Chapter VI
Using Patterns for Engineering High-Quality Web Applications

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ABSTRACT
In this chapter, we view the development and maintenance of Web applications from an engineering perspective. A methodology, termed as POWEM, for deploying patterns as means for improving the quality of Web applications is presented. To that end, relevant quality attributes and corresponding stakeholder types are identified. The role of a process, the challenges in making optimal use of patterns, and feasibility issues involved in doing so, are analyzed. The activities of a systematic selection and application of patterns are explored. Following a top-down approach to design, examples illustrating the use of patterns during macro- and micro-architecture design of a Web application are given. Finally, the implications towards Semantic Web applications and Web 2.0 applications are briefly outlined.

INTRODUCTION
In the past decade, the Internet and the Web have opened new vistas for many sectors of society including education, businesses, and government. Indeed, Web applications have played an increasingly integral role in our daily activities of communication, information, and entertainment, and continue to do so. In retrospect, the sustainability of the successes of Web applications is brought into question due to their failures (Nguyen, Johnson, & Hackett, 2003), many of which are related to issues of quality (Pertet & Narasimhan, 2005; Vijayaraghavan, 2003).

In order to continue providing the desirable services to the consumers, it is the responsibility of the providers to ensure the quality of Web applications. There have been several approaches from different viewpoints for understanding and managing the issue of the quality of Web applications. However, as discussed later, most focus on (1) quality as an afterthought rather than as an integral consideration to be embraced early and carried throughout the development process, and (2) preventative rather than curative means for addressing quality. The purpose of this chapter is to motivate the use of patterns (Appleton, 1997)
within a systematic approach to the development of “high-quality” Web applications and to point out the benefits and challenges in doing so (Kamthan, 2008).

The rest of the chapter is organized as follows. We first outline the background and state-of-the-art necessary for the discussion that follows and state our position in that regard. This is followed by a discussion of the suitability of a process model, the presentation of the quality model that includes quality attributes at a granular level for representations in Web applications, selection and application of patterns as means for addressing the quality attributes in the quality model, and supporting examples. Next, challenges and directions for future research are outlined and, finally, concluding remarks are given.

BACKGROUND

In this section, we present a synopsis of Web Engineering, quality in Web applications, and patterns.

Characteristics of Web Applications

There are certain uniquely defining social and technical characteristics of Web applications that bring enormous benefits to the users. They also pose a variety of new challenges that the providers must deal with.

Specifically, Web applications differ from traditional software in many ways including that they are largely document-centric (rather than data-centric), they are delivered to a user over the network (rather than locally installed), their users often have little control over the behavior or rendering of information, they need to increasingly compete for visibility, the laws of jurisdictions from where they are being served and where they being consumed can be quite different, they are based on user interfaces that currently lack standards for presentation and interaction, they are expected to be an exemplar of universality (delivered to anybody, anywhere, at any time, on virtually any device), and so on. These characteristics naturally manifest in their development, operation, and maintenance.

Engineering of Web Applications

The need for managing increasing size and complexity of Web applications and the necessity of a planned development was realized in the late 1990s (Coda et al., 1998; Powell, Jones, & Cutts, 1998). This led to the discipline of Web Engineering (Ginige & Murugesan, 2001), which has been treated comprehensively in recent years (Kappel et al., 2006; Mendes & Mosley, 2006; Rossi et al., 2008).

Web Engineering is defined as a discipline concerned with the establishment and use of sound scientific, engineering and management principles and disciplined and systematic approaches to the successful development, deployment, and maintenance of high-quality Web applications. It relies and draws upon other engineering disciplines including computer engineering, document engineering, hypermedia engineering, information systems engineering, media engineering, network engineering, software engineering, and systems engineering for its existence.

For the rest of the chapter, a Web application will mean a Web site that behaves like an interactive software system specific to a domain in a distributed client-server environment. A Web application will in general require programmatic ability and may deploy additional software (such as application servers, media servers, or database servers) for some purpose (such as dynamic delivery of resources).

Quality of Web Applications

The unique nature of Web applications as compared to traditional software makes the need for “high-quality” all the more critical. That Web
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