Support for Migration through Graphical and Vocal Interfaces in Multi-Device Environments

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Abstract. The increasing availability of new mobile devices in everyday life raises the need for new interaction capabilities to support users immersed in ubiquitous environments. User interface migration provides the possibility of changing device while continuing the task performance and adapting the user interface to the new device. We have designed and developed a solution able to support migration, even among devices with different interaction modalities, in particular graphic and vocal modality.

1 Introduction

In a world where we are surrounded by an increasing number of interactive devices, including personal mobile devices, user interface migration is becoming a necessity. Users may feel the desire to switch towards a more powerful device for increasing interaction possibilities, changing from a small screen to a wider one, while freely moving. They may experience power consuming problems, with the urgent need for switching device before loosing their work, or they may need to carry on with an application while their hands are used for other tasks. For example we can think of a user interacting with the PDA while entering the car, starting to drive and continuing interaction by migrating to the voice car system. A good user interface migration should support three basic points:

- Continuity: users must be able to continue the task started with the source device on the target one without having to restart the application from scratch. The state of the interface on the source device before migration must be preserved and opportunely adapted on the target interface.
- Usability: migration can involve different types of platform offering different interaction capabilities. A User interface optimized for a certain platform hardly maintains its usability when accessed through a different type of device. Transferring a user interface from a platform onto another, requires the interface to be redesigned in order to meet the limitation and constraints or vice versa the higher potentialities of the target platform
- Support for different modalities: the two platforms involved in migration can differ in interaction modality, for example one could support only graphic interaction (i.e. through typical web browser) and the other one only vocal interaction (i.e. a

voice car system). In this case there is also a change in the implementation language for the source and target, thus it is necessary to translate the information describing the state of the interface from one language to the other.

In this paper we present our solution for supporting transmodal migration and the associated demo highlighting its main possibilities.

2 The Trans-modal Migration Service.

Migration is obtained through different interface versions (one for each platform) of the same application. When the interface migrates then the migration service is able to activate the version for the target device at the point where the user interaction on the source device and maintain the state resulting from the previous interactions in the new device. Our trans-modal migration service applies to Web applications whose interfaces have been developed through a model-based approach. This means that for each interface version several levels of logical descriptions can be obtained through the support of specific tools:

- The task level, where the logical activities are considered;
- The abstract interface level, consisting in a modality-independent description of the user interface. The interface is described in terms of presentations. Each presentation contains: a set of interactors, providing an abstract description of the objects that will be used to support the tasks, and composition operators, providing declarative indications on how to compose interactors.
- The concrete interface level, consisting in a modality-dependent description of the user interface but independent of the implementation language. It is a refinement of the information contained in the abstract level.
- The user interface, the actual user interface generated in the appropriate language (in the demo we consider XHTML and VoiceXML).

The service relies on a server that contains the migratable interfaces, as well as their logical descriptions and the mechanisms to support migration. The logical descriptions are used for comparing the source and target platform interface versions, to identify the presentation for the target platform that should be first activated and associate the state resulting from the user interactions with the source device to the target interface. The users who want to access the service have to load the migration client onto their devices. The migration client allows the server to identify the client devices and their platform type and enables the user to issue migration requests.
When a migration is required by the user, the server retrieves the interface loaded on the source device, its logical description and the state resulting from the previous user interactions. At this point, the server accesses the abstract interface for the target platform type.
The server uses the logical descriptions, to search for the target presentation that is the most similar to the source one. Similarity is calculated in terms of supported tasks:

the higher number of tasks the source and target presentation share, the more similar the presentations are. In case of multiple target presentations sharing the same number of tasks with the source one, the system identifies the target presentation supporting the task associated with the interaction object last modified by the user on the source device, since the user is most likely to continue interaction from that point. A one to one mapping between presentations and pages permits to retrieve the final target page. The state of the objects contained in the target page is calculated considering objects implementing corresponding tasks in the source and target pages. In different versions of the interface obtained for different platform types, the same task can be implemented by means of different interaction objects. In particular, when source and target platforms support different interaction modalities, the two versions of the interface are written in different languages, and different sets of available interaction objects.

The support for different modalities raises a number of issues. While in graphic modality it is possible to have a complete overview of all or at least part of the information previously inserted, this is not possible in vocal modality, since vocal interaction is strictly serial and not persistent. When migrating from graphic to vocal interaction, users loose the perception of the result of tasks performed before changing device and can feel disoriented. To facilitate users in continuing the interaction on the vocal platform, an initial audio feedback is inserted. The initial feedback message summarises the information entered before migration and is built collecting all the feedback messages concerning the tasks already performed by users on the source platform and removing them from their original position in the vocal interface. This means that when migrating from a graphic to a vocal platform, users first hear a message recalling the result of the tasks performed on the graphic platform, then it will be possible to carry on the vocal interaction asking to complete the missing tasks.

3 The Demonstration and Concluding Remarks

The demonstration concerns an example of graphic to vocal migration based on a sample application we called “Restaurant Application”.

The “Restaurant Application” allow users to select a restaurant, accessing general information about it and book a table for a chosen day. In the demonstration we use a PDA as the graphic source platform, while the target voice platform is obtained by a vocal interpreter and synthesizer on a laptop pc. The experiment is performed starting the interaction with the PDA. First the migration client must be activated. Hence, the sample application is selected from a list of available applications presented by the migration client interface and loaded on the PDA. Then, it is possible to interact with the “Restaurant Application” selecting a restaurant and getting the registration form. To better appreciate the effects of trans-modal migration, the form must be partially filled, no matter which fields and in which order. At this point, interacting with the migration client, it is possible to selected the target device for migration that in this case will be the vocal platform and send the migration request. The control passes automatically onto the vocal platform that starts giving the initial audio feedback and

continues asking for missing information, skipping the tasks already performed on the PDA. At the end the confirmation of the reservation will be asked.

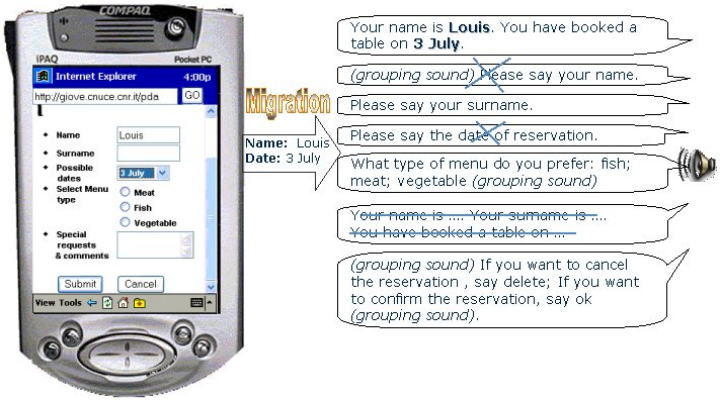

Figura 1. graphic to voice migration sample.

In Figure 1 we can see an example of the trans-modal migration applied to the "Restaurant Application", using a PDA as the source graphic platform. The user has filled in the field "Name" and selected a value for the "Date". We can notice on the vocal side, the initial audio feedback repeating the values inserted before migration. The dialogues marked with an "X" show removed feedback messages and parts concerning information request that are skipped (because the corresponding information has already been entered through the graphical device). The Figure also shows how some graphic interaction objects are mapped into vocal ones. Text fields (Name, Surname) are mapped into free speech input parts, the selection element ("Date") is in this case also mapped into a free speech input. The radio group (Select Menu Type) is mapped into a voice menu, where the user can say its preference using one of the keywords presented by the synthesizer. The PDA textarea (Specila Requests and Comments) implements a task that is not supported in the voice platform because it can be tedious to provide this information vocally.
We have designed and implemented a migration service able to support user interface migration involving platforms with different interaction modalities. We offer the possibility of changing device and continuing task performance with an application even when changing interaction modality.

References

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