Chapter X

Requirements Engineering for Technical Products: Integrating Specification, Validation and Change Management

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Abstract

Over the last few years the functionality and complexity of technical products has increased dramatically. This is reflected in the complexity of the development process. In this chapter we discuss in detail the resulting challenges that have to be faced by requirements engineering. We identified these challenges in interviews conducted at a German car manufacturer. The main part of this chapter presents the QUASAR requirements engineering process that faces all identified challenges. In particular, it supports: (1) a set of views and abstraction levels tailored to the stakeholders, (2)
communication about these views through understandable notations, (3) efficient access based on tools and traces that make relationships between views explicit, (4) explicit feedback based on inspection and simulation, and (5) overall quality by integrating a formal specification technique with informal, textual specification techniques as well as through guidelines, checklists and tailored review techniques.

Introduction

Technical products, such as automobiles, washing machines, or video recorders, play an important role in our daily lives. Over the last few years the functionality and complexity of these products increased dramatically. Reasons for this are a technology push through reduced costs for hardware but also growing shares of software. Technical products are specific sociotechnical systems. Typical sociotechnical systems, for example, service engineer support systems, are characterized by many stakeholders in different roles that interact with the system. To understand and design such a system adequately, stakeholders and their relationships, as well as the influence of the system on the usage environment, have to be analyzed in detail (Sutcliff & Minocha, 1998). For a technical product, typically, there is only a small set of users. In addition the context of the user is already well known because products are typically developed in series. Therefore requirements engineering (RE) can concentrate on the interaction of the users with the new functionalities of the product. However the development process has to be reflected during RE. Technical products are sold on the market. They integrate hardware, software, and mechanics. And for complex technical products such as cars several suppliers are involved. Thus viewpoints of various stakeholders with differing backgrounds have to be elicited and integrated. Typically these stakeholders are distributed over several companies and locations and work in a fast-changing environment. This induces challenges for the whole product development process, and in particular for identifying, collecting, managing, and validating requirements (Grimm, 2003). In terms of the onion model of stakeholder relationships proposed in Alexander & Robertson (2004), this means that most stakeholders are found in the outer-most layers. Roles and often even persons involved in the development process of technical products are typically quite stable and well-known because of the series development. To reflect this situation, the emphasis during RE of technical products is on fostering long-term relationships based on efficient communication between the stakeholders and not so much on identifying the stakeholders.

In the following we discuss in detail the challenges that have to be faced by RE for technical products. We identified these challenges in interviews that we conducted at a German car manufacturer. The main part of this chapter presents a prescriptive RE process that faces all identified challenges. This process has been developed and evaluated during the last three years and is the major result of the QUASAR project funded by the German ministry for research. Throughout this chapter we use an example (that is, the development of a door control unit of a car) to illustrate the challenges and
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