

Chapter 19

Hybrid Modeling: An Instrument for Conceptual Interoperability

Robert Woitsch
BOC Asset Management, Austria

ABSTRACT

Enterprise Interoperability can be identified on cultural, rule, process, data, software, object, social network, services, knowledge, electronic ID, cloud, and ecosystem level, whereas the challenge is the conceptual integration across those layers in a flexible way. Meta Modeling as a concept is a proven technology to enable such conceptual integration for both machine computation and human-oriented interpretation for information value creation. Hybrid Modeling is a realization approach to merge different meta models and hence enable the interoperability between conceptual models. Stability is provided by the meta modeling platform whereas flexibility is ensured by hybrid modeling via a holistic integration framework. This approach has been successfully implemented in a list of EU-research projects. This chapter introduces (a) concept models as an instrument for interoperability, (b) a meta model approach as a flexible but stable platform, and (c) hybrid modeling as an approach to flexibly compose the conceptual integration. After discussing this theoretical background, the chapter introduces different realization scenarios of hybrid modeling. Each scenario is supported differently by the underlying meta modeling platform ADOxx®. Here, the experience of a list of EU-research projects is explained and reflected to enterprise interoperability requirements. Sample solutions are introduced, showing different hybrid modeling implementations. Technical overviews of the ADOxx® meta modeling platforms are introduced and references to open development communities are provided to invite readers to realize their own modeling solutions.

1. INTRODUCTION

Industry 4.0 (Fraunhofer IAO, 2013) describes the ongoing paradigm shift in production industry towards networked enterprises. Future Internet Enterprise Systems (FInES), virtual enterprises

and networked IT-infrastructure are keywords indicating current and upcoming challenges of future enterprises facing (FINES Cluster, 2010) agility, sensing, community-orientation, liquidity and globalism.

DOI: 10.4018/978-1-4666-8111-8.ch019

Enterprise Interoperability is hence defined “as a field of activity with the aim to improve the manner in which enterprises, by means of Information and Communications Technologies (ICT), interoperate with other enterprises, organization, or with other business units of the same enterprise, in order to conduct their business. This enables enterprises to, for instance, build partnerships, deliver new products and services, and/or become more cost efficient.” (Popplewell, Lampathaki, Koussouris, Mouzakitis, Charalabidis, Goncalves, & Agostinho, 2012).

Conceptual models such as business process models, value process chains or e3value models are commodity and hence the conceptual modeling approach is a promising candidate to support enterprise interoperability. This chapter sees the result of conceptual modeling not only to be used for software generation, but also to act as an Enterprise Knowledge Platform (Karagiannis, 2012) by enabling information value creation for human interpretation out of models. Hence conceptual modeling approach is argued to be applied for the so-called Next Generation Enterprise System in order to conceptualize relevant parts and to support different layers of interoperability. This approach results in a list of modeling requirements dealing with the modeling language, the modeling steps as well as algorithms and mechanisms that are required to describe the Next Generation Enterprise Systems.

Depending on the complexity of the requirements, those modeling requirements may be covered by one meta model but most likely require the interplay of several meta models focusing on different viewpoints. Domain-specific modeling languages are context-specific and hence designed to optimally support domain experts within that particular domain. Often interoperability issues require the involvement of several domains and hence raise the issue of interoperability of different domain-specific languages. Such interplay between different domain-specific meta models is defined as hybrid modeling, where different

viewpoints are commonly applied to create a holistic observation of a Next Generation Enterprise System.

Hence, hybrid modeling is seen as an appropriate technology to observe the different layers of interoperability between different enterprises in order to holistically describe this interoperability in a conceptualized way.

After this introduction, the second section indicates the different levels of enterprise-interoperability and identifies different layers that can be individually supported via conceptual modeling. Samples from previous and currently running EU-projects are briefly mentioned to demonstrate the wide area of hybrid modeling with concrete application samples for the benefit of enterprise interoperability.

The third section discusses challenges when applying conceptual models in form of hybrid modeling. Meta models are a well-established realization approach for conceptual models, hence background is provided on meta models, before hybrid modeling is introduced.

Interoperability between layers is commonly a vertical integration of meta models, whereas interoperability between enterprises is most commonly a horizontal integration. The proposed technical realizations using the ADOxx® meta modeling platform are briefly introduced and relevant parts of the used technologies are underlined.

The fourth section introduces the sample from the EU-project BIVEE in more detail showing the challenges of a complex meta model covering several aspects of enterprise interoperability within a virtual enterprise.

The fifth section discusses approaches, solutions and lessons learned with respect to enterprise interoperability. The last section depicts the concluding remarks mainly pointing to open development communities using enterprise models (Open Models, 2013), developing meta models (Open Models Laboratory, 2013) or in providing technology and platforms (ADOxx.org, 2013).

20 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/hybrid-modeling/125302

Related Content

Password Sharing and How to Reduce It

Ana Ferreira, Ricardo Correia, David Chadwick, Henrique M.D. Santos, Rui Gomes, Diogo Reis and Luis Antunes (2013). *IT Policy and Ethics: Concepts, Methodologies, Tools, and Applications* (pp. 22-42).

www.irma-international.org/chapter/password-sharing-reduce/75023

Tackling Uncertainty in the Bio-Based Economy

Pasquale Marcello Falcone and Enrica Imbert (2019). *International Journal of Standardization Research* (pp. 74-84).

www.irma-international.org/article/tackling-uncertainty-in-the-bio-based-economy/249243

Activity: IT Audit Follow-Up Course of Action

(2020). *IT Auditing Using a System Perspective* (pp. 235-256).

www.irma-international.org/chapter/activity/258493

On Engagement With ICT Standards and Their Implementations in Open Source Software Projects: Experiences and Insights From the Multimedia Field

Jonas Gamalielsson and Björn Lundell (2021). *International Journal of Standardization Research* (pp. 1-28).

www.irma-international.org/article/on-engagement-with-ict-standards-and-their-implementations-in-open-source-software-projects/287102

Standardization Strategies and Their Impact on Partners' Relationships in Complex Product and Systems: Cases in the Space Sector

Karim Benmeziane and Anne Mione (2014). *International Journal of IT Standards and Standardization Research* (pp. 21-37).

www.irma-international.org/article/standardization-strategies-and-their-impact-on-partners-relationships-in-complex-product-and-systems/121703