Chapter 1
Usability Evaluation of User Interfaces Generated with a Model-Driven
Architecture Tool

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Abstract Model-driven architecture (MDA) has recently attracted the interest of both the research community and industry corporations. It specifies an automated process for developing interactive applications from high-level models to code generation. This approach can play a key role in the fields of software engineering (SE) and human-computer interaction (HCI). Although there are some MDA-compliant methods for developing user interfaces, none of them explicitly integrates usability engineering with user interface engineering. This chapter addresses this issue by showing how the usability of user interfaces that are generated automatically by an industrial MDA-compliant CASE tool can be assessed. The goal is to investigate whether MDA-compliant methods improve software usability through model transformations. To accomplish this, two usability evaluations were conducted in the code model (final user interface). Results showed that the usability problems identified at this level provide valuable feedback on the improvement of platform-independent models (PIM) and platform-specific models (PSM) supporting the notion of usability produced by construction.

1.1 Introduction

The object management group (OMG) launched an initiative called model-driven architecture (MDA) to support the development of large, complex, interactive software applications providing a standardized architecture with the following features (MDA 2005):

- Interactive applications can easily evolve to address constantly evolving user requirements
- Old, current, and new technologies can be harmonized
- Business logic can be maintained constantly or can evolve independently of technological changes, or of the rest of the interactive application
- Legacy systems can be integrated and unified with new systems
In this approach, models are applied in all the steps of development up to a target computing platform. This provides a complete software production process where model transformation at different levels of abstraction becomes the basic strategy for obtaining a software application from models.

An MDA development process basically transforms a PIM into one or more PSMs, which then are transformed into code (code model–CM). The CM is just the actual code generated from PSMs through transformation. Here, the goal is to decouple the way in which interactive applications are currently defined, which is dependent on the technology they use. The purpose of this decoupling is to ensure that the investments made in building systems can be preserved even when the underlying technological platforms change. MDA has been applied to many kinds of business problems and integrated with a wide range of other common computing technologies, including user interfaces (UIs). It makes sense, therefore, to assess the usability of UIs in an interactive application resulting from a MDA process.

The MDA paradigm is a recent manifestation of the old tradition of model-based interface design environments (MB-IDEs) (Puerta 1997), which are aimed at generating the UI of an interactive application as automatically as possible from a conceptual model. Technicians have long observed that the usability of such an automatically generated UI is not known and should be compared with respect to the usability of a manually produced UI. The goal of this chapter, therefore, is to show how to assess the usability of UIs that are automatically generated by a MDA-compliant CASE tool. We also show how the usability evaluation process provides feedback to improve the models that are obtained in an MDA process.

The research question addressed by this study is the following: Can MDA-compliant methods improve software usability through model transformations? Specifically, our motivations are the following:

- Information systems (online or offline) probably represent a very significant portion of the total portfolio of today’s interactive applications and are used by the widest and mostly diversified population of users. Therefore, it is important to assess the usability of this type of system.
- Because MDA is a modern method for developing information systems, and because it represents a family of development methods that is largely applied in the field of SE, we will focus on this family of methods by selecting a representative member of this family.
- Some works have been conducted in the field of SE (OMG 2006), as well as in HCI (Jespersen and Linvald 2003), to show how MDA can effectively be applied. However, we are not aware of any existing usability assessment of an UI obtained by a MDA-compliant method.
- We select a representative MDA-compliant CASE tool to support the complete development life cycle of the systems we are considering. This CASE tool enables us to automatically generate a completely running interactive application from conceptual models.
- If the usability of an automatically generated UI could be assessed, we would be able for the first time to predict (to some extent) the usability of any future UI produced by this CASE tool. In other words, we will talk about a UI that is (to some extent) usable by construction, at least.