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Personalizing Web Portals

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INTRODUCTION

A Web portal is a gateway to the information and services on the Web where its users can interchange and share information (Tatnall, 2005). It is designed and implemented for a specific *community*. However, it is unlikely that people who access a Web portal are all so similar in their interests that one standardized way of delivering information fits all needs. This has motivated the need for personalization in Web portals.

The extent to which a personalized Web portal can adapt to individual users (or a group of individuals acting as a single entity) depends on how the information in the Web portal is represented and utilized subsequently. In this article, we take the position that the current technological infrastructure for representing information in Web portals must evolve for improving the support for personalization.

The rest of the article is organized as follows. We first outline the background necessary for later discussion. This is followed by an introduction to a framework for addressing client- and server-side knowledge representation concerns pertaining to Web portals that can enhance support for personalization. Next, challenges and directions for future research are outlined. Finally, concluding remarks are given.

BACKGROUND

A key aspect of a Web portal is sensitivity to its users, and one of the established approaches to realize that is personalization. The term *personalization* can have different meanings to different people in different contexts. From a management perspective, personalization is a part of customer relationship management (CRM); from an engineering viewpoint, it is a human-computer interaction (HCI) concern; for a provider, it is a strategic issue; while for a user, it is a feature. For the sake of this article, we define personalization as a strategy that enables delivery of information that is customized to the user and user's computing environment in order to access a Web portal.

Personalization benefits all types of Web portals, whether they be vertical or horizontal. There are some features such as displaying date/time or weather conditions corresponding to user's geographical point-of-access, that can be personalized independent of the demography or Web portal type. Personalization in commercial Web portals allows vendors the opportunity to improve customer satisfaction and loyalty (Riecken, 2000), and provides option for one-to-one marketing (McAllister, 2001); it allows customers to, for example, have only their favorite item sections of the Web portal rendered to them, or have shipping information automatically filled in when purchasing an item.

As Web portals evolve from static information catalogs to dynamic environments, they are beginning to behave more like interactive software systems. The goal of personalization is to improve user *experience* with the Web portal during the course of interaction leading to user *satisfaction*. The My Yahoo! Web portal was perhaps the earliest effort of deploying personalization in a commercial setting. Experiences of using its personalized features (Manber, Patel, & Robison, 2000) over the years have exposed their strengths and weaknesses, much of which are related to lack of understanding of users and of variations among them.

To that regard, the fundamental premise for enabling personalization in a Web portal is based on the client-side *knowledge*: the more a Web portal *knows* about the user and user environment, the more sophisticated personalization features could be provided to the user. This of course must be done in conjunction with an appropriate *representation* of information that the Web portal itself consists of and is supplied to the user upon request. In this sense, representation permeates all aspects of personalization (Pednault, 2000).

A USER-CENTRIC FRAMEWORK FOR PERSONALIZATION OF WEB PORTALS

The knowledge representation requirements that we consider pertinent for personalizing a Web portal can be informally and broadly stated as the following:

- **Server-Side (Provider) Viewpoint:** A provider would like to represent the domain knowledge of the Web portal well, and in doing so, would like to be able to personalize the functionality (which is a combination

of structure, content, presentation, and behavior) of a Web portal to suit a user.

• **Client-Side (User) Viewpoint:** A user performs certain *tasks* when accessing a Web portal via a user agent and to that regard would like the response from the provider that would meet his or her needs and goal(s) while respecting personal preferences.

As we see, these requirements are interrelated and address concerns of both the client-side (user and user computing environment) and the server-side (information being supplied by the provider).

Motivated by these constraints, we propose a framework for knowledge representation in personalization of a Web portal (Figure 1), and make the following observations:

• A user-centered approach is critical to any interactive system development including personalized Web portals. Once the user needs, goals, and preferences are identified (Karat, Karat, & Ukelson, 2000; Kramer, Noronha, & Vergo, 2000), this information (the *profiles*) should be represented appropriately.

• The request-response takes place between the client and server. The technologies for digital certification, compression, encryption, and protocols for a secure transmission of represented entities are important in their own right but are beyond the scope of the discussion here.

Based on the aforementioned requirements and observations, we now describe the technological infrastructure for knowledge representation for Web portal personalization.

The Semantic Web has recently emerged as an extension of the current Web that adds technological infrastructure for better knowledge representation, interpretation, and reasoning (Hendler, Lassila, & Berners-Lee, 2001). It consists of a stack of technologies where the definition of each depends upon the layers beneath it, addressing technical as well as social concerns. We adopt them as part of our framework, and now discuss how some of the Semantic Web technologies can play a crucial role in realizing Web portal personalization.

The eXtensible Markup Language (XML) lends a suitable meta-syntactical basis for expressing information in a Web portal as descriptive markup. Specifically, XML enables a document to be rendered via a transformation on multiple devices being used to access a Web portal, without making substantial modifications to the original source document. This is crucial to generate multiple structures or views (say, text, and graphics) from a single source—an aspect of product information that is preferred by customers and has been shown to lead to higher customer satisfaction (Lightner & Eastman, 2002). It may also be useful for providing alternate views for users for which a specific view of information is not accessible (say, due to device constraints or visual impairment). In addition, it supports and provides means for heterogeneity in documents, which is important for a Web portal if multiple representations from different origins need to co-exist in a single container.

The resource description framework (RDF), layered on top of XML, provides a first step toward a meta-semantical basis for describing information in a Web portal.

The declarative knowledge of a domain is often modeled using ontology, which for the purpose of this article, is defined as an explicit formal specification of a conceptualization that consists of a set of concepts in a domain and relations among them (Gruber, 1993). The Web Ontology Language (OWL), layered on top of XML and RDF, provides onto-

Figure 1. A knowledge representation framework for personalization of a Web portal
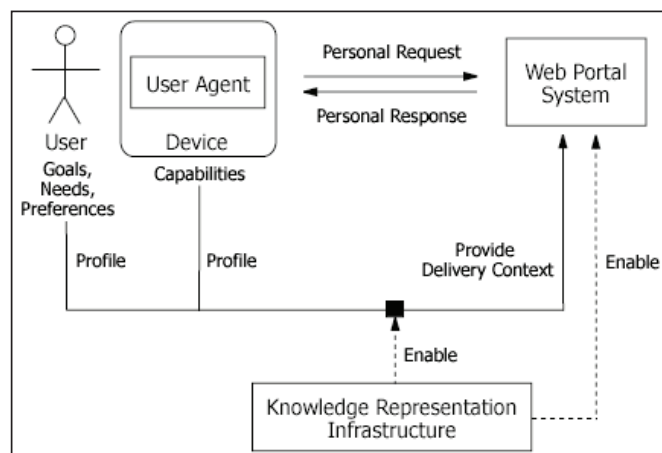
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