

Heterogeneous Model Composability for Simulating and Evaluating Interacting Process Dynamics and Decision Plans

Today's supply-chain networks must be able to withstand expanding complexity and scale due to business imperatives coupled with technology advances. Success depends on formulation of how dynamic processes and projected decision plans satisfy their individual and collective roles. Toward this goal, flexible, industrial-scale platforms capable of simulating and evaluating operations of such systems are called for.

Two challenges standing in the way of building such platforms are model heterogeneity and execution scalability; these form the foundation for coupling different modeling theories as well as their corresponding execution protocols. The former requires a formal basis for describing interactions between models that have distinct concepts for knowledge representation and operations. The latter requires developing software designs and implementations that can manage large, varied data sets.

Our approach for simulating Intel's supply-chain systems has been to use discrete-event system specification (DEVS) formalism for modeling stochastic processes and logistics. For decision plans, we use linear programming (LP) and heuristics to predict controls for decision nodes across supply-chain systems. We have developed the knowledge interchange brokers (KIB) model for formalizing bi-directional data transformation under controlled exchange frequencies between DEVS, LP, and heuristic models. The KIB's central advantage is its ability to independently account for the interactions taking place among heterogeneous models of processes, logistics, and decision plans.

Our approach is applied to one of Intel's product lines where high-resolution, multi-chain process-logistics network simulation models are developed, verified, evaluated, and validated. Decision plans find optimized control signals among hundreds of thousands of possibilities. The modeling and simulation platform is developed using DEVS-Suite simulator, ILOG CPLEX optimization, and Eclipse/Java tools.

This kind of simulation platform with KIB offers the essential benefit of gaining insights into the time-based interactions taking place among different kinds of models. Existing and future enterprise supply-chain networks can be simulated and evaluated under alternative interaction arrangements and operational policies.

Bio-sketch

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