Chapter 19

INSTITUTIONAL WEBSITES PERSONALIZATION USING MACRO AND MICRO USER PROFILES

Paulo Sergio Rodrigues Lima and Marcelo Soares Pimenta

Abstract: Institutional sites usually have a great volume of documents and a heavy navigation structure, requiring complex users browsing behavior. In order to allow users to find quickly and easily some information relevant to their usage it is imperative rethinking the structure of the site and the design of each individual page with relevant links to information concerning each user role, i.e., to be able to customize which information is more adequate for each user. This paper presents a personalization approach specifically designed for institutional sites, supporting personalization in two complementary levels, called respectively macro and micro user profiles. Basically, the macro user profile aims to model features related to organizational roles that are common to groups of users within the same organizational unit (for example, department, division, etc) whereas the micro user profile aims to concern preferences of specific individuals. The paper also presents the main aspects of our personalization approach, step by step explanation of an associated personalization engine and some preliminary results of an actual case study using the prototype built for its validation.

Key words: Institutional Web Sites, Personalization, Macro and Micro User Profiles.

1. INTRODUCTION

In the last years, the number of institutional Websites is growing exponentially: more and more enterprises and institutions have made available a lot of Web-based information and applications (WBI&A) for their suppliers, partners, clients, managers and employees. In fact, WBI&A need only a browser to user access, independently of user location. In addition, WBI&A provide an unified and at same time dynamic way to connect enterprise information systems, use web mail tools, obtain enterprise

documents, etc. Particularly, institutional sites usually have a great volume of documents and a heavy navigation structure, requiring a complex users browsing behavior. In order to allow users to find quickly and easily some information relevant to their usage it is imperative rethinking the structure of the site and the design of each individual page with relevant links to information concerning each user role, i.e., to be able to customize which information is more adequate for clients, which is more adequate for suppliers, which is more adequate for managers, which is more adequate for employees, and so on. This is a great challenge: how to make available all enterprise WBI&A according to each kind of user in a simple, fast but adequate way [3].

Institutional sites are a very promising field for applying personalization techniques because they are composed of a great volume of high-diversity information pages, and significant number of well-defined organizational roles that can be used to characterize user profiles. The use of personalization techniques aims to improve the Web site usability since a personalized site automatically customize the interface considering the user profile [7] and each user may think that the site was designed specifically for him/her [4]. However, despite their importance, institutional sites are not so often studied.

This paper presents a personalization approach specifically designed for institutional sites, supporting personalization in two complementary levels, called respectively macro and micro level. It is structured as follows. Section 2 discusses some aspects of personalization based on user profiles and introduces the macro user profile level and the micro user profile level. Section 3 resumes the personalization process. Section 4 describes the personalization approach, illustrated by means some actual examples extracted from a real case study where our approach was applied. Some preliminary results of its evaluation in actual usage conditions with actual users are discussed in the section 5. Finally the section 6 presents the conclusion.

2. PERSONALIZATION AND USER PROFILES

The word profile comes from Latin “*pro filare*” that means to map in general way, and can be considered the outline of a set of object or people characteristics [1].

For general purposes, typical characteristics of user profiles include age, scholarship, profession, etc. However, if we focus on website-related characteristics, more specific and sometimes more technological information are needed like for example browser type and version, operating system, IP

address, etc. E-commerce sites usually register behavior pattern (last bought products, preferred music styles or book subjects, etc) of a visitor in order to generate dynamic pages focused on its interests and preferences or to offer discount or special promotions in a future visit.

In addition, during user profiling for institutional websites we may be concerned with some user role or job information related aspects like organizational units hierarchy, organizational function, job related activities, information access policy, etc.

We assume that an important goal for institutional websites is to provide quick and easy access to applications related to user's organizational unit and to information concerned job activities. There is an evident progress in recent years with respect to aesthetics of sites and easiness of building websites with the availability of simple (commercial or not) WYSIWYG tools [6]. Despite this progress, even experienced users have many difficulties in finding information over web due bad design. Personalization leaves users from time-consuming searches for daily-used information. The goal of customized content is to focus on information and links directly related to a specific role or a specific activity. Obviously, any other kind of information related to other activities or roles is accessible by browsing. In summary, direct access is provided to content directly related to daily work activities and complementary non-frequently-used content may be obtained by browsing.

3. PERSONALIZATION PROCESS: OVERVIEW

Before applying personalization techniques at institutional websites, it is very important to define clearly: a) the personalization goals; b) the user groups and institutional roles; c) the appropriate personalization approach to be applied to the institution and d) the personalization level desired. Next these aspects are discussed in more details.

Defining the personalization goals. In order to a better choice of personalization strategies and techniques, the personalization goals should be defined. Our assumption is: in institutional sites the main goal is to provide quick and easy access to information concerned user job activities and applications related to users' organizational unit. For achieving such goal, the site structure and content should be rearranged.

Knowing the institution and modeling users. It is important to know the user as well the institution organizational structure before personalization. The basic process that allows personalizing the attendance to the user is to know more about him [9]. Models can be used to predict the

user behavior, to diagnose his errors and to assist him, and they can help the designer in the personalization process [5].

In institutional sites the designer can begin studying the institution organization in order to group the users with the same interests according to the job inside the enterprise organization chart.

A good user comprehension is essential for a good user community classification, and it can contribute in the personalization process, providing:

- A clear view of institution culture;
- Experience and institution functional knowledge;
- Knowledge of process, resources and system's institution.

Selecting personalization levels. After to know the institution structure and her users, the designer need to select the personalization levels he wants to apply to the site. These levels can begin in a generic way, from the user groups creation with common interests up to a detail level that provide an individual preferences of each user.

Defining content and navigation structure according scope and user profiles. For each particular user profiles defined for the institution, the designer should define a particular content and a particular navigation structure, i.e., the designer should select which pages (or which frames) and which links are enabled and visible for such particular user. The idea is to create sub-sites based on each user profile identified and to make standalone tests with the users by profile groups. After the validation of each sub site, these contents and links can be stored in the database for further usage according to the user profile.

Elaboration of navigation map by profile. After defined the content that will be compose the profiles, the designer can elaborate the site map concerning each user identified and validated profile, thus, this map can be used by users and always will be linked to user profile.

4. THE PERSONALIZATION APPROACH

Since we are specially interested in providing customized information for each organization role, we adopt a variation of previously and well known established profile-based personalization mode. Typically, in traditional approaches the elements displayed are chosen according to the data concerned to the **one** user profile. Our personalization approach makes use of **two** complementary user profile levels: the first, called **macro profile**, is based on user group and the second, called **micro profile**, is based on individual preferences of each user.

4.1 Macro Profiles

We assume that typically users are very attached to WBI&A of their organizational units, and consequently we can identify a profile with common features applied to each unit member. This group profile is called **macro profile**. The macro user profile aims to model features, characteristics and job-related relevant information related to organizational roles that are common to groups of users within the same organizational unit (for example, department, division, etc) or working in the same project. In addition, the macro level is mandatory and it allows to adapt website defining both content and navigation according each users group or role.

It is not necessary form filling by users for the macro profile definition. In fact, forms usage usually repulses a user from the site and it only will be achieved after an established reliance with the site [12].In our approach, the user identification is obtained by means the authentication procedure (logon) of the site (or institution network). After the validation of user Id, the content (and links) concerned to the macro user profile will be assembled and displayed.

To exemplify the macro user profile usage, lets consider a organization chart (see figure 1). Users from National Administrative Department and the users from National Informatics Department and National Financial Department will see different website content considering they are members of different departments.

Figure 1. An Enterprise organization chart

The approach was developed in order to make available page layouts and contents totally dedicated and oriented to specific activities of each department. The user interface and content definitions are stored in a database allowing that the site management be decentralized: each department can has an own site management providing his own content.

The layout of personalized Web pages are pre-defined as composed by five main sections: header – including search mechanism (top), messages (bottom), personalized vertical menu (left), department topics (center), general news (right).

The figure 2 shows one interface generated by the personalization engine using this predefined layout. Basically, it shows the website as it is displayed to an user (called Mr. Paulo Lima) associated to user profile “Informatics Department Employee” - an employee of a Regional Informatics unit of Pará Brazilian State (region A in the organizational chart in the figure 1). The content may change in the Area 1 and Area 2, depending on macro user profile. In this view, the section named **Area 1** displays all the links available to Mr. Lima’s usage. Clearly, the decision of link availability (or not) is totally based on macro profile specification. Additionally, the section named **Area 2** contains selected news considered relevant for members of Informatics Department (ID). In the bottom of **Area 2** we can note two links: the left link is a “more”-like link (see “Ver mais destaques”) in order to scrolling the ID news; the right link (see “Destaques da Coordenação de Informática”) links to upper-level (see figure 2) relevant news, i.e., news from upper-level organizational unit named “Coordenação de Informática”. The Area 3 concerns micro level definition and it will be explained later.

Figure 2. Macro Level Personalized View – Pará Regional Informatics Department Employee

By the other hand, another user – for example associated to another user profile like Regional Informatics Manager - has other macro level personalized view. In particular, some links displayed are distinct, and some of them may be displayed in a new order arrangement, defined in a more appropriate way to this different user profile.

Considering that for most of institutions we can use an organization chart to represent the organizational unit's hierarchy, our personalization approach makes use of this feature, exploring the inheritance concept: each organizational unit can to inherit the upper-level unit's content. For better understanding the figure 3a shows an example of hierarchy, specifying four-levels hierarchy and relationships between the organizational units.

The simple inheritance hierarchy concept is implemented when an lower-level organizational unit inherits content from upper-level units. The figure 3b illustrates an inheritance example using the hierarchy suggested in the figure 3a. In this example the user linked to organizational unit F will inherit the available links in the units A (link A1, link A2, link A3), B (A1,A2,A3 plus B1,B2), and D (A1,A2,A3,B1,B2 plus D1, D2), respectively. In other words, he/she can browse all pages containing inherited information.

The content related to each macro profile is defined by the site administrator. Each department defines a set of "relevant" content, that is stored in the database. The personalization engine "recognizes" the user by means the authentication procedure (logon) and retrieves the appropriate content.

Obviously, the content associated to each macro profile cannot be modified directly by the user, because the content is shared by many users in order to achieve some general department goals. Content changes related the macro profiles are made always by the website administrator.

Figures 3a and 3b. Organizational Units hierarchy and OrganizationalUnits Links inheritance with the macro user profile

4.2 Micro Profiles

In addition to macro level group-oriented personalization schema, the user may create his/her individual profile, called **micro profile**. The user can configure this micro profile any time, and this configuration is optional: the user himself/herself decides about his/her personal preferences related to bookmarking, schedule and virtual disk facilities.

To enabling the micro profile the user has to select the link named **making my profile** that appears usually in Area 3. Three options may be chosen individually by the user (see figure 4). These options are:

My favorites: allowing to include her favorite links (with a short description) in a bookmarking list.

My notebook: allowing to manage personal, group and corporate events in order to control individual calendaring and scheduling.

My documents: allowing the storage and further retrieval of files (standards documents, manuals, memos, reports, etc.), independently of user location.

The user enables the options associated to the micro profile selecting the link “Create my profile” (see “Criar meu perfil (veja como)” in the area 3 at figure 2). These options will be displayed in his/her home page by means the pop-up window “Making my profile”, chosen in the option “Making my profile”. The figure 4 illustrates a simple situation where the pop-window is displayed and the options “My favorites” and “My documents” are enabled. The user can modify his/her options any time by selecting the option “Change my Profile”.

Making my Profile		
Enable My favorites	☒ Yes	☐ No
Enable My notebook	☐ Yes	☒ No
Enable My documents	☒ Yes	☐ No
<input type="button" value="Save"/>		

Figure 4. Enabling the micro profile

4.3 Personalization Engine: Architecture and step by step behavior

The approach described above is supported by a personalization engine, a software component which is responsible for providing all functionality related to personalization and user profile treatment. By didactical purposes

the personalization engine behavior is presented in sequence of steps. Figure 5 illustrates all steps, considering an successful personalization situation (i.e. existent exceptions handling is not discussed here). The sequence is: 1) The user is identified either by net login or via site login; 2) The web server gets the user id (for example, the net login); 3) The personalization engine recovers the user id by web server scripting execution; 4) The personalization engine sends the user id to database server by web server scripting execution; 5) The database server does the query in the macro profile table using the user id; 6) The database server recovers the macro profile content; 7) The database server does the query in the micro profile table using the user id from the user identification; 8) The database server recovers the micro profile content; 9) The database server sends to the personalization engine the personalized content (micro and macro profile); 10) The personalization engine provides the personalized page by web server scripting execution; 11) The personalized page is showed to the user.

Figure 5. Personalization engine architecture

5. CASE STUDY: EVALUATION AND DISCUSSION

Our personalization approach has been applied in actual conditions at Brazilian Telecommunications National Agency – Anatel, even the definitions are made aiming to turn this method so generic as possible.

A prototype of personalization engine was built and the personalized Anatel website was made available for usage by actual users. Taking into accounting some well-known websites subjective evaluation methods from HCI and Ergonomics literature [2,7,10,11,13], we apply user-satisfaction-oriented interviews in two different moments: i) before the beginning of personalization activities, concerning the non-personalized site; and ii) after finished the final personalized site, according our profile-based approach.

In order to capture rich comments and critics (and also to avoid non-recorded opinions), users was invited to answer all questions *in loco*, immediately after site usage. The interview contains few questions (4), takes only a few minutes to answer, its data analysis is quick and easy, and the whole process costs very little.

The questions were conceived to identify:

- a) degree of correspondence between principal homepage menu items and principal user job activities; **Question A:** “Are the menu items available representing the most frequently activities you execute during your job?”
- b) convenience of information ordering and structuring for user job activities, clearly to verify if the most frequently used information are easily visualized; **Question B:** “Is the content structured in a appropriate way concerning information you need for your activities?”
- c) adequacy of site navigation structure, asking the user if information is *easy-to-find*. In fact, navigation complexity increases very quickly on larger web sites. broken links, ghost pages, long paths and complex navigation are frequently reported on usability testing as symptoms of poor navigation design. **Question C:** “Are the links available for website navigation well organized?”
- d) if users would wish a job-oriented personalized view of site (only in the first “before-personalization” interview); **Question D:** “Would you wish a job oriented personalized view of site?”
- e) if users are satisfied with the personalized approach implemented (only in the second “after-personalization” interview). **Question E:** “Are you satisfied with the new personalized site?”

The table 1 summarizes the quantitative percentages of interview results. Questions A, B, C, D and E are the questions presented above. The columns “Before Personalization” and “After Personalization” refer to two different moments of interview.

Although a simple examination of the satisfaction interview results seems very successful (80% of our users are satisfied !! – see Question E), the fact is that 20% of your customers are indifferent, i.e. *not completely satisfied*. Perhaps their indifference means they aren’t angry enough to be truly

“dissatisfied” but they didn’t feel good enough to consider themselves satisfied. For this, in addition to the answers, the interview gives users the opportunity to provide comments and we have to examine the comments seriously.

Table 1. Percentages of user-satisfaction-oriented interviews

	Before Personalization			After Personalization		
	Yes	No	Indifferent	Yes	No	Indifferent
Question A	21%	79%	0%	80%	0%	20%
Question B	29%	71%	0%	60%	0%	40%
Question C	21%	58%	21%	80%	0%	20%
Question D	79%	0%	21%	-	-	-
Question E	-	-	-	80%	0%	20%

People often comment about more than one thing, so it was a good practice to break each comment into positive and the negative aspects. We would commonly see many of the same things identified as issues in the quantitative portion of the interview like effective improvements in website navigation schema and information structure organization. Often, the comments provide you with more specific information about how to fix problems yet identified. However, it is not uncommon to uncover completely new issues by reviewing comments. The main defeat identified by the users in the personalization process was the **lack of user involvement** in the personalization policy and practice definition. This specific comment is very helpful in understanding the users needs and considering them in future modifications of personalization process. It will be also taking in account in future development practices and future interviews will specifically ask about such issue as well.

6. CONCLUSION

As institutional websites become more sophisticated, website administrators need to deal with more efficient technologies and approaches in order to face their complexity and diversity. One example is the need to deal with the personalization, which is an increasingly important topic.

Our approach for personalization based on user profiles is an example of a very promising technique because it enables the management of a great volume of institutional job-related information pages. Consequently, the relevant information is automatically customized for each user depending on his/her organizational role (macro profile) and individual preferences for configuration (micro profile). However, we acknowledge our personalization

approach may be used to complement other personalization useful and well-known approaches and not to replace them.

Our personalization approach has been applied in actual case study and the results obtained from evaluation methods until now express the relative success of our work but we intend to continue our research towards better improvements. It is better to acknowledge we can involve employees affected by the website in the improvement process itself.

In a further work, for example, we intend to develop an authoring tool that allows each user group administrator to define the content of his group with no direct interference of site designer or administrator. More (qualitative and quantitative) assessment experiments are also needed to evaluate the scalability of our approach.

REFERENCES

1. Davor. Whitepaper: "Profiling Basics". 04/03/2001. Available at: <http://www.davor.com/main/whitepapers/profbasics.html>
2. Dong, J.; Martin, S. Interactive Usage of Customer Satisfaction Surveys to Assess an Evolving Web Site. Proceedings of the 6th Conference on Human Factors and the Web, Austin, TX, USA, June 19, 2000.
3. Greening, D. R. Tracking Users. Web Techniques, July 1999.
4. IBM - HIGH VOLUME WEB SITE TEAM. Web Site Personalization. 2000. Available at: <http://www7b.boulder.ibm.com/wsdd/library/techarticles/hvws/personalize.html>.
5. Kass, Robert, Tim Finin., A General User Modeling Facility, Proceedings of CHI'88 - Conference of Human Factors in Computing Systems, Washington D.D., May, 1988.
6. Lynch, P. J; Horton, S. Web Style Guide: Basic Design Principles for Creating. Web Sites. Yale Univ Press. 1999. 164 p.
7. Nielsen, Jakob. Designing Web Usability: The Practice of Simplicity. New Riders Publishing; 2000.
8. Perkowitz, M.; Etzioni, O. Adaptive Web Sites: An AI Challenge. In: International Joint Conference on Intelligence, 15., 1997. Proceedings[S.I.:s.n.], 1997.
9. Perkowitz, M.; Etzioni, O. Towards Adaptive Web Sites: Conceptual Framework and Case Study. In: International World Wide Web Conference, 8., 1999. Proceedings... [S.I.:s.n.], 1999. p. 167-180.
10. Rubin, J. Handbook of Usability Testing: How to Plan, Design and Conduct Effective Tests. John Wiley & Sons. New York. 1994. 330 p.
11. Scholtz, J.; Laskowski, S.; Downey, L. Developing Usability Tools and Techniques For Designing and Testing Web Sites. 4th Conference on Human Factors & the Web, June 5, 1998, Basking Ridge, USA (1998).
12. Udi Manber, Ash Patel, and John Robison, Experience with Personalization on Yahoo!, Communications of the ACM, special issue on Personalization, 43 (8), August, 2000.
13. Winckler, M.A.; Pimenta, M.S.; Palanque, P.; Farenc, C.; Usability Evaluation Methods: What is still missing for the WWW? In: Proc. of 9th International Conference on Human-Computer Interaction, HCI2001, New Orleans USA, August 5-10, 2001.