Chapter XI

Web Application Quality: Supporting Maintenance and Testing

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ABSTRACT

The World Wide Web has become an interesting opportunity for companies to deliver services and products at distance. Correspondingly, the quality of Web applications, responsible for the related transactions, has become a crucial factor. It can be improved by properly modeling the application during its design, but if the whole life cycle is considered, the availability of a consistent model of the application is fundamental also during maintenance and testing.

In this chapter, the problem of recovering a model of a Web application from the implementation is faced. Algorithms are provided to obtain it even in presence of a highly dynamic structure. Based upon such a model, several static analysis techniques, among which reaching definitions and slicing, are considered, as well as some restructuring techniques. White box testing exploits the model in that the related coverage levels are based on it, while statistical testing assumes that transitions in the model are labeled with the conditional probabilities of being traversed.
INTRODUCTION

To satisfy the increasing demand for high-quality and reliable Web applications, descending from their economical and social importance, methodologies and techniques are being studied to support the different phases of their life-cycle. Production is moving from an artistic phase, based on individual skills, to an industrial phase, in which quality is controlled by means of consolidated practices.

The discipline of software engineering explored several areas in which software development was formalized and assisted. A similar path is being followed for Web applications, which require adaptations of the techniques used with traditional software, due to their peculiarities. In fact, Web applications are subject to a tremendous pressure for change and are based on rapidly evolving technologies, so that many of the available techniques are inadequate. Moreover, they often require ad-hoc solutions to the problems of distributed computing, concurrency and safety.

This chapter is focused on algorithms and techniques supporting maintenance and testing. This is achieved by customizing known practices from software engineering — in particular, static verification and dynamic validation — to the characteristics of Web-based systems. While the design and development of Web applications received remarkable attention (Conallen, 2000; Isakowitz, Kamis, & Koufar, 1997), the life-cycle phases in which analysis is central, namely maintenance and testing, were somewhat neglected (Antoniol, Canfora, Casazza, & De Lucia, 2000; Warren, Boldyreff, & Munro, 1999; Kallepalli & Tian, 2001). The main contribution of this work is the definition of a model of Web applications and the identification of a set of static analyses (e.g., reaching frames, slicing), transformations and testing techniques (e.g., structural test, statistical test), based on such a model. An algorithm for model extraction (reverse engineering) from existing Web sites is also presented.

The existence of problems in Web site development, similar to those encountered in software before the advent of software engineering and the importance of the maintenance phase were recognized by Warren et al. (1999). An experience of Web site reengineering is described by Antoniol et al. (2000), where the target representation of the manual reverse engineering activity is RMM. Because our reference model is closer to the implementation than theirs, we can provide a stronger automatic support for its extraction. Statistical testing was proposed by Kallepalli and Tian (2001) for the automatic selection of the paths to be exercised in a Web application. The number of invalid links encountered along the test paths allows estimating the site reliability, i.e.,
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