Chapter 13

Automate Model Transformation From CIM to PIM up to PSM in Model-Driven Architecture

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ABSTRACT

The CIM, PIM, and PSM models are the main levels of the MDA approach. Model transformation is an important step in the MDA process. Indeed, in MDA there are two elementary transformation kinds: CIM to PIM transformation and PIM to PSM transformation. However, most searches propose approaches transforming PIM to PSM, since there are multiple points in common between PIM and PSM. Nevertheless, transforming CIM to PIM is rarely addressed in research because these two levels are mainly different. However, there is not a synthesis work that makes it possible to carry out a model transformation from CIM to PIM towards PSM until obtaining the code. This synthesis methodology allows controlling models transformation from CIM to PIM to PSM, indeed, up to obtaining code according the MDA. This approach makes it possible to limit the intervention of computer scientists in the life cycle of software development. Indeed, this methodology allows modeling only CIM, the business process, and then obtains the source code through successive semi-automatic transformations.

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INTRODUCTION

MDE (Model Driven Engineering) (Schmidt, 2006) is an alternative approach of software engineering. This approach allows the development of software systems by basing on the models. This approach focuses on the creation of the basic models and transforming them, to multiple levels of abstraction, in order to automatic generation of source code. The objective of this approach is to automate the operation of software development that is realized manually by the software experts. MDE is a general methodology which can be supported by several approaches, indeed, MDA (Model Driven Architecture) (OMG-MDA, 2015) of OMG (Object Management Group) is considered as the most prevalent approach. MDA follows the same fundamentals of MDE; however, it identifies its own bases presented by three levels of abstraction, respect of various requirements, and the recommendation of some standards.

CIM (Computation Independent Model) is the highest level of abstraction and the first into MDA. Indeed, CIM level is independent of computation, for this, the researchers represent only the business process reality into this level. CIM models are made by business experts. The second level of abstraction in MDA is the PIM level that describes models useful to information system analysts and designers. PIM (Platform Independent Model) level contains the conceptual models, and the analysis models, of information system. The lowest level of abstraction in MDA is the PSM (Platform Specific Model) which is constituted by code models; these models are very useful by software developers. The models of PSM level formed of all information related to a specific platform. MDA is a model-based architecture, for this, the textual code does not interpreted as a level in MDA, however, source code is the ultimate goal into MDA.

Model transformation presents the key of MDA. The transformations between different levels of MDA start with the transformations from CIM (Computation Independent Mode) to PIM (Platform Independent Model) that allow to partially obtain the PIM models from the CIM models. The objective is to rewrite technically the information contained in the CIM models into PIM models, which enables to ensure that business information is preserved throughout the MDA process. Then, the transformation from PIM level to PSM (Platform Specific Model) level requires adding into PIM models the technical information related to the target platform.

Our approach based, in CIM level, BPMN (Business Process Model and Notation) (OMG-BPMN, 2011) collaboration diagram and business process diagram which represent standards of business process model. Next, through these latter standards the authors can build rich business models that contain well-concentrated information help us to get PIM models. The first model in the PIM level is the use case diagram model that interprets the functionalities of the system. Then, the sequence diagram model describes information interaction with the system in a dynamic way. Next, the class diagram model allows presenting the system classes and their relationships. Finally, all classes are structured in packages into package diagram model. Then, PIM models can be transformed through a tool to PSM, indeed, up to code.

CIM, PIM and PSM are the important levels in MDA. Model transformation is the main step in the MDA approach. However, in MDA there are two primary transformation: CIM to PIM transformation and PIM to PSM transformation. Nevertheless, most works offer approaches transforming PIM to PSM, indeed, there are several commonality between PIM and PSM. However, transforming CIM to PIM is rarely broached in research because these two levels are mainly dissimilar. Indeed, there is not a synthesis work which makes it possible to achieve a model transformation from CIM to PIM towards PSM until getting the code. This synthesis research allows mastering models transformation from CIM to PIM to PSM, indeed, up to obtaining code according the MDA. This work makes it possible to limit the interven-
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