A Model for Characterizing Web Engineering

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INTRODUCTION

The Internet, particularly the Web, has opened new vistas for many sectors of society, and over the last decade it has played an increasingly integral role in our daily activities of communication, information, and entertainment. This evidently has had an impact on how Web applications are perceived, developed, and managed.

The need to manage the size, complexity, and growth of Web applications has led to the discipline of Web engineering (Ginige & Murugesan, 2001). It is known (Kruchten, 2004) that conventional engineering practices cannot be simply mapped to software engineering without the engineer first understanding the nature of the software, and we contend the same applies to Web engineering. This article proposes a systematic approach to identify and elaborate the characteristics that make Web engineering a unique discipline, and considers the implications of these characteristics.

The rest of the article is organized as follows. We first outline the background and related work necessary for the discussion that follows, and state our position in that regard. This is followed by a model to uniquely posit the nature of Web applications based on the dimensions of project, people, process, product, and resources. Next, challenges and directions for future research are outlined. Finally, concluding remarks are given.

BACKGROUND

The notion of a Web application has evolved from its origins in the mid 1990s. For the sake of this article, by a Web application we will mean a Web site that behaves more like an interactive software system specific to a domain (such as health, entertainment, commerce, and so on) rather than a catalog. If the recent predictions (Jazayeri, 2007) are correct, then it is likely that the crosspollination of software engineering and Web applications will continue to flourish.

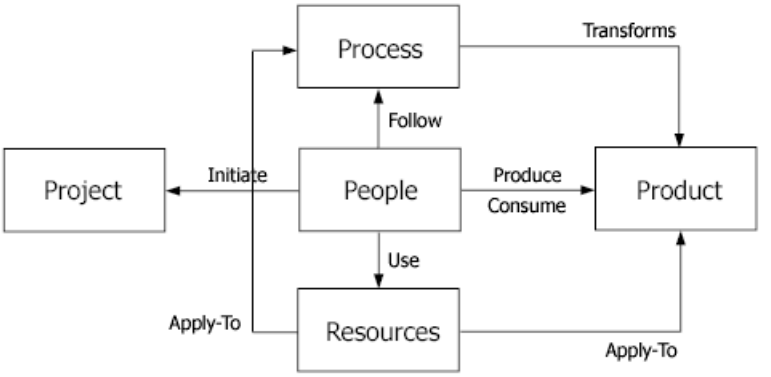
There has been some previous work that presents unique aspects of Web engineering, which we now discuss chronologically. It has been highlighted that Web applications differ from traditional software due to their focus on publishing, strong emphasis on quality attributes such as usability, and shorter initial delivery cycles (Overmyer, 2000). It has also been pointed out that the development of Web applications involves several social and technical disciplines and different sets of skills compared to conventional software development (Ginige & Murugesan, 2001), but stakeholders have not been considered as possessing one of the viewpoints. A model for the characterization of Web applications has been presented (Lowe, 2002), but details of individual characteristics are not given. It has also been noted that Web applications vary in many ways from traditional software including in the uncertainty of the domain, often shorter time to market, and rapid changes in technologies (Lowe, 2003; Ziemer & Stålhane, 2004); however, the arguments are often based on perception than technical reality. It has been pointed out that different types of Web applications vary along the lines of their nature, form, purpose, and development (Selmi, Kraïem, & Ghézala, 2005). An overview of the client-side properties of Web applications related to usability has been presented, and based on it, a more precise usability model has been derived (Bruno, Tam, & Thom, 2005). The variations between software engineering and Web engineering have been pointed out (Mendes & Mosley, 2006); however, the criteria focus on the development and underlying technologies rather than the stakeholders. Finally, the differences between Web applications and traditional software mentioned above have been recently amassed in a survey (Al-Salema & Samahab, 2007).

A MODEL FOR THE CHARACTERIZATION OF THE UNIQUE NATURE OF WEB ENGINEERING

In this section, we propose a model labeled henceforth as 4P+R for a characterization of the unique nature of Web engineering. The model, along with its high-level nonmutually exclusive elements, namely people, project, process, product, and resources, is illustrated in Figure 1.

The 4P+R model for Web engineering could be applied in a few different contexts. First, it could serve as a starting point for a reference model for Web engineering. Second, the existence of a body of knowledge is a sign of maturity of a discipline, and the 4P+R model could contribute to (and, once established, benefit from) the Web engineering body of knowledge (WEBOK), as is the case with the software engineering body of knowledge (SWEBOK) and the project management body of knowledge (PMBOK). Third, the 4P+R model could also be used as a basis for Web engineering pedagogy. In particular, it could be useful for deciding the

Figure 1. A high-level view of the elements of the 4P+R model of Web engineering



prerequisites and the selection of topics for an intensive course on Web engineering.

We do not claim that the 4P+R model is static or complete. Indeed, the model is subject to evolution along with the discipline of Web engineering and, indeed, the Web itself. We next discuss the elements of the 4P+R model in detail.

People Viewpoint

A stakeholder is a person or organization who influences a Web application or who is impacted by that Web application. In this section, we take the people view of a Web application and consider the challenges facing the stakeholders.

There are systematic approaches for the identification and refinement of stakeholder classes (Sharp, Galal, & Finkelstein, 1999). We identify two broad classes of stakeholders with respect to their roles in relation to a Web application, namely, a producer and a consumer. (There are other possible stakeholder classes such as legislators, but their characteristics are not unique to Web applications.) The mapping between stakeholders and roles is many to many. For a successful realization of the contract between producer and a consumer, the technical as well as the social differences between the development of traditional software and of Web applications need to be acknowledged and acted upon.

Producer

A producer (provider, project manager, marketing manager, engineer, media producer, graphic designer, or maintainer) is a person who owns, finances, develops, deploys, operates, or maintains the Web application. As shown in Figure 2, the desirable knowledge and skills (Kamthan, 2007) demanded of a producer go beyond what is part of the conventional training of a typical software engineer. Unfortunately, courses related to the Web offered at universities and training

Figure 2. The universe of engineering disciplines on which Web engineering draws upon