

# Higher-Order Transformation for Incremental Propagation of Changes from Software to Performance Models

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## Abstract

This paper proposes a higher-order transformation (HOT) for realizing Incremental Change Propagation (ICP) from software UML models extended with performance annotations to performance Layered Queueing Network (LQN) models. Such a transformation is necessary for integrating quantitative performance analysis into the model-driven engineering of real-time systems. The entire process starts by automatically generating an LQN and a trace model from a UML model extended with MARTE annotations, with a batch Epsilon ETL transformation previously developed by the authors. The textual ETL transformation definition is translated to an ETL transformation model using the Epsilon Haetae tool. The ETL transformation model conforms to the ETL metamodel and represents the mapping between source and target models at a high level of abstraction. We use it to answer the question: what needs to be changed in the target model upon detecting changes in the source model? During the development process, when the UML model evolves, we detect such changes with the Eclipse EMF Compare tool, then incrementally propagate them to the LQN model to keep it synchronized. The extended approach is illustrated by applying it to an e-commerce model from the literature. The execution time of ICP is measured and compared to the traditional batch transformation.

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