

Modelling Public Administration Portals

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INTRODUCTION

Portals for the public administration (PA) are Internet gateways leading to a broad range of services, devoted to a great number of users. The offered services can potentially be all the ones offered by the PA offices. The final users involved are potentially all the citizens, thus ranging from young people to retired ones, to impaired ones. The benefits offered by putting PA services on the Internet are various: a reduced number of employees at the PA offices, an increased number of citizens that can interact with the PA, immediately available information (news, laws, regulations), faster data integration in PA informative systems, and overall costs reductions (citizen mobility, time consumption, etc.). Such benefits are driving a wide diffusion of PA portals with an increasing number of accesses and users (Reis, 2005).

Although the number of PA portals available is increasing, their use by citizens is still limited due to usability problems and the low quality of the offered services (Atkinson & Leigh, 2003; Cullen, O'Connor, & Veritt, 2003; Nielsen, 1999).

To obtain usable PA portals, a design methodology that considers the user interaction in the early development phases must be adopted (Conallen, 2003). This already happens for e-commerce Web sites (Nielsen, 1999). Conversely, as usually happens with standard development tools for portals, accessibility, and usability issues are faced at the end of the PA portals development process, with high costs and growing times to the final release.

Focusing on usability issues, the purpose of our article is twofold: (i) analyzing requirements and standard methodologies to design the user interaction in such environment, and (ii) proposing a design methodology to solve usability problems. Usual methods model some navigation aspects, but they are not focused on usability and layout design issues; neither do they make the comprehension of the navigation aspects easier. In order to face user experience problems and speed-up the whole development process, we designed a methodology (Prete, Foglia, & Zanda, 2005a, 2005b) and a set of tools for the rapid development and deployment of PA portals.

In the following, we identify main PA portals requirements. Then, we describe methodologies to design and develop Web sites and PA portals and present our methodology to rapidly develop and deploy usable PA portals. Finally, we draw conclusions.

PA PORTALS REQUIREMENTS

Functional Requirements

Due to their importance, most of the PA central offices have analyzed the functional requirements of PA portals (Reis, 2005). They identified *classes of services*, *classes of users*, and the *sophistication degree*.

Classes of services identify the sets of services that must be furnished by PA portals. They are classified according to the citizens' lifestyle and mental model to respect the users' own classification.

Classes of users identify homogeneous groups of actors involved in interactions with the PA portals, and their main informative needs. They are classified following their roles, their skills, and their previous knowledge.

The *sophistication degree* specifies the way and to what extent a service is provided remotely to the *users*. Four *sophistication degrees* can be identified. The first stage is represented by just providing some information to complete the procedure. The second stage is the *one-way* phase with documents download, and the third stage is the *two-way* phase with the filled in documents that can be uploaded. The fourth stage is reached when the whole procedure can be completed online, including payments.

Table 1 shows a specification of *classes of services* adopted by the Italian PA (GU, 2002; Resca, 2004; Signore, Chesi, & Pallotti, 2005). More than 500 services are fully specified. Other classifications may be found in literature (Kaylor, Deshazo, & Van Eck, 2001). A classification summary of *users* and relative needs is given in Table 2 (Reis, 2005).

Table 1. Sample classification of PA services specified by Italian Government

Users	Class of Services				
Citizens	Being a citizen	House	Free time	Health	Sports
	Legal issues	Education	Transports	Work	Voting
	Retirement	Taxes	Cultural activities		
Companies	Starting a new activity	Developing existing activities	Modifying an existing activity	Funds	Personnel/employees
	Buildings	Taxes	Import/Export	Legal issues	

Table 2. Classes of users and relative needs

User Class	Most required services			
Students	Education	Jobs	House	Public Transports
Normal Citizens	Payments	Security	House	Public Transports
Tourists	Accommodation	Cultural Attractions	Public Transports	
Foreigners	Regulations	VISA		
Companies	Taxes	Laws	Financial Services	
Retired People	Health	Public Transports		
Elected Officials and Candidates	Personal info	Q&A	Laws and Regulations	
Portal Administrators	Content Management Systems			

Concerning other functional requirements, connections with heterogeneous back-end informative systems are outside the scope of this article. However, we can say that governments are specifying common protocols and interfaces for the various PA portals. For instance, in the Italian scenario, government is developing a unified application interface (SPC, 2005), and each administration will have to conform to such specification.

Usability and Other Non-Functional Requirements

Atkinson et al. (2003) emphasize the importance of having PA portals that are easy to use: “too often customer-focused portals have mostly meant putting a myriad of links on one

Web page.” They show that in many PA portals citizens have to navigate deeply in the site to find out that they cannot perform their tasks online. Cullen et al. (2003) describe the New Zealand local administration Web sites: “although over 90% of users approached a particular site seeking specific information, less than half were able to find the information they sought.” It turns out that the main problem in PA portals is not the design of services and communication protocols that are well specified, but the way contents and services are presented to the final users.

Many Web usability guidelines have been identified (Curtin, Sommer, & Vis-Sommer, 2003; Nielsen, 1992, 1999, 2001a; Nielsen & Tahir, 2001b), particularly in the e-commerce field (Nielsen, 2001a). Such guidelines are a set of rules and patterns that must be followed in content

presentation and service delivery to achieve a good level of user interaction. Unfortunately, such guidelines can only be partially applied to the design of PA portals. Indeed, PA portals users differ from e-commerce ones and they have different aims and needs. Essentially, e-commerce portals are accessed because users (and providers) want to, while PA portals are accessed because users have to. As a consequence, a major metric in e-commerce sites is the conversion rate—percentage of visitors that become customers (Nielsen, 2001a; Prete, 2005b)—while in PA sites, a major metric is the completion rate—percentage of visitors that complete their task (Withrow, Brick, & Sperdelozzi, 2000). Hence, e-commerce sites emphasize the products presentation with marketing strategies, while the only complex procedures are product selection and checkout. Conversely, PA portals must face very complex procedural aspects. For instance, in a tax payment service, the page layout and its design must facilitate the form filling, giving useful hints if the user doesn't know how to proceed, identifying the progress in the procedure, and notifying the sophistication degree and the established deadline of a service.

In addition, the e-commerce field is a competitive environment with actors competing to ensure the best user experience. Such competition drives e-commerce sites toward improved usability. Conversely, PA Web sites have no competitors and their actual effectiveness can only be evaluated via user tests. Besides, to increase retainability (Calongne, 2001), PA portals procedures must not be modified. So, it is important to immediately deploy a good portal, with major usability issues faced and solved. In summary, e-commerce portals should be designed for change while PA portals must not change.

As for main usability guidelines, PA portals should include the name and logo of the agencies or the local administration offices in the home page as trust is one of the major factors, which encourage user interaction (Van Slyke, Belanger, & Comunale, 2004); all details useful to fully identify the agencies must be provided (Nielsen et al., 2001b). To encourage the interaction of all users, it should be given major emphasis to services rather than to politicians and their programs (Curtin et al., 2003). A *most requested services* area can be worthy of inclusion as many PA services are more accessed when established deadlines are approaching.

As a general rule, services must be organized following the citizens' mental model (Nielsen, 1999), not the PA internal organization. So, PA portals must be orthogonally organized for groups of users and services, while citizens do not have to know which agency actually delivers the service they need. Citizens should be able to find services and information by fast searching and browsing so PA portals must include smart search engines, which should always be reachable (Curtin et al., 2003). The sophistication degree of services should be stated immediately to enable users to achieve a fast

knowledge of what they can do, especially when expiration time is near. The overall user learning time can be reduced by adopting metaphors taken from major Web sites, and it is better not to explain procedures, but drive properly user actions, usually by means of wizards.

CURRENT METHODOLOGIES

A common trend in software design consists of adopting a user-centered approach in which the design is driven by the user needs, utilizing use cases (IBM, 2005; Kruchten, 2003). Use cases are useful to specify functional requirements, but different methodologies must be adopted to specify and design user interfaces and user interactions. Such methodologies should include usability factors in the early development phases (Conallen, 2003; IBM, 2005).

A lot of methodologies have been developed, as well as many commercial or proprietary products for designing PA portals (IBM Websphere Portal Enable, Microsoft Site Server, Oracle Portal...). In the following, we give a description of significant approaches addressing the design of the user experience.

The first approach to specify and design Web interfaces is paper prototyping (Grady, 2000; Newman & Landay, 2000), despite the technological developments. A Web designer sketches Web page prototypes on paper to describe the layout and the user interface. This method doesn't leverage the digital support, but it has specific advantages: an extreme low cost, no learning time, and the implementation details are not taken into account while designing the pages.

The tool DENIM (Lin, Newman, Hong, & Landay, 2000), considering the common practice of paper prototyping, combines the benefits of such approach with the benefits of the digital support. DENIM consists of an electronic blackboard with pages drawn roughly and connected with arrows. The blackboard area has different zoom levels to visualize different aspects of the site: from a general navigation structure, to storyboards, to single pages. However, it does not furnish support for automatic code generation.

Web modeling language, WebML (Ceri et al., 2002), permits the modeling of data intensive Web applications. Its main purpose is the specification of relationships among data and code generation. The tool WebRatio (Ceri, Fraternali, & Bongio, 2003) includes the WebML methodology. The Web pages are rapidly structured and traversed in a GUI, and then presented by page templates or by XSL descriptions. At the end, with XML and XSL, the pages source code is generated. In the overall process, usability aspects are faced at the end when the Web developer writes or imports the presentation code.

To better model the interaction between Web application and final user, Conallen (2003) develops the user eXperience modeling. It is based on UX diagrams, which model the

storyboards and the dynamic information of the Web pages. These diagrams show the site structure, an important factor of Web usability: a site with a good user interface but with a complex structure results unusable. The UX modeling adds to the usual UML diagrams two new types of diagrams: the navigation maps and the storyboards.

As a summary, all of these methodologies have as their main goal the early inclusion of users needs in the development process. Since they assess the usability toward final users, a prototype of the application must be prepared. The final version of the application is always obtained with refinement iterations.

resources to perform such cyclic phases. As explained in section “PA Portals Requirements,” PA portals don’t have to be designed to offer generic services, but well-defined ones to known classes of users. According to this, it is not necessary to start a complete design process each time a PA portal must be developed. The whole process can be performed only once by designing a prototype. PA developers, with proper design tools, can then rapidly customize such prototype. They don’t have worry about usability issues, which are solved in the *prototyping phase*. From this idea, we derive our methodology (Prete et al., 2005a, 2005b) and a set of tools that we will describe in the following.

AN INTEGRATED APPROACH

Rationale

The iterative loops in the design process are needed to satisfy usability requirements (Newman et al., 2000). Such loops are critical for the success of PA portals, but they are a resource consuming task. Indeed, developers should have experience in techniques for achieving user experience, not usual in software houses, and the final users should have a perfect knowledge of what they want, which is usually achieved only at the end of the process. In addition, PA offices, especially smaller ones, may not have the required

Description of the Methodology

The methodology consists of two phases: a *prototyping phase* and a *customization phase* (Figure 1).

In the *prototyping phase*, the structure of a PA portal prototype is defined. In particular, the structures of the main services are defined, and the main usability guidelines are enforced. Such phase is the most critical, since cyclic iterations with users are performed to derive portal templates and usability guidelines. This phase is performed by the PA prototype developer, who is a usability and Web systems expert; he utilizes standard tools for portal development. Usability inspection methods (Nielsen & Mack, 1994) are applied to converge to *usable portal templates*.

Figure 1. A two phase methodology to develop and rapidly deploy usable PA portals

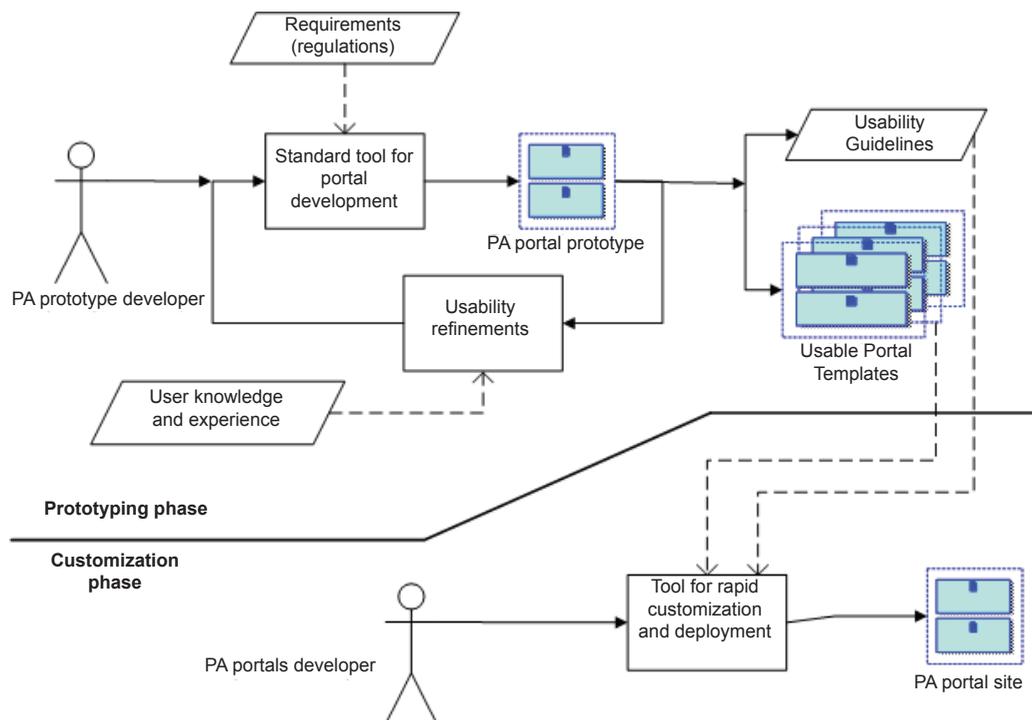
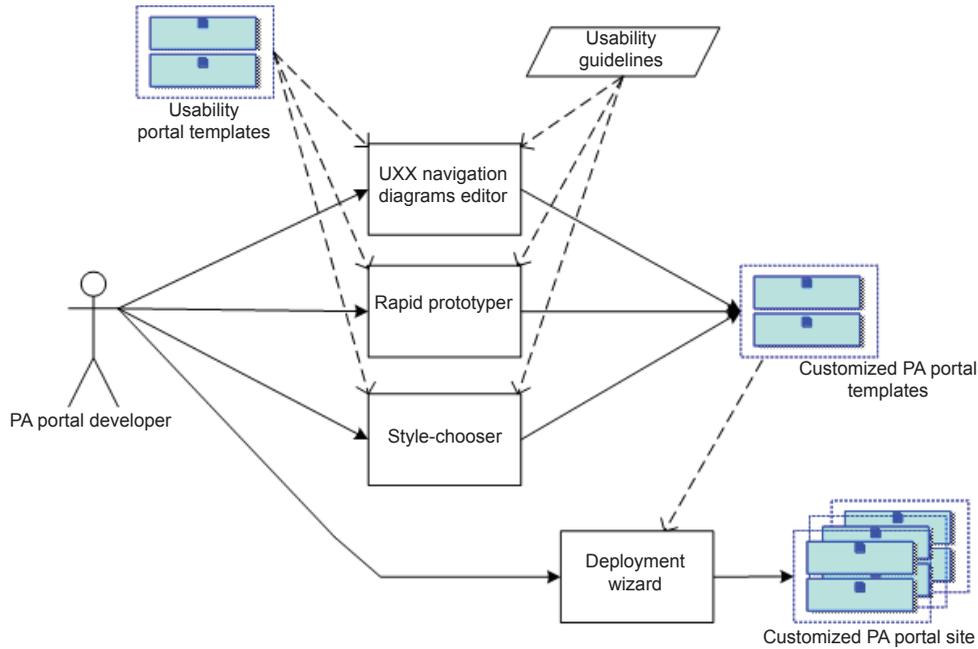


Figure 2. The tools utilized to customize PA portal templates



In the *customization phase*, PA portal developers utilize a set of tools specifically designed to easily customize the *usable portal templates*. In particular, they customize the services sophistication degree, the static content (i.e., textual info such as the name of the PA, the location, the colors, etc.), and adapt some navigation structure to specific needs. In such phase, limited usability and programming knowledge is required so that it can be performed by inexperienced users who can focus only on contents and services without worrying about presentation.

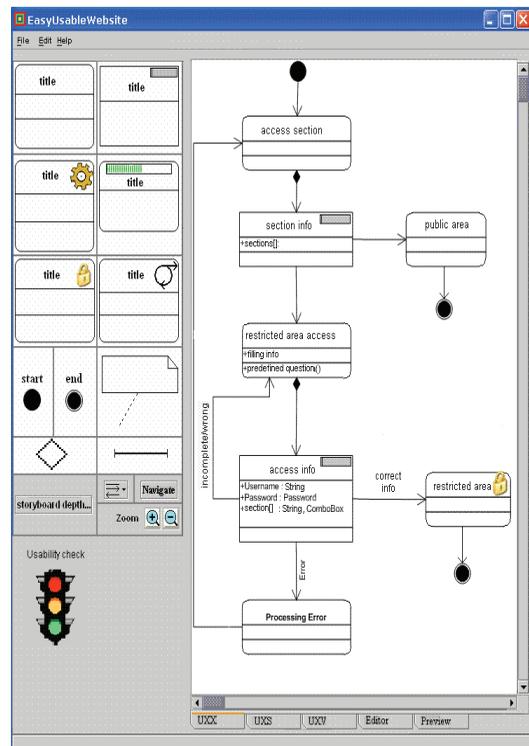
In conclusion, our methodology includes the usability constraints in the early development phases as required by the user-centered design. The usability assessment is performed once, reducing the overall process costs, while the whole methodology simplifies the customization, as PA portal developers can configure the site with drag&drop tools without coding or having knowledge of usability factors. Usability checks are automatically performed by the tools on the basis of the knowledge acquired during the *prototyping phase*. Such knowledge is codified in *usable portal templates* and *usability guidelines*.

The Tools

The tools available to the PA portal developer include a *UX navigation diagrams editor*, a *rapid prototyper*, a *style-chooser*, plus a *portal deployment wizard* (Figure 2).

The *UX navigation diagram editor* (Figure 3) is utilized to specify the dynamic contents of the single pages, and

Figure 3. The UX editor with a navigation diagram. The frames on the left column can be dragged and dropped in the central window.



specify and visualize the overall navigation structure. UXX is our extension to the UX diagram proposed by Conallen (Prete et al., 2005b). The editor can be used to modify the portal structure as long as the result respects the usability constraints. A traffic light, included in every tool, warns the PA portal developer about usability problems and utilizes the usability guidelines to perform its work.

The *rapid prototyper* (Figure 4) is used to specify the layout and static content of Web pages. It utilizes the *usable portal templates* as a set of predefined page templates. The tool provides a central window to define each page with *working areas*. The *working areas* can be specified by choosing their types setting their contents and relative attributes.

The *style-chooser* (Figure 5) is utilized to assign color, text style, and size to the static and dynamic content of the site, following usability guidelines. Our software helps the developer by giving him or her the correspondence between every color and its meaning in various cultures (western, oriental...).

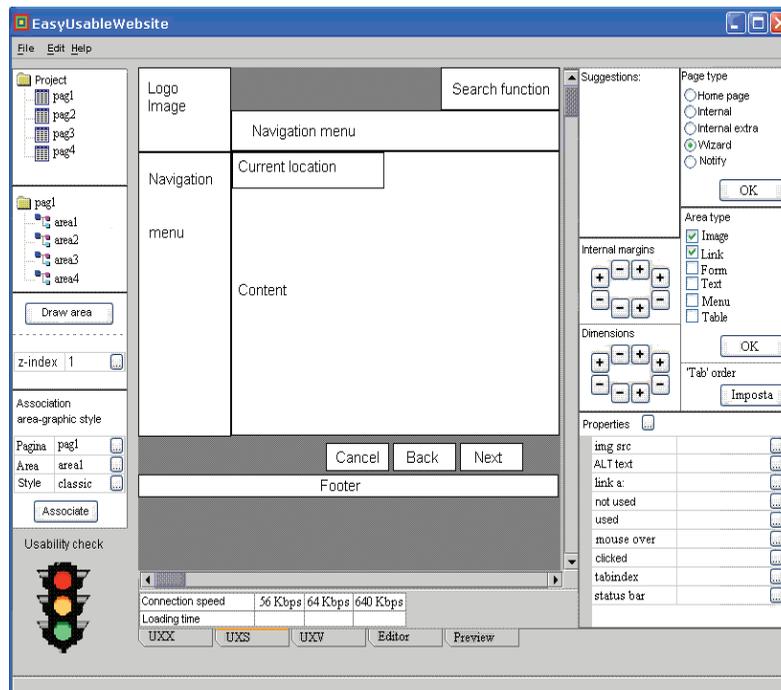
The *deployment wizard* permits you to select the specific services and the sophistication degree the portal must have (Figure 6). Once the services and the interactions are chosen, the PA portal code can be generated. The code generation is based on HTML with CSS, while JSPs and servlets generate the dynamic Web pages.

CONCLUSION

In this article we approached the design of PA portals focusing on user experience factors. We reviewed methodologies and tools that can be used to design interactions in PA portals. Considering that such methodologies include usability requirements only in the final development phase, and that PA portals requirements are well known (often standardized by government laws), we propose a methodology with relative tools to rapidly design usable PA portals. Our methodology consists of three steps: (i) build a usable PA portal template by applying standard and innovative tools to ensure good user interaction; (ii) customize, and (iii) deploy such template to adapt it to specific PA needs. In this way, usability requirements of PA portals are managed only once by experienced software/usability engineers, while the customization can be performed by local officers with little technical expertise. A wizard-based tool guides the user in the customization without permitting the violation of the usability constraints. Such approach simplifies the development of such portals and permits it to deploy high quality PA portals as we are experiencing in the framework of the *Easy.Gov* project.

Further improvements include the extension of our framework with the inclusion of affective interfaces. Their effectiveness is currently under evaluation.

Figure 4. The rapid prototyper . The developer can draw rectangles in the main area to prototype the static structure of the pages. The rectangles can be chosen with a check box from: image, link, text, form, menu, table. This example shows a wizard page template.



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Figure 5. The style-chooser. It can be utilized to set text and background colors. On the left column, the created styles can be associated with the page areas drawn in the prototyping tool.

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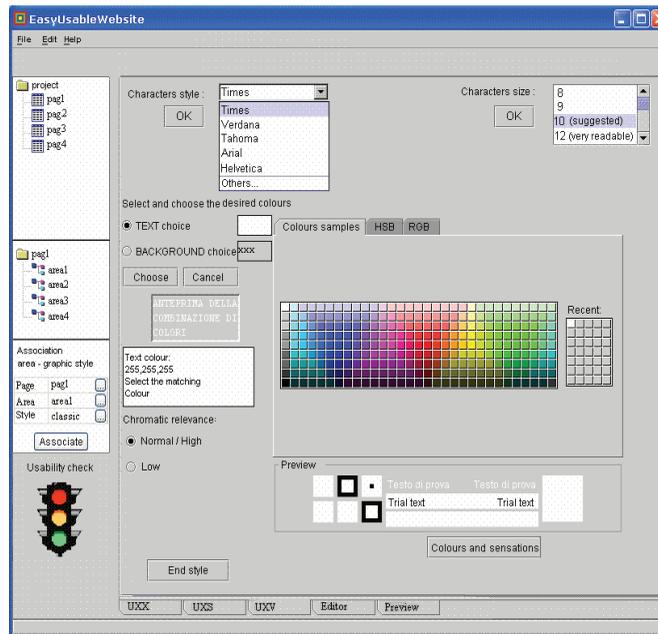
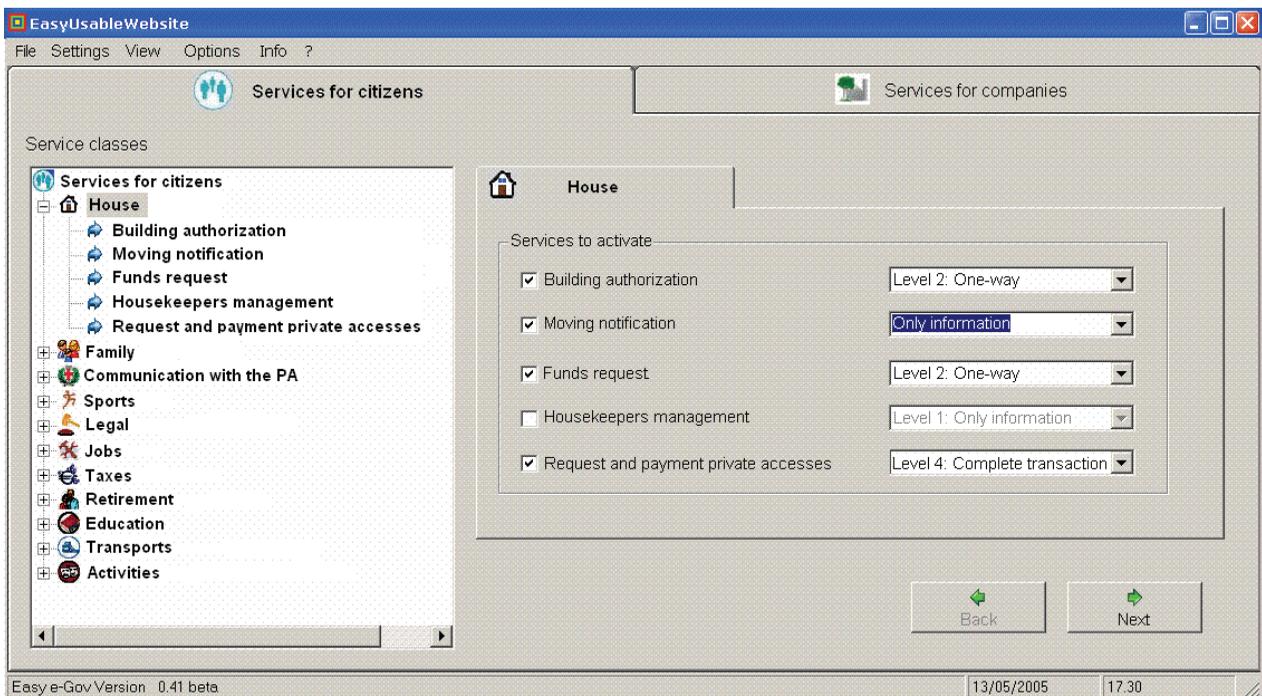


Figure 6. The layout of the deployment wizard



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KEY TERMS

Classes of Services: Identify sets of services that must be furnished by PA portals. They are classified according to

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the citizens' lifestyle and mental model to respect the users' own classification.

Classes of Users: Identify homogeneous groups of actors involved in interactions with PA portals and their main informative needs. They are classified following their roles, skills, and previous knowledge.

Computer Impaired User: A user with inabilities in using the computer in an effective, useful, and comfortable way.

Internet Barriers: Impediments in some classes of users while visiting a Web page. They are similar to architectural barriers for impaired users (they can be considered a new kind of architectural barriers).

PA Portal Usability Guidelines: A set of rules and patterns that must be followed in content presentation and

service delivery to achieve a good level of usability. They are specific for the PA portals domain.

Public Administration (PA) Portal: A portal, which gives access to the PA services. It should become the main interface between PA and citizens as it can provide access to all the services offered by the PA.

Sophistication Degree: Specifies the way and to what extent a service is provided remotely to the users.

Usability: A qualitative and quantitative measure that assesses how a specific task is easy to fulfil. According to Nielsen, U. can be defined by five quality components: learnability, efficiency, memorability, errors, and satisfaction. According to ISO 9241, U. can be defined as the effectiveness, efficiency, and satisfaction with which specified users achieve specified goals in particular environments.