Title

Modeling and Simulation for Engineering of Self-Improving Service Systems of Systems: Barriers and Prospects

Abstract

Modeling and Simulation (M&S) for Systems of Systems Engineering (SoSE) faces barriers to adoption due to scale of difficulty and cost – enormous size of system and component systems and ever evolving nature of components and their relation to the system. Model engineering, a newly identified subfield of M&S, aims at setting up a systematic, normalized, and quantifiable engineering methodology for construction, management and maintenance of the data, processes and organizations/people involved in the full lifecycle of a SoS model.

A service system has been defined as a SoS that comprises service providers and clients working together to coproduce value in complex value chains. Healthcare delivery, as an example, is the focus of attention to alter its trajectory of sky-rocketing cost and diminishing value to the consumer. Under what conditions can such a SoS learn to reform itself and continuously improve its quality while reducing its cost? A service SoS is made of humans and technology, where for the foreseeable future, self-improvement will be primarily based on human understanding augmented by machine learning, Therefore, in order for the system to continually self-improve it must provide the right data and models to support human experimentation with alternatives likely to improve the value of its services. It follows that there must be implemented systems that allow alternative component configurations (protocols, processes, procedures) to be continually tested and to correlate measured value with component configurations to provide performance ratings that humans can employ to select the most promising options. M&S systems and services then become essential infrastructure components within the panoply of services of any self-improving SoS.

In this talk, we probe the nature of model engineering in the context of self-improving service systems. To establish the background needed for this discussion, we briefly introduce the definition and theory of SoS as it relates to the Discrete Event System Specification (DEVS) formalism, a widely employed computational basis for M&S. With these concepts as foundation, we discuss the barriers and prospects for a service oriented model engineering and simulation environment to support design of self-improving SoS. We close with a discussion of how model engineering and DEVS enable new frameworks for application areas and the opportunities for further research.

Bio

Bernard P Zeigler is Emeritus Professor of Electrical and Computer Engineering at the University of Arizona and Adjunct Research Professor in the C4I Center at George Mason University. He is internationally known for his seminal contributions in modeling and simulation theory and has published several books including “Theory of Modeling and Simulation” and “Guide to Modeling and Simulation of Systems of Systems. “ He was named Fellow of the IEEE for the Discrete Event System Specification (DEVS) formalism that he invented in 1976. Among numerous positions held with the Society for Modeling and Simulation International (SCS) he served as President and was inducted into its Hall of Fame. He is currently Chief Scientist with RTSync Corp., a developer of the MS4 modeling and simulation software based on DEVS. Zeigler’s research has been funded by a variety of sponsors including National Science Foundation (NSF), Defense Advanced Reseach Projects Agency, US Air Force Research Laboratory among others. For more information see the Wikipedia entry on Bernard P Zeigler.