A Summary of Challenges for "MDE as Service"

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Abstract. *The introduction of resources for Model Driven Engineering (MDE) in industrial contexts is seen as a business opportunity for some companies and professionals. From an ecosystems perspective, resources are analyzed, acquired from repositories, adapted and integrated in software development environments. This paper summarizes some challenges for "MDE as Service", which require the introduction of these resources in target contexts, considering a perspective for MDE ecosystems.*

1. Introduction

Model Driven Engineering (MDE) achieved a certain maturity in practice and research, leading Software Engineers to the development of several tools, Domain Specific Languages (DSL) and resources that assist tasks for software development [Mohagheghi et al. 2013]. Aiming at introducing MDE in target contexts, some initiatives for "MDE as Service" [Basso et al. 2013, Monteiro et al. 2014] develop and adapt resources such as DSLs, model transformations, Model Transformation Chains (MTCs), etc. This implies in an effort from professionals to analyze and integrate candidate MDE resources that cooperate in one or more Software Development Process (SDP) adopted by a company.

This scenario can be considered from the perspective of software ecosystems (SECO) [Bosch 2009]. To Jansen et al., a SECO is a unit of business where a common technological platform for services and software allows to connect resources, information and artifacts [Jansen et al. 2009]. Although ecosystems gained attention from research in recent years [Bosch 2009, dos Santos et al. 2013, Fuggetta and Nitto 2014], existing work does not identify issues for the implementation of approaches for MDE as Service. Thus, research gaps must be discussed.

This paper presents some challenges to implement this reuse approach and it is organized as follows: Section 2 contextualizes MDE as Service; Section 3 presents our analysis of the challenges to introduce MDE in target contexts from the MDE ecosystems perspective and conclusion is presented in Section 4.

2. MDE as Service

Approaches for MDE as Service [Basso et al. 2013, Monteiro et al. 2014, Mohagheghi et al. 2013] need to deal with resources for MDE reused in an inter-organizational level (i.e., used by one or more software development companies). Bosch makes a distinction between SECO and regular Software Product Line (SPL) approaches, claiming that when a SPL extends the organizational boundary (i.e., intra-organizational), then a software ecosystem is established to manage inter-organizational

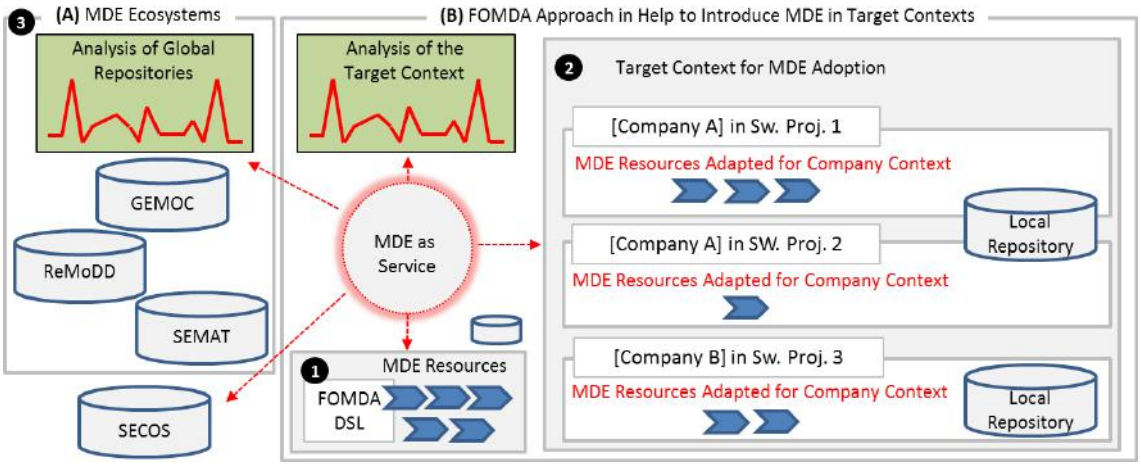

Figure 1. A Possible Scenario for MDE as Service.

resources [Bosch 2009]. In [Basso et al. 2013], although not discussing about SECOs, we exemplified a scenario where SPL is applied to manage inter-organizational resources for MDE. Thus, MDE as Service is an interesting scenario where concepts for SECO can be applied.

In this scenario, resources developed for MDE (e.g., model transformations, DSLs and transformation tools) are introduced in different contexts. This is not easy and requires a set of techniques and tool support for reuse that makes the configuration of resources for MDE flexible. An analysis of the target context is carried out, highlighting which resources for MDE are used in the development of a specific software project, e.g., selecting an appropriate DSL to be used in the development of web information systems. It is also important to consider the know how of teams to support the design and development tasks, which may imply on the use of different frameworks, processes and technologies.

In our previous experiences [Basso et al. 2013], the analysis is followed by the adaptation in existing resources for MDE (Figure 1, box 1), delivering at the end a configured tool in conformity with target context (Figure 1, box 2). This is described in the Features-Oriented Model-Driven Architecture (FOMDA) approach [Basso et al. 2013], which includes technical information on how to execute the engineering of adaptive model transformations. The generation of a flexible tool support for MDE is possible through the FOMDA DSL, a language to design MTCs, Feature Model, and to associate features with model transformation components. Thus, resources are customized for intra and inter-organizational contexts.

The current challenge is to support the usage/reuse of resources for MDE developed around the world in a perspective of ecosystems, which makes the FOMDA DSL limited. This is discussed in the next section.

3. MDE Ecosystems

We believe that collaboration is the key to reduce cost in MDE as Service, as illustrated in Figure 1 (A). In other words, instead of developing new DSLs, we can make use of those proposed in the literature of the area, analysing the best options to introduce in

inter-organizational contexts. In the following we present the main initiatives for MDE Ecosystems that are inserted in this scenario.

MDE Knowledge Base (KB). ReMoDD [France et al. 2007] is a repository that shares some didactic material for MDE published in some conferences such as MODELS, ECMFA, etc. Most information is available in documents, papers, tutorials, models, metamodels and transformations. In [Mussbacher et al. 2014], the authors claimed that this KB will centralize good practices, but that the lack of critical mass imposes difficulties since we have no habit to share information in the area. ReMoDD, therefore, is a KB in operation that can be important to help in reducing the learning curve.

Globalization of DSLs. In order to share resources for MDE, it is important to ensure that eventual compositions in MTCs are valid. The GMOC initiative is an effort to ensure that technicalities from MDE will be interchangeable in practice [Combemale et al. 2014]. In other words, GMOC will enable a collaborative scenario for MDE considering heterogeneous inter-organizational contexts. Thus, this is important for MDE as Service, since GMOC can help in reducing the costs to introduce MDE in practice.

Knowledge Base for Processes. SEMAT [Johnson et al. 2012] is an initiative to provide a knowledge base in Software Engineering related to process models. This is important because some companies target for MDE adoption have not defined their SDP, making costly the analysis of the target context. SEMAT can help in reducing costs through information about processes. Besides, SEMAT uses Essence as a core representation language, which can be used in the context of MDE to automatically integrate technical resources for MDE with target process models represented with Essence.

Ongoing work. OMG should support a common language for resources associated with these KBs. This language could be helpful to Software Engineers while deciding about a design tool to include in a target software project, making more viable MDE as Service. In order to implement this new scenario, in [Basso et al. 2014], some requirements for this common representation are presented. We proposed RAS++, a DSL that extends the Reusable Asset Specification (RAS) to represent data associated with MDE artifacts. RAS++ aims at facilitating the transition from an information found in a repository (e.g., ReMoDD or GMOC) automatically to target contexts (e.g., representations that integrate these artifacts through MDE Settings such as the FOMDA DSL).

Summary of research gaps. On a perspective of ecosystems, MDE researchers and practitioners could: 1) investigate the applicability of approaches for SECO to promote the reuse of MDE resources, thus helping in the MDE adoption; 2) propose and develop platforms as services for MDE Ecosystems, e.g., finding the requirements for the integration of OSLC [Basso et al. 2014] in this scenario; and 3) propose approaches for a network of collaborative services, connecting people, processes, tools and companies on the support for MDE as Service.

4. Conclusion

MDE as Service is an approach where the introduction of MDE in target software development companies is considered as the core business. In order to reduce costs through shared resources for MDE among organizations, MDE as Service can benefit from ap-

proaches that propose the reuse through repositories/Knowledge Bases. This reuse approach, which is related with the ecosystem perspective, is few discussed in the literature of the area related to the MDE specificity. Thus, our contribution is a summary of some research gaps related with promising MDE ecosystems, which can help in future initiatives for MDE as Service.

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