Chapter 1
Evolution of ArchiMate and ArchiMate Models:
An Operations Catalogue for Automating the Migration of ArchiMate Models

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ABSTRACT

Models are a fundamental aspect of enterprise architecture, as they capture the concepts and relationships that describe the essentials of the different enterprise domains. These models are tightly coupled to an enterprise architecture modeling language that defines the rules for creating and updating such models. In the model-driven engineering field, these languages are formalized as meta-models. Over time, to keep up with the need to capture a more complex reality in their enterprise architecture models, organizations need to enrich the meta-model and, consequently, migrate the existing models. Model migration poses a strenuous modeling effort with the gathering of enterprise data and model redesign, leading to an error-prone and time-consuming task. In this chapter, the authors present a catalog of co-evolution operations for enabling automation of ArchiMate model migration based on a set of meta-model changes.

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INTRODUCTION

Enterprise Architecture (EA) models are fundamental tools of every EA initiative used to design and disseminate the enterprise's organizational structure, business processes, information systems, and IT infrastructure (M. Lankhorst et al., 2013). In general, a particular domain is analyzed and engineered by means of a domain-specific modeling language, also named meta-model by the model-driven engineering community (Cicchetti, Di Ruscio, Eramo, & Pierantonio, 2008b; Herrmannsdoerfer, Vermolen, & Wachsmuth, 2011; Wachsmuth, 2007). Since the EA meta-model is typically defined at the very first steps of EA initiatives, it is likely to evolve in subsequent stages of EA initiatives. There are several causes for an EA meta-model to evolve. Internal causes, when the needs of expressiveness increase along with the evolution and scope of the EA initiatives, and external causes, when the standards or compliance rules change. Take the example of ArchiMate (The Open Group, 2013). The ArchiMate language has seen significant changes since its conception in 2010 up to its current 3.0.1 version (The Open Group, 2013). New domains, concepts, and relationships were added while others were updated or removed from the language. This holds true to other EA meta-models, either proprietary or open.

The real challenge of evolving an EA meta-model is the co-evolution of the models that might no longer conform to the new version of the meta-model. A model is said to conform to a meta-model when such model is expressed by the concepts encoded in the meta-model (Cicchetti, Di Ruscio, Eramo, & Pierantonio, 2008a). The need to adapt the EA model combined with its inherent complexity puts a strenuous effort in organizations that seek to evolve and maintain their existing EA, leading ultimately to an ineffective EA process within organizations.

Taking into account the numerous changes a meta-model can have, one comes to the conclusion that not all the meta-model changes are problematic. In fact, a significant part of the meta-model evolution is just the addition of new concepts, and therefore have no implications for the existing EA models. Another part, however, is the redefinition of concepts in the meta-model, which typically happens when organizations need to increase the expressiveness of their EA models. In spite of being a limited part of the meta-model changes, these last changes are usually responsible for most of the effort implied in the evolution of the meta-model, because they also force changes to the existing models to conform to the new meta-model (Cicchetti et al., 2008a).

The pertinence of this research is justified, in practice, by the pace in which standards themselves change compared to the most of the organization's ability to implement EA initiatives, thus forcing transformations to the initial models. Therefore, the organizations only choice is to spend more effort in evolving their EA meta-model and update their models accordingly. Moreover, with the increase of manual modeling effort comes the error-proneness of performing the model migration task, due to human error. Consequently, EA model migration poses resistance to the incremental approach of EA practice within organizations. As a result, the research problem can be identified as follows: *The process of manually migrating EA models using stepwise EA meta-model evolution is error-prone and time-consuming.*

This paper presents a catalog composed of nine co-evolution operation specifications as an innovative, purposeful IS artifact for automating the migration task of ArchiMate models when stepwise evolution of the ArchiMate language takes place. The remainder of the paper is presented as follows: first, in "RESEARCH PROBLEM", the authors present the problem of model co-evolution from the model-driven engineering field. Then, an overview on the state-of-the-art is presented in "RELATED WORK". In "RESEARCH PROPOSAL", a description of each co-evolution operation specification is made. Then, a stepwise evolution scenario is given in "DEMONSTRATION", showing the application