**Abstract for the 2011 INFORMS Simulation Society Research Workshop**

# Composite Simulation Modeling of Complex Service Systems: Example and Research Challenges

*Peter J. Haas*

IBM Almaden Research Center, 650 Harry Road, San Jose, CA 95120-6099

peterh@almaden.ibm.com

Complex service systems typically are affected by a broad array of factors. E.g., healthcare programs for reducing population obesity are affected by location decisions for grocery stores, available modes of transportation, economic and social demographics, urban planning, medicine, agriculture, advertising and marketing practices, and regulations. Modeling and simulation can, and should, play a key role in supporting policy and investment decisions in such complex environments. Typically, however, different organizations have developed their own expert models for understanding various pieces of the complex system of interest. The grand challenge is to somehow pull all of these pieces together into an integrated picture via collaborative modeling and analysis.

We give an overview of the Splash platform, a research prototype under development at IBM that facilitates composition of multiple existing simulation models, statistical models, optimization models, and datasets. This platform comprises mechanisms for cataloging, describing, connecting, executing, and analyzing a set of models. The Splash approach differs from simulation interoperability techniques in which models are simultaneously executed and tightly coupled. This latter approach requires detailed knowledge of the participating models and often changes to the code to achieve interoperability. In contrast, models in Splash are loosely coupled, meaning they can execute independently and communicate mainly via data, either through files, databases, or web-service calls. The goal is to leverage the power of a community of experts and a range of individual modeling techniques by making the process of collaborative modeling and analysis sufficiently attractive, flexible, practical, and cost-effective. An overriding research question is whether such a goal is feasible.

Our loosely-coupled approach to simulation interoperability pushes the limits of existing simulation technology with respect to tasks such as sensitivity analysis, experimental design, and simulation optimization. Our work also raises an array of interesting research issues that touch almost every area of simulation methodology. We discuss some of these challenges, which include input modeling, inter-model data transformations, data-privacy concerns, pseudo-random number management, efficient simulation execution, model validation, and output analysis. Other intriguing challenges include the handling of bi-directional causality between loosely coupled models, the presentation of simulation results to decision-makers, and the creation of an "ecosystem" of collaborating simulation modelers.