

Event-based model transformations with incremental pattern matching

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Nowadays the model-based software development paradigm has gained significant popularity. The most important component of its realisation is a model transformation system capable of mapping between different abstraction levels of the system under design. Several technologies are available for model transformation, due to their widespread applicability and visual nature, methods based on graph transformation (graph rewriting) have given birth to a variety of academic and industrial tools. This paper features the VIATRA2 transformation framework which is developed at the Department of Measurement and Information Systems and is used in various research projects.

In addition to model transformation systems, domain-specific modelling environments have become an integral part of the model based design workflow as well. They facilitate the integration of domain experts into the development process, which is a crucial improvement over previous software-centric approaches. Additionally, DSM technology makes it possible to approach the development of the system from multiple aspects while maintaining consistency within and between aspects. The most important challenge to such coherent modelling is the synchronisation between models, which cannot be solved automatically and efficiently by state-of-the-art tools.

The reason for this lies in the fact that general graph transformation solutions are not effective in these interactive applications, which require the constant monitoring of the model changes. By the traditional naive method, the applicability of each transformation rule has to be checked after each model change, which is a computationally costly procedure. In contrast to this, our approach uses incremental pattern matching to improve the efficiency, that is, after each change to the modelspace, the set of matches are maintained step by step. This new type of pattern matching strategy enabled us to apply a new event-based model transformation paradigm in the VIATRA2 system. In analogy with database management systems, we introduced the concept of triggers. In our context a trigger is an action sequence associated with the occurrence of predefined graph pattern conditions. With this new execution technique, various problems, which can be reduced to incremental synchronization have become easy and effective to implement.

Our results allowed us to extend the VIATRA2 based ViatraDSM graphical domain-specific modelling tool with a new generation domain-specific modelling language technology which supports the full separation of the abstract and concrete syntax, together with simple and efficient inter-domain mapping and code generation. We demonstrate our results using a case study on a domain specific workflow editor and code generator written for the SENSORIA European Union research project.