

Development of Extensible and Flexible Collaborative Applications Using a Web Service-Based Architecture^{*}

Mario Anzures-García¹, Miguel J. Hornos², and Patricia Paderewski-Rodríguez²

¹ Facultad de Ciencias de la Computación, Benemérita Universidad Autónoma de Puebla,
14 sur y avenida San Claudio. Ciudad Universitaria, San Manuel,

72570 Puebla, Mexico
anzures@correo.ugr.es

² Dept. de Lenguajes y Sistemas Informáticos, E.T.S. de Ingenierías Informática y de
Telecomunicación, Universidad de Granada, C/ Periodista Saucedo Aranda, s/n,
18071 Granada, Spain
{mhornos,patricia}@ugr.es

Abstract. This paper presents a study of the main current collaborative applications and shows how their architectural models focus on the interactive aspects of the systems for very specific applications. It also analyses state-of-the-art web service-based collaborative applications and shows how they only solve specific problems and do not provide an extensible and flexible architecture. From this study, we conclude that there is currently no standard architecture (and even less a web service-based one) which can be taken as a model for collaborative application development. We therefore propose a web service-based architectural model for the development of this type of application. This model provides flexible collaborative sessions in order to facilitate collaborative work in a consistent way and with group awareness mechanisms. The proposed architecture enables applications, components or tools to be added and can be extended with new web services when required without the need to modify existing services. The resulting collaborative applications are therefore flexible and extensible.

1 Introduction

As a result of technological progress (especially in telecommunications) and also the development of new software technologies and globalization, there has been a strong trend towards distributed groupwork, crossing (for example) geographical, organizational and cultural boundaries. For this, software systems are needed that support, contribute and strengthen groupwork, and such systems must be supported by models, methodologies, architectures, and platforms that allow CSCW (Computer Supported Cooperative Work) applications to be developed with respect to current needs.

Development of groupware applications is based on different approaches including object-oriented, component-oriented, aspect-oriented, and agent-oriented ones. Each groupware system has been designed to support a particular form of cooperative work or a specific range of cooperative work forms. In recent years, the use of SOA

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(Service-Oriented Architecture) for the development of distributed collaborative applications has increased since it provides an abstract interface that supplies a set of loosely coupled, asynchronous, document-based services. This makes the resulting applications reusable, efficient and adaptable [10]. The most common way to implement SOA is with web services and since they have been developed under a series of standard protocols and open technologies, the resulting applications are interoperable, portable, and easy to integrate [9]. For this reason, the computer industry has increasingly focused on web services as an alternative for the construction of open distributed Internet systems since any web-accessible program can be wrapped as a web service, and the system components can therefore be implemented as services. Web service technology is ideal for implementing collaborative work because it is based on the notion of building new applications by combining network-available services.

An architectural model is necessary, however, for the development of flexible and extensible collaborative applications and which supports the three key characteristics of CSCW systems: communication, coordination, and collaboration [8]. For this purpose, we present a web service-based architecture which enables flexible (i.e. able to support different ways of organizing the groupwork) and extensible (i.e. able to increase the functionality of the application according to new requirements) collaborative systems to be developed.

In Section 2 of this paper, we present the conclusions of the analysis carried out on the main architectural models and environments for the development of collaborative applications, in addition to a study on a series of web service-based collaborative applications. Section 3 shows our architecture and describes its main elements. Section 4 briefly explains the use of our architecture for developing collaborative applications. The final section presents our conclusions and future lines of research.

2 Related Work

A wide range of applications, prototypes, and products have been developed to support groupwork. Each groupware system has been designed to support a particular form of cooperative work or a specific range of cooperative work forms. There are also a wide variety of architectural models and environments which help us develop collaborative applications, such as the ones analysed in Section 2.1. In recent years, web services have been the technological basis for the development of CSCW applications. The study carried out on nine of the most representative web service-based applications of this type is presented in Section 2.2.

2.1 Models and Environments for Developing Collaborative Applications

Architectural models attempt to model the system as a group of components and the relationships between them, e.g. Interactor Models [18], PAC [6], and MVC (Model-View-Controller) [16]. Extensions have also been proposed for CSCW systems, e.g. PAC* [4] and Dewan's generic architecture [7], and new models such as Patterson's taxonomy [23], COCA (Collaborative Objects Coordination Architecture) [20], Clock [14] and Clover [19]. One disadvantage of these models is that they focus on the interactive aspects of the system (with the exception of COCA, although this is mainly