DESCRIPTIVE ANALYSIS OF BUSINESS VALUE MODELS’ TRANSFORMATION IN MDA APPROACH

N. KHARMOUM, K. EL BOUCHTI, S. ZITI AND F. OMARY

Abstract. During the last decade, the model transformation has been considered as one of the Model Driven Architecture (MDA) approach’s key. For this purpose, the Object Management Group proposes for this approach three abstraction levels, which are Computation Independent Model (CIM), Platform Independent Model (PIM) and Platform Specific Model (PSM). Therefore, most researches avoid the transformation in relationship with the CIM level because there is no defined standard and contains higher abstraction model nature, such as Business Value Models (BVM). However, the CIM level is considered as an essential level, because each change in the CIM level influences all the other abstraction levels such as PIM and PSM. So, our contribution and challenge in this work are to study, analyze and discuss different methods that deal with the Business Value models transformation in CIM, which were made over the last decade and respect the MDA approach.

1. Introduction

At the beginning of the 21st century, the Object Management Group (OMG) proposed a new approach called Model Driven Architecture (MDA) approach and has become a standard in the software engineering domain [1]. It assigns different keys, such as the models’ transformations task. For that, the OMG offers three abstraction levels which are; CIM, PIM, and PSM.

The Computation Independent Mode level (CIM) bestows a higher level of abstraction. Models of this level do not give any concern about the technical or system implementation. The Platform Independent Model (PIM) grants the average level of abstraction while the models in this level do not know any implementation and technical specifications. Moreover, the Platform Specific Model (PSM) level is linked to the platform execution and rated as the low level of abstraction. However, the Code source is not a level in the MDA approach, it is just an end expected from the multiple transformations [2], and it is just a textual formalism for the PSM

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models [3]. Figure 1 summarizes the MDA approach with the various levels and transformations.

![Figure 1. Overview of the MDA](image)

In this contribution, we will study models transformations from Business Value models at the CIM level for the MDA approach. On the one hand, Business Value models represent the value-based requirements engineering [4, 5], introduce the notation to model and unify the e-business models from a value point of view and defines how the economic value is created, exchanged and consumed within a network of actors [6]. On the other hand, each change in the CIM level will influence all other regenerated models for average (PIM) and lowest (PSM) levels. Thus, the transformation in the higher levels is not supported by any standard [2].

So, our contribution and challenge in this work are to study different approaches focusing on the construction and the transformation of Business Value models. To comprehend: how these models are built? How can we transform these models? Have these transformations respected any approach or standard? Also, how these models transformation is evaluated?

To answer these questions, we will structure the rest of the paper as follows; the second section studies various approaches focus on the transformations of Business Value models. Analysis and discussion of all the results obtained from the study of different approaches based on descriptive analysis will be the subject of the third section. Finally, the fourth section presents the conclusion of our study and specifies our future work.

2. Transformation Approaches of Business Value Models

Our study analyzes various models’ transformations from the Business Value models, and considered as the continuation of our last analytical studies [7, 8]; that we are frequently based on the CIM level Transformation in MDA approach. Until now, few studies have been made since the last decade deals with Business Value models. Luckily, we succeeded to detect the bellow studies.
Pijpers and Gordin in their E3transition approach [9], start with the Business Value Models of a value web as source model, to generate their Process Models in relation with same value web, within the E3transition models.

The generation of the process model from the value model is proposed by Weigand et al. in [10]. They commence their method by molding E3value model [4] to the resource management model and communication model, to construct their process models.

Besides, improvement of the Business Modeling Ontology (BMO) [11] suggested by Schuster and Motal [12] in their approach, is about transforming the E3value notation into an REA-stereotyped [13].

Aligning the business services obtained in a Business Value model with e-services, is suggested by Zdravkovic and Ilayperuma [14]. The source model is represented by the Business Value models dealing with the REA framework and the OeBTO (Open edi-Business Transaction Ontology) [15] to create a service-centric. However, after applying the proposed mapping rules, the target model represented by the UML-based system model [16]; producing both the static and behavioral specifications of the e-services.

Fatemi et al. in [17] use a graph transformation tool (Groove) [18], to generate the Coordination process Model from the E3value model (Business Value model).

De Castro et al. in [19] apply a semi-automatic CIM to-PIM model transformation for the service-oriented development of information systems. In the CIM level, they modeled the business view using both the BPMN model [20] and the E3value model. Whereas, after the semi-automatic transformation using ATL language [21], the generated PIM level is structured by the UML Use Case diagrams and by the UML activity diagrams.

Kinderen et al. in [22] transform the E3value model automatically to ArchiMate [23] through transaction patterns from the DEMO [24] method, via the ATL Transformation language.

Aligning Business Models with Requirements Models is proposed in [25] by Souza et al. they offer a systematic approach to automatically transform the Dynamic Value description (DVD) to the Goal-oriented models (KAOS and iStar).

Finally, Kharmoum et al. [26] propose an automatic transformation method from E3value model to the Data Flow diagram (DFD) [27] dealing with the ATL transformation rules and respecting the MDA approach.

3. Analysis and Discussion Based on Descriptive Analysis

We analyze and discuss, in this section, different approaches studied above dealing with a descriptive analysis. For this purpose, we start with the assembly of the different proposed evaluation criteria, respecting various recommendations.

3.1. Evaluation criteria. We based on the OMG recommendations [1] and papers [2, 28, 29, 30], to gather the following criteria for the studied models’ analysis:

- Choice of the approach criterion 1: use of MDA approach;
- Model construction criterion 2: coverage of Business Value model;
- Model construction criterion 3: coverage of the graphical representation;
- Transformation criterion 4: transformation automation;
- Transformation criterion 5: meta-models based transformation;
- Transformation criterion 6: definition of the mapping rules;
• Evaluation approach criterion 7: the existence of an assessment methodology.

3.2. Analyze and Discussion. In this part, we analyze and discuss all the above-studied method dealing with a descriptive analysis. To do so, Figure 2 presents the result of the studied papers Comparison via Evaluation criteria; the figure columns present the deduced criteria, whereas, the figure lines present studied papers. Thus, for a better analysis of our results; figure 3 presents all our deduced descriptive analysis histograms. So, to bolster our analysis and discussion, the rest of this section will be based on the two figures: 2 and 3.

![Figure 2: Studied papers Comparison via Evaluation criteria](image)

We start with figure 3(a), representing the number of studied approach participants in each criterion, we observe that the whole of the studied papers validates our proposed criteria; this justifies the excellent choice of studied papers for this analytical study.

The figure 3(b) focuses on the Business Value representation manner; we can deduce that most approaches use E3value model [9], [10], [12], [17], [19], [22], and [26]. However, for the Business Value models representation, we can use Resources, Events, Agents model (REA) [12] and [14], Business Modeling Ontology (BMO) [12], and Dynamic Value Description (DVD) [25].

Furthermore, figure 3(c) based on the transformation type between models. We grasp that most methods manually transform their models using human language. Elsewise, the approaches [25] and [26] practice an automatic transformation (using Transformation language) while semi-automatic transformation (that combining the manual and the automatic transformation way) is used in [19] and [22]. In the same way, we understand that the studied papers transform their models automatically or semi-automatically, using a transformation language such as ATL in [19], [22], and [26].
For the assessment methodology, we obtain from figure 3(d) that all methods are based on a case study to evaluate their transformations. However, we have just the three methods [19], [22], and [26] are based on a standard tool for their practical case.

Thus, we have from figure 2 that most of the generated models from the studied Business Value models are Business Process nature. For example, we find the UML Activity diagram used by [9] and [19]. Also, the BPMN is generated in [10]. We have the REA model (Resources, Events, Agents model) in [12], and Coordination Process Model in [17]. Finally, the Data Flow Diagram (DFD) is generated in [26].

So far, we have tried to answer all the posed questions, which triggers this analytical study; specifying the models that can be used to model Business Value models, all of the transformation manner, and the different assessment methodologies. Resultantly, we can deduce all the taxonomies shown in figure 4. Hence, the figure 4(a) shows the deduced representation taxonomy of the Business Value model, the figure 4(b) presents the transformation type taxonomy, while the figure 4(c) shows assessment methodology taxonomy.

4. Conclusion and Future Work

This paper studied the transformation of Business Value models in the MDA approach, dealing with a descriptive analysis of different methods done over the
last decade. For this, we compared all studied papers via our gathered evaluation criteria. After that, we deduced histograms and taxonomies concerning Business Value model representation, transformation type, and Assessment methodology. Until now different methods are proposed, and few of them are complete.

In our future work, will base on the complete and consistence studied papers, in order to propose a new method; generating new models automatically on the average level from the Business Value models; respecting, the OMG recommendations.

REFERENCES


Nassem Kharmoum
Department of Computer Science, Intelligent Processing Systems & Security Team, Faculty of Sciences, Mohamed V University in Rabat, Morocco
E-mail address: nassem.kharmoum@um5s.net.ma, nkharmoum@gmail.com
Karim El Bouchti  
Department of Computer Science, Intelligent Processing Systems & Security Team,  
Faculty of Sciences, Mohammed V University in Rabat, Morocco  
E-mail address: elbouchtikarim@gmail.com

Soumia Ziti  
Department of Computer Science, Intelligent Processing Systems & Security Team,  
Faculty of Sciences, Mohammed V University in Rabat, Morocco  
E-mail address: ziti.soumia@gmail.com

Fouzia Omary  
Department of Computer Science, Intelligent Processing Systems & Security Team,  
Faculty of Sciences, Mohammed V University in Rabat, Morocco  
E-mail address: omaryfouzia@gmail.com