Chapter III
Patterns for Improving the Pragmatic Quality of Web Information Systems

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ABSTRACT

The significance of approaching Web information systems (WIS) from an engineering viewpoint is emphasized. A methodology for deploying patterns as means for improving the quality of WIS as perceived by their stakeholders is presented. In doing so, relevant quality attributes and corresponding stakeholder types are identified. The role of a process, feasibility issues, and the challenges in making optimal use of patterns are pointed out. Examples illustrating the use of patterns during macro- and micro-architecture design of a WIS, with the purpose of the improvement of quality attributes, are given.

INTRODUCTION

The Web information systems (WIS) (Holck, 2003) have begun to play an increasingly vital role in our daily activities of communication, information, and entertainment. This evidently has had an impact on how WIS have been developed and used over the last decade (Taniar & Rahayu, 2004).

The development environment of WIS is constantly facing technological and social challenges posed by new implementation languages, variations in user agents, demands for new services, and user classes from different cultural backgrounds, age groups, and capabilities. This motivates the need for a methodical approach toward the development life cycle and maintenance of “high-quality” WIS.

In this chapter, we address the quality of WIS as viewed by the stakeholders by considering WIS as end-products of a pattern-oriented engineering process. The purpose of this chapter is to motivate the use of patterns (Alexander, 1979) within a systematic approach to the development of WIS...
and to point out the benefits and challenges in doing so.

The rest of the chapter is organized as follows. We first outline the background and related work necessary for the discussion that follows and state our position. This is followed by the presentation of the pragmatic quality framework for representations in WIS, discussion of patterns as means for addressing the granular quality attributes in the framework, and 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.

For the purpose of this chapter, we view the WIS as a specialized class of Web Applications. The need for managing increasing size and complexity of Web Applications and the necessity of a planned development led to the discipline of Web Engineering (Ginige & Murugesan, 2001; Powell, Jones, & Cutts, 1998), which has been treated comprehensively in recent years (Kappel, Proll, Reich, & Retschitzegger, 2006; Mendes & Mosley, 2006).

That WIS exhibit “high-quality” is critical for all stakeholders involved. If unaddressed, there is a potential for a resource in WIS to be rendered unreadable on a user agent of a customer, be inaccessible to someone who is visually impaired, or be prohibitive to adaptive maintenance by an engineer.

There have been various initiatives for addressing the quality of WIS: listing, organizing, and discussing relevant quality attributes (Brajnik, 2001; Dustin, Rashka, & McDiarmid, 2001; Hasan & Auelrub, 2006; Offutt, 2002), including in some cases from a user’s perspective (Ross, 2002), providing a means for evaluation (Mich, Franch, & Gaio, 2003; Olsina & Rossi, 2002). However, these efforts are limited by one of more of the following issues: although quality attributes relevant to WIS are given, the means of addressing them are either suggested informally or not at all, or the focus is less on assurance (prevention) and more on evaluation (cure).

Patterns were formally introduced in the urban planning and architecture domain (Alexander, 1979; Alexander, Ishikawa, & Silverstein, 1977). A pattern is a proven solution to a recurring problem in a given context. The existence of proven and rationalized solutions based on established principles (Ghezzi, Jazayeri, & Mandrioli, 2003), that are specific to problems in a given context in a structured form, often makes patterns more practical in their applicability compared to other means for quality improvement, such as guidelines (Wesson, Cowley, 2003).

Formally, a pattern is typically described (Meszaros & Doble, 1998) using an ordered list of elements labeled as (pattern) name, author, context, problem, forces, solution, example, and related patterns. At times, the labels may vary across a community, and optional elements, such as those related to metadata, may be included to enrich the description. In the rest of the chapter, the elements of a pattern are highlighted in italics.

Over the last decade, patterns have been discovered in a variety of domains of interest including those that are applicable to the development of WIS: navigation design (Gillenson, Sherrell, & Chen, 2000; Rossi, Schwabe, & Lyardet, 1999); hypermedia design (German & Cowan, 2000; Rossi, Lyardet, & Schwabe, 1999); and Web Applications in general and electronic commerce in particular (Montero, Lozano, & González, 2002; Rossi & Koch, 2002; Van Duyne, Landay, & Hong, 2003).

There are some patterns available specifically for addressing maintainability concerns of Web Applications (Weiss, 2003). However, in some cases the solutions are highly technology-specific and the integration of patterns into any development process is not mentioned. There are also