A Based-Rule Method to Transform CIM to PIM into MDA

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ABSTRACT

The model transformation is the most interesting part into MDA. Indeed, two transformations exist between three levels of MDA. Most searches cover the transformation from PIM to PSM. However, a little of approaches allow transforming CIM to PIM. This paper represents an approach allows mastering transformation from CIM to PIM into MDA. This approach is based on good CIM level through selected rules allowing provide rich models that facilitate the transformation to PIM level. Afterwards, the authors determine a concentrated PIM level with main design models established through use case diagram, state diagram, and package diagram. Next, to ensure a semi-automatic transformation from CIM to PIM the researchers specify a set of well-chosen transformation rules. For respecting MDA approach the authors consider the business dimension in CIM level by using business modeling standards of OMG (BPMN and activity diagram). However, the researchers focus on UML diagrams to establish PIM models because UML is recommended by MDA in PIM level.

KEYWORDS

Business Process Model, CIM, MDA, Model Transformation, PIM

1. 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. MDE founds on the construction of basic models and transforming them, in order to provide code source automatically. 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 sometimes 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 interpret 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.

The unique transformation in practice is PIM to PSM transformation. However, our objective consists to make the CIM a productive level, and a basis for manufacturing PIM level through an automatic transformation. Nevertheless, the goal is that business models will not remain simple documents of communication between software designers and business experts.

The researchers propose, in this paper, a solution for automating transformation from CIM level to PIM level, by studying how to use the current standards of business modeling effectively, in order to achieve concentrated CIM models that allow simplifying the transformation to PIM. Next, the authors specify a set of well-selected rules to automate transformation to PIM level.

Our approach based, in CIM level, on UML (Unified Modeling Language) (Miles & Hamilton, 2006) activity diagram and BPMN (Business Process Model and Notation) (OMG-BPMN, 2011) collaboration 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 state diagram model describes information system states. Next, the class diagram model allows presenting the system classes and their relationships. Finally, all classes are structured in packages into package diagram model.

The rest of this paper is organized as follows. In Section 2, the authors describe the related works of the transformation from CIM to PIM. Then, in Section 3, the researchers show the approach, specify the construction rules of CIM level, and describe the transformation rules that allow transforming CIM models to PIM models. Next, in Section 4, the authors illustrate the proposal in a case study showing the establishment of CIM level and transforming it to PIM level. However, in Section 5 the researchers analyze the contributions of the approach compared with related work. Finally, in Section 6, the authors conclude by specifying the current works and by presenting future works.

2. RELATED WORK

In this section, the researchers describe the related works concerning the transformation from CIM level to PIM level into MDA.

The oriented-service transformation from CIM to PIM presented in (Castro et al., 2011). In this approach the authors establish CIM level with: the BPMN notation for modeling the business process and the value model (Gordijn et al., 2003) for identifying services from the beginning in the business perspective. The authors based on the ATL (atlas transformation language) language for moving toward PIM level which is represented by two extensions of the activity diagram and two extensions of use case diagram.

A methodology for transforming CIM to PIM founded on security requirements in CIM level is represented in (Rodríguez et al., 2010). The authors use the BPMN notation for modeling business processes secure into CIM level; next, they specify the transformation with QVT (query view transformation) (OMG-QVT, 2015) in order to obtain models of class diagram and use case diagram.

In (Hahn et al., 2010) the authors propose an approach of engineering services model-driven, they represent the CIM level through BPMN notation. Then, they use ATL
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