

## Chapter 3

# Topological Functioning Model as a CIM–Business Model

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### ABSTRACT

*The first model in Model Driven Architecture (MDA) is a Computation Independent Model (CIM) that specifies domain information. One of issues discussed in this chapter is the meaning of “computation independence”. Another one is formalism of CIMs. And the last issue discussed is a use of a Topological Functioning Model (TFM) for problem domain modeling from a computation independent viewpoint. The TFM is a mathematical model that holistically and formally represents functionality of the problem domain, and does not show any details of the implementation and modeling platform. The TFM contains information from functional, information, and organizational domains of business process modeling. Construction of the TFM from the informal description of the system and guidelines for its decomposition into business processes are discussed and demonstrated by an example.*

### INTRODUCTION

The Object Management Group (OMG) proposed Model Driven Architecture (MDA) that architecturally separates viewpoints on specifications. MDA suggests three different models for each of the proposed viewpoints. According to MDA principles stated in (The Object Management Group, 2003), they are a Computation Independent Model (CIM), a Platform Independent Model

(PIM), and a Platform Specific Model (PSM). The CIM describes system requirements and a way a system works within its environment, while details of the application structure and realization are hidden or as yet undetermined. This model is sometimes called a domain model (a business model) and a vocabulary. The PIM describes operation of a system. It suppresses all the details necessary for a particular platform a system works within and shows only those parts of the complete specification that do not change going from one platform to another. The PSM

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shows these suppressed platform-specific details for each certain platform.

Since the CIM initially was “embedded” into the PIM, the border between these two viewpoints and, correspondingly, models is fuzzy. Besides that, the notion of platform independence is clear enough in comparison with the notion of computation independence.

The first objective of this chapter is to answer the following questions: What does the “computation independent” mean? Does the computation independent model have a single viewpoint on the system or does it have sub-viewpoints? Could it be a formal model in MDA sense? The second objective is to demonstrate how a formal mathematical model, Topological Functioning Model (TFM), complies with the notion of the CIM.

## **BACKGROUND**

When we try to answer questions about the computation independent model asked in Introduction, it is worth to overview academic researches and results in application and understanding of this model.

As mentioned in Introduction, the CIM is a *domain model* or a *business model*. The term “business model” and related terms such as “a business fact”, “a business rule” and “a business process” originated from business modeling. According to (Hendryx, 2003a, para. 2), a business model is a precise description of the business in its environment, by the business, in the language of business people, dedicated to business purposes (not necessarily IT). A model can be textual, tabular, graphic or a combination of them. If underpinnings of the business model are formal, then it is possible to handle this model by machine. Moreover, different objectives can require different models, thus it is necessary to determine purposes of construction of business models. The definition in (Hendryx, 2003b, p. 1) extends the previous one with the statement

that “A business model provides comprehensive answers to the six basic interrogatives: What? How? Where? Who? When? Why?”.

Thus, a business model reflects some *business knowledge*. Usually business knowledge is expressed using words and phrases that business people know and understand, i.e. in other words by using terms. *Business facts* are constructed using these terms as foundations, and express things that business peoples know about their own businesses. *Business rules* make a use of facts in order to help in control of business operations and to ensure that business is executed in the way required by business people (Chappel, 2005). Besides that, a *business process* can be considered as a category of a business model that focuses on transforming input resources to the output in order to add value for people inside and/or outside the business (Hendryx, 2003b). Summarizing, a business model is able to reflect those parts and rules of business that are not related to computerized information systems as well as those ones that are related to computerized information systems.

Hence, the CIM is mainly oriented on the business people. However, a discussion of what is to be modeled in the CIM and how the CIM can be organized is held still. Thus first we need to understand what does it mean “computation” and “computation independent” in the context of system modeling?

The conception of “computation” comes from mathematics, where this conception means an algorithmic process that generates certain results by following an effective procedure. In turn, the poly-semantic conception “information processing” comes from the control engineering, where this means things that are transmissible (mentally or physically) using messages to the target point. As stated in (Piccinini & Scarantino, 2008), these two conceptions were separated in cybernetics at the beginning, but as the years go by, they merged.

However, when we speak about computation in the context of software development, it is necessary to understand that “computation”

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