An Approach for Developing Component-based Groupware Product Lines using the Groupware Workbench

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Abstract. Groupware are computer-based systems designed to support groups of people working together providing a shared environment. Given that developing this kind of application is not a trivial task because of the huge amount of time wasted on implementing infrastructure aspects, a few component-based approaches appeared. Groupware Workbench structures groupware using components and tools that encapsulate the technical difficulties of distributed and multi-user systems based on the 3C Collaboration Model. In this paper we propose the development of a Collablet product line using the Groupware Workbench. This approach combines the benefits of Software Product Lines and software components providing a systematic way for tailoring customized groupware through the use of Collablets automatically derived from product lines.

Keywords: software product lines, component-based development, groupware.

1 Introduction

Groupware development isn't a trivial task because it shares a particular set of common requirements [1] and on the top of that it needs specific software development techniques. One key issue that should be mitigated in groupware development is the huge amount of time wasted on implementing infrastructure aspects like protocols, synchronism, session management and others, leaving little time for implementing innovative solutions [2]. Following this line of thought, [3] cite several groupware component-based approaches allowing software reuse and making groupware development faster.

The Groupware Workbench [4] structures collaborative systems using components (Collablet Elements) and tools (Collablets) that encapsulate the technical difficulties of distributed and multi-user systems based on the 3C Collaboration Model [5, 6]. This model considers that collaboration is achieved by the interplay of communication, coordination and cooperation efforts. The 3C Collaboration Model guides all the development process from the domain analysis, organizing the feature model, through implementation where Collablet Elements are developed and classified according to the model.

In this paper we propose the development of a Collablet product line using the Groupware Workbench combining the benefits of SPL and software components. Our goal is to provide a systematic way for tailoring customized groupware through the use of Collablets derived from product lines. Collablets result from the joining of Collablet Element followed by adapting them to provide specific functionality.

2 A Discussion Forum Collablet Product Line

Discussion forum is an asynchronous textual communication tool, largely used to delve deeper into a subject of study. It is used in many different contexts and purposes, from entertainment where users discuss some topic of interest like TV shows, music and more, to education where students can "share their thinking with each other, comment on each other's ideas and find partners that share interests in order to get into a deeper discussion" [7].

Different uses for discussion forums impose different requirements. This section describes the development of a product line for developing discussion forums as Collablets – from the domain analysis until the instantiation of a product and installation on a groupware environment developed using Groupware Workbench.

4.1 Domain Analysis

In order to capture commonalities and variabilities on the discussion forums domain, it is necessary to know in advance their most common uses. Bellow, we describe three different scenarios of use for discussion forums:

- **Scenario 1 – General Purpose Forum.** General purpose forums are widely available on the internet and are open to user participation. In these forums, the discussion topic can vary from games to technical computer issues and the purpose of the discussion can be for entertainment, education, work or other. In general, there are no mediators, and all users play the same role, posting and answering posts to each topic. Some of these forums require user registration for keeping user data and future announcements.
- **Scenario 2 – Frequently Asked Questions (FAQ).** This kind of resource can be viewed as a discussion forum given that that users post their doubts and experts answer them. In this scenario, we can identify at least three different roles for the users: general users, mediators and expert users. General users are only allowed to post questions, but not to answer them. Mediators select posts

to be answered by experts according to their relevance and check whether a similar question has been answered. Expert users are the ones who answer questions and make them visible to other users.

- **Scenario 3 – Educational Forums.** In this kind of forum, topics are usually suggested by teachers or mediators, and topics are opened during a certain period of time for posts. Posts may be evaluated by teachers, depending on the educational methodology that is being applied. Like in scenario 2, here we can also identify different roles for the participants (students, mediators, teachers, and others). In this situation, a new set of requirements like session manager and categorization of messages should be taken into account.

Although having different objectives, applications for the scenarios abovementioned share a common set of characteristics. They are applications for posting and answering messages. These messages are displayed according to some criteria (hierarchically or by order of post) depending on each situation.

This way, based on the requirements of these scenarios and on our experience on developing and using groupware, we indentified a set of common and variable features for discussion forums development. These features were analyzed and classified according to the 3C Collaboration Model. One issue that should be observed is that although discussion forums are communication-oriented, most of the identified features are coordination- and cooperation-oriented, reflecting the intra-relationships of these dimensions of the collaboration model.

The identified features were then organized in the Forum PL 3C feature model, which is depicted in Fig 1. The feature model not only shows the features with their respective variability information (mandatory or optional), but also their purpose. Once again, the purpose of the derived products (communication) is indicated by the root of the feature model.
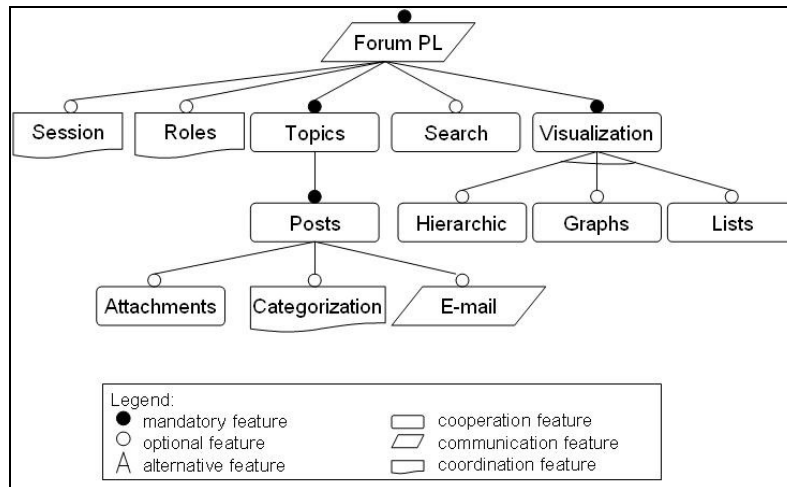
Fig 1. Forum PL 3C-Feature Model

4.2 Design and Implementation

In order to provide a flexible architecture to support the variability provided by the Forum PL, the features identified in the previous phase were designed and implemented as independent Collablet Elements in Groupware Workbench. This assures that these components may be tailored and reused not only on Forum PL, but in any other product line or component-based software implemented with GW.

The independent Collablet Elements must be implemented and deployed on GW according to its 3C purpose. It keeps the workbench organized for future software maintenance and reuse, in addition to maintaining consistence with the previous development phase.

Product derivation [8] in the software product line engineering refers to the process of constructing a product from a set of reusable assets. In the Forum PL, products are derived by the composition of reusable Collablet Elements and configuration of specific Collablets. These artifacts encapsulate the technical difficulties of distributed and multi-user systems based on the 3C Collaboration Model.

4.3 Product Derivation

In order to facilitate the selection and composition of Collablet Elements and configuration of the Collablets, we specialize the GenArch [9] product derivation tool to incorporate a new model entitled Collab-specific Model.

The product derivation process starts by configuring the feature model. It encompasses the selection of Collablet features that satisfy the requirements of a certain product requested by customers. Based on the previous defined feature model configuration, the GenArch derivation process is devised in three steps: (i) selection of the Collablet Elements that will compose the specific Collablet; (ii) selection of the implementation elements (class, aspects, files, components, folders) that will be part of the derived product; and (iii) customization of Tool Descriptor Files – XML files that declare the Collablet Elements and their settings.

The selection of Collablet Elements from the Groupware Workbench is accomplished based on the configuration knowledge provided by the configuration model, which relates Collablet features to Collablet Elements. After that, the GenArch tool uses the information provided by the Collab-specific model that relates the Collablet Elements with implementation elements; in order to decide which implementation elements (classes, interfaces, extra files, etc.) will be part of the final product.

5 Conclusion

In this paper, we proposed the development of a Collablet Product Line (CPL) using the GW aiming to provide a systematic way for tailoring customized groupware derived from product lines. As an example, we developed a CPL for discussion forums.

The use of GW in the development of the product line was adequate, since the structure provided by GW was already designed for the reuse of software components. In addition, the GW already provides mechanisms for composition of Collablet Elements to the creation of Collablets and composition of Collablets for groupware. The concept of product line systematizes the groupware development process using the GW, supplying the need of having technical management aspects that are important throughout the life cycle of the software.

This paper addresses ongoing research on the GPL development. We are currently investigating how to combine and instantiate two or more Collablets Product Lines in order to provide customizable Collablets on groupware composition according to specific group dynamics and needs.

Acknowledgments

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