. A critical challenge is ensuring that models in a multi-model are consistent—that is, the shared components across the multiple models are identical.

To solve these modeling challenges, Lockheed Martin Advanced Technology Laboratories (LM ATL) and its partners are developing NAOMI—a platform to integrate multiple diverse models written in different DSMLs into a single multi-model. NAOMI enables enhanced model precision that is not possible with any one individual modeling language.

NAOMI automates the most difficult manual processes in multi-modeling and makes construction of robust multi-models possible. It supports an interface that connects individual models to the NAOMI multi-model platform, allows users to specify the interactions

between models, controls the flow of data exchange, and provides visualization of the multi-model—similar to a hardware computer-aided design (CAD) tool, except that it is used to hook together models.

NAOMI also automates the arduous manual process of tracking dependencies between models, and sequences the execution of updates when one or more of the models in the system changes, helping to achieve multi-model consistency.

The LM ATL team is presently testing NAOMI on a

multi-model that mimics capabilities representative of a DoD application. Current experiments are focused on how the entire multi-model responds to various changes in the constituent models.

LM ATL's NAOMI project is being developed under



NAOMI will accelerate software component integration in large integrated software systems and expose flaws early in the development cycle.

Lockheed Martin's Corporate Systems and Software Initiative in collaboration with the University of California at Berkeley, the University of Illinois at Urbana Champaign, the University of Leicester, and Vanderbilt University.

The LM ATL Software Technology Initiative is seeking partners to further test, develop, demonstrate, and transition NAOMI.

For More Information:

Lockheed Martin Advanced Technology Laboratories
Hugh Pearce, PhD, Director Business Development
3 Executive Campus • Suite 600 • Cherry Hill, NJ 08002
856.792.9810 • hpearce@atl.lmco.com