

A Declarative Approach for Designing Web Portals

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INTRODUCTION

As many enterprise and industrial content management techniques are moving towards a distributed model, the need to exchange data between heterogeneous data sources in a seamless fashion is constantly increasing. These heterogeneous data sources could arise from server groups from different manufacturers or databases at different sites with their own schemas. Since its introduction in 1996, eXtensible Markup Language (XML) (W3C-XML, 2004) has established itself as the open, presentation independent data representation and exchange medium. XML provides a mechanism for seamless data exchange in many industrial informatics settings. In addition, XML is also emerging as the dominant standard for storing, describing, representing, and interchanging data among various enterprises systems and databases in the context of complex Web enterprises information systems (EIS). For such Web EIS (such as e-commerce and portals) to be successful, it is important to apply a high level, model-driven solution to design and implementation techniques that are capable of handling heterogonous schemas and documents. For this, we need a methodology that provides a higher level of abstraction of the domain in question, with rigorously defined standards that are to be more widely understood by all stakeholders of the system. With the introduction of XML Schema, which provides rich facilities for constraining, describing, and defining enterprise XML content, the XML technologies provide a good platform (and the flexibility) for modelling, designing and representing complex enterprise contents for building successful EIS. For example, a particular user may want to get an appropriate view of such XML data at a given location or level of the company. One way to handle such a complex task is to build semantic-aware enterprise Web sites and Web portals (Nakano, 2002; Tatnall, 2004).

Furthermore, XML and user-aware dynamic user interface design technologies have gained a foothold in mainstream Web engineering research. With the introduction of XML schema (W3C-XSD, 2001) and related querying technologies, XML has established itself as the language for the Web. To enhance XML's ability to include high level modelling capabilities and data abstraction, various supplementary techniques have been proposed by research communities including automated schemata transformation based design methodologies (Feng, Chang, & Dillon, 2003), view mechanisms and a high-level XML view design methodology (Rajugan, Chang, Dillon, & Feng, 2005, 2006). We argue that, unlike old Web portal designs, these new technologies and methodologies provide an added enhancement for developing meaningful Web portals. In addition, new security and access control mechanisms for XML and the Web have improved trustworthiness and collaboration among distributed Web communities and enterprises (Nakano, 2002; Steele, Gardner, Chandra, & Dillon, 2005). This results in design and development of distributed portals for information sharing and collaborative work such as 3rd party logistics (Chang et al., 2003; ITEC, 2002; Logistics, 2004).

BACKGROUND

There are many existing works that deal with the possibility of application of portal in different areas of use (Gant & Gant, 2002), and on the classification and discussion of different type of portal (Tatnall, 2004). In related literatures, many forms of portals are discussed ranging from generic information oriented community portals to complex enterprise and e-business portals (Chang et al., 2003) for the employees (e.g., workflow systems, SAP), B2B (e.g., supply chain management systems), B2C (e.g., Web EDI), and C2C (e.g.,

eBay, IT user groups). The advancing of Web technologies have resulted in variety of platforms from leading software vendors (IBM, SAP, Oracle, etc.) that concentrated on the issue of building and deploying of Web portals. However, these solutions are mainly technological and community oriented (i.e., constraint by community they are designed to serve) and *not* by issues such as semantics, expandability (high-level design, future constraints), adoptability (user interface, change of business process, etc.), data (data formats, structure, availability) and knowledge (semantics of collective or aggregate information).

One of the more recent work that have look into the issues of the actual design and development of a portals, is Bellas, Fernández, and Muiño (2004), where the authors looks at the development of portal from a software engineering perspective. In Aragonés and Hart-Davidson (2002), usability issues are taken into account and the importance of evaluating these on customizable portals is also discussed. There is a lack of research directions that provide a comprehensive design and technological solution for addressing both Web data and Web user interface design issues under one design methodology. We argue that, such a combined designing approach is a *must* for any Web system development such as portals.

In Gu, Henderson-Sellers, and Lowe (2002), the authors have argued that there are two aspects of technical architecture that a Web modelling language must possess for it to be used effectively on the development of Web systems, namely information architecture and functional architecture. In the related literature, there is a lack of consideration of the idea that the implementation of a Web user interface (WUI) is quite different to that of a traditional software system, as a traditional software GUI is mainly constructed through the use of GUI widgets. Also, the kinds of device that are used for the display of WUI are much more diverse, such as PDAs, mobile phone, and so forth. Over the years, several techniques have been introduced in the literature for the modeling and design of Web-based systems. There is a heavy concentration in the earlier methods to be; (a) hypertext-oriented (Garzotto, Paolini, & Schwabe, 1993; Schwabe, Rossi, & Barbosa, 1996), or (b) data centric or data driven (Ceri, Fraternali, & Bongio, 2000). While some of the more recent methods have its base on (c) object oriented paradigm (Conallen, 1999). These models were found to not pay sufficient attention to users, who are central in Web systems. These systems, hypertext, or data centered approaches need to be contrasted with the (d) user-centered approach (Chang & Dillon, 1999; Troyer & Leune, 1998).

In general, most of the aforementioned methods have navigational design addressed in the process. However, the navigational model is often a by-product of the underlying domain model, which does not always provide the user view required as the user would like to perceive the information. Rather, it only maps this data model from a representation of the data suitable for storage and efficient for system

manipulation directly onto the presentation layer. It can be observed there is the assumption that all the data sources come from the internal system. However, with the swift advent of technologies such as Web services and agent-based systems, the final contexts that are presented to user on client devices may include content from a number of different data sources. This will certainly have a fundamental effect on the way the whole system is to be built.

MOTIVATION

In recent years, many research directions are revisiting the issue of Web engineering to investigate metadata semantics for Web content that is independent of the presentation oriented Web page mark-ups. Such momentum was initially created by the Semantic Web initiatives (W3C-SW, 2005), where domain specific Web content are described using metadata languages such as XML, OWL (W3C-OWL, 2004), RDF (W3C-RDF, 2004), and so forth. Though useful, it is a complex task to provide a presentation independent, yet generic, semantically rich Web content description for small scale Web sites (and Web portals). Also challenging are the Web useability concerns (Gardner, Chang, & Dillon, 2003a, 2003b) that is core to the success of the Web (and the Semantic Web). Here, in this article, we try to address part of this problem, the Web metadata description and (generic) logical storage structure for Web site content.

Thus, the core issues to this research in the context of Web portal design are (Gardner et al., 2003a, 2003b; Rajugan, Gardner, Chang, & Dillon, 2005):

1. (Web user) context selection
2. (Web user) task design
3. Web content (data) representation

The main motivation for the xPortal includes:

1. **Web Content:** The separation of Web site and Web portal content from presentation oriented languages such as XHTML, embedded scripts (e.g., JavaScript, server pages, etc.)
2. **Web Interface/Navigation Design:** A top-down Web User interaction analysis model (WUiAM). Utilization of the dynamic modelling approaches of WUiAM (Gardner et al., 2003a, 2003b) to develop robust and user friendly Web user interfaces to support Web sites and Web portals.
3. **Design Methodology:** A top-down Web site modelling and design approach using Object-Oriented (OO) conceptual modelling techniques
4. **Generic Model:** A generic (logical) storage and description model to represent Web content (in the form of Web site and Web portal definitions)

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