Easing Access for Novice Users in Multi-screen Mashups by Rule-Based Adaption

Philipp Oehme, Fabian Wiedemann, Michael Krug, and Martin Gaedke

Technische Universität Chemnitz, Germany
{firstname.lastname}@informatik.tu-chemnitz.de

Abstract. Novice users often need support to become familiar with a new mashup. The most common problem is that mashups offer a high grade of personalization, such as the user's choice which widgets she wants to use. This problem becomes more difficult in multi-screen mashups, because the user has to decide additionally on which screen the widgets should run. In our recent work we focused on creating multi-screen mashups for enriching multimedia content. That is, a user can watch a video on one screen and also can consume additional content, like a Google Maps excerpt, on another one. This paper presents an approach for rule-based adaption of multi-screen mashups to ease the access for novice users. Therefore, we analyze the users' interaction with the mashup and detect patterns. Based on these patterns we derive rules which will be applied to the mashups of novice users as well as experienced ones. Thus, widgets will be added and arranged automatically on the user's several screens when the execution of a previously generated rule is triggered.

Keywords: Mobile, distributed user interface, distributed displays, multi-screen applications, web applications, mashup, widgets, user interface adaption.

1 Introduction

Mashups allow end users without programming knowledge to easily create applications for their desired target. There, the end users combine small applications, so called widgets, to accomplish their goal. With the emerging amount of mobile devices the opportunities of mashups increase. That is, the mashup is not limited to run on one screen. Rather, multiple screens can be used to create the user interface of one mashup. The following example illustrates the opportunities of these multi-screen mashups: Alice watches a video about an animal documentary on her TV. Meanwhile, she receives additional content on her tablet. This additional content could be a map excerpt about the location of the current scene or the Wikipedia article of the animal which is presented. In this scenario several widgets are described, like a video widget, a map widget or a Wikipedia widget.

One problem for users - especially for novice ones - is that they have to decide which widget they should add. This problem gets more difficult in the

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field of multi-screen mashups due to the choice on which screen a widget should be placed. Closely related to this topic is the automatic composition in classic single-screen mashups described in [4]. While Roy Chowdhury et al. focus on creating a useful startup configuration of a mashup, they do support neither the adaption of the mashup during runtime nor mashups across multiple screens.

In this paper, we enhance our recent approach for multi-screen mashups to ease the access for novice users to multi-screen mashups by rule-based adaption. By observing and analyzing user actions we create rules which are executed, if a defined action is triggered. For example, Alice adds a video widget to her TV and a map widget to her tablet. This interaction will be transformed into a rule. When Bob adds a video widget to his TV, the rule is triggered and a map widget is automatically added to his tablet.

The rest of this paper is organized as follows: In Section 2 we first present our previous work called SmartComposition and we extend this approach with rule-based adaption in Section 3. Finally, we provide a conclusion and give an outlook on future work in Section 4.

2 SmartComposition Overview

In recent work we described an approach for creating multi-screen mashups called SmartComposition. For illustrating this approach we developed a prototype that enriches a video with related information originating from the Web [1]. In the SmartComposition approach, we describe a workspace as the union of all SmartScreens of one user who uses a mashup. A SmartScreen is an abstract representation of the browser window. It offers the runtime environment for the widgets and also includes functionality to enable the inter widget communication. We differentiate between mobile and desktop SmartScreens that differ in size, accessibility and the available widgets. We also developed a mechanism to enable inter widget communication across multiple screens.

We extend the SmartComposition to offer rule-based adaption of multi-screen mashups for novice users.

3 SmartComposition Enhancements

Our approach enhances the existing architecture of the SmartComposition to effectively support adaption for novice users. The following is a brief description of the extensions we made.

To capture the user actions and also the goal of the users [3, 5] the interaction receiver observes every interaction of the user with the system. We consider actions as every interaction of the user with the system, such as adding new widgets to any SmartScreen as well as moving widgets across several screens or removing them. The captured actions include all required information to reproduce the action by the system, such as the device, the type of the action and other relevant options, such as the widget position. Afterwards, the captured actions are analyzed by the pattern detector to search for patterns on the different

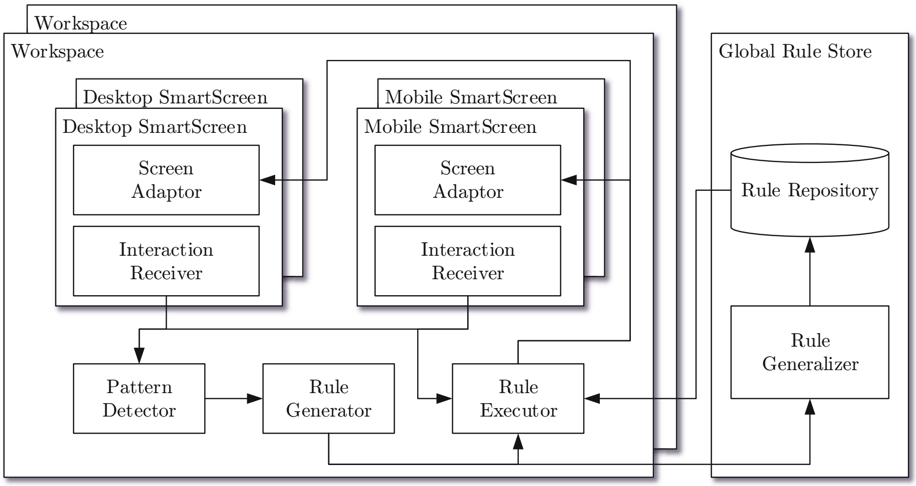

Fig. 1. Architecture of the approach

actions on all devices of a user. That is, the pattern detector examines similar actions which are performed in a specific time interval. Thereby it searches for two actions, one of them is the initiating action and the other one is the resulting action.

If the identified pattern is detected again, the rule generator creates a new rule based on the actions of the pattern. For deciding which pattern will be transformed to a rule we introduce a significance value. This significance value takes two parameters into account: the time difference between the two related actions of one pattern and the amount of occurrences of the same pattern.

The generated rules consist of the initiating action, the resulting action and further parameters to particularize the rule. While the initiating action is triggering the rule later on, the resulting action takes effect in the process of adaption. The rules are utilized to adapt the system to the user [2]. With the aid of the interaction receiver, the rule executor searches for a recurrence of an action that is part of a rule as an initiating action. If an initiating action is found, the rule executor executes the associated resulting action of the related rule. Thus, the action of adding a video widget can lead to the automatic execution of adding a map widget on one of the screens in the workspace.

The rule generalizer uses created user specific rules to derive global rules that are applicable to all users. Therefore, the rule generalizer examines the quality of a rule. This quality is associated to the user's experience in using the mashup. That is, a novice user also creates rules in her own workspace but they are ignored by the rule generalizer because of their minor quality. The generalized rules are saved in the rule repository from which rules can be retrieved from the rule executor in any workspace.

Demonstration. The prototype presented in this paper is available for testing at: `http://vsr.informatik.tu-chemnitz.de/demo/chrooma/adaption/`

4 Lessons Learned and Outlook

In this paper we enhanced our SmartComposition approach to adapt multi-screen mashups by a rule-based system. We observe the users' interaction with the mashup and detect patterns of these interactions. Based on these patterns the system generated rules that follow the abstract template of If-This-Then-That. These rules are executed if a condition is triggered and the multi-screen mashup will be updated. We also introduced a rule-system which differentiates two types. While rules of the first type are applicable only for one specific user, rules of the second type are applicable for all users.

Our future work will focus on a comprehensive user study to examine good thresholds for the rule generation based on the detected patterns as well as the rule generalization. This also includes the time interval within which user interactions will be grouped as one pattern and not as separated ones. We also plan to extend the evolution of generalized rules. That is, rules can be outdated, modified or merged with other rules based on their acceptance of the users.

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