Tool Orchestration in e-Collaboration: A Case Study Analyzing the Developer and Student Perspectives

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ABSTRACT

In this study the authors start by highlighting the lack of a “tool orchestration” framework in e-collaboration environments (either for work or learning purposes). To address this issue, they propose the MAPIS3 software architecture to efficiently manage the key problem in tool orchestration, which is the efficient data transfer among various tools used in e-collaboration activities. To evaluate their proposal, they present a case study of a flexible e-collaboration scenario that cannot be implemented automatically with any known architectures or tools. This scenario entails transfer and processing of students’ collaboration data emerging originally in a chat tool to an IMS-LD compatible application (“player”) and, finally, to a Moodle installment forum. The overall implementation was evaluated both from the developer’s and the student’s perspective. Results indicate that seamless data flow establishing tool orchestration can be achieved by the proposed approach in a cost-efficient and flexible manner. Moreover, the authors highlight and discuss how data flow and flexible management supported by the architecture may have a profound impact on the quality of users’ collaboration.

Keywords: E-Collaboration, IMS-LD, Software Architecture, Tool Orchestration, Web Services

INTRODUCTION

The multifaceted benefits emerging from collaboration either at work or educational settings have been well established in previous research work (Dillenbourg et. al., 2011). Technology-supported collaboration (e-collaboration) is always considered as an asset to the toolbox of a company or educational institution (Prinz et. al., 2010). However, integrating advanced e-collaboration technologies into a traditional workplace or classroom is a complex procedure. Among others, one technological factor that causes such complexity is what we call the “tool orchestration” problem. This refers to the necessity of establishing a seamless communication and data flow pattern among the various tools that may be used in a specific e-collaboration scenario.

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In this work, we initially explain the tool orchestration problem and we present the MAPIS3 architecture to address this problem. At the same time, we limit our scope and avoid tackling other technical issues such as security concerns (Bracher & Padmanabhan, 2012). We continue by comparing our proposal to other similar solutions presented in the literature, highlighting the expected benefits and possible shortcomings. Finally, we provide architecture evaluation data based on a case study, exploring both the developer’s and user’s perspective.

BACKGROUND

The Tool Orchestration Problem and Proposed Solutions

E-Collaboration activities, either in the work environment on businesses interested in improving their collaborative performance and obtaining a higher Return on Investment (Kristensen & Kijl, 2010) or for learning purposes (Hayne & Smith, 2005), are usually guided by an e-collaboration scenario defined at an abstract, technologically independent level (Kock, 2008). In the area of computer-supported collaborative work (Bouras et al., 2009), this is typically referred to as “scenario” (Dillenbourg et al., 2011), while in the computer-supported collaborative learning (CSCL) field it is known as “learning design”, “collaboration script” or simply “script” (Dillenbourg et al., 2011). For reasons of simplicity and generalization, in the current work, we call this abstract design as e-collaboration scenario or simply scenario.

By integrating scenario techniques, e-collaboration has gradually evolved to a setting of considerable complexity because of multiple human-human and human-technology interactions. In the context of such e-collaboration scenarios with many component activities and consequently tools, there are several technical challenges that have to be addressed (Munkvold & Zirius, 2005). Designers have to decide which e-collaboration tools to use and, most importantly, how these tools will interoperate with each other. Moreover, proposals for reference architectures (Peristeras et al., 2010) towards integration of collaborative work environments mainly focus on the support of the individual during collaboration, possibly underestimating group dynamics and learning or work effects.

A common example illustrating the needs and limitations in e-collaboration scenarios is when flexible regrouping is required at a certain point of the scenario. Perhaps some users fail a test/project or some others cannot attend the course/activity anymore; or maybe some users exhibit collaborative skills and knowledge that can be helpful when users are regrouped for another project. Let us suppose that the initial phase of e-collaboration is supported by software tool A (for example, a synchronous chat tool), while another tool B is used for online asynchronous e-collaboration at a later phase. Then, to implement the regrouping scenario, data about user skills and knowledge from tool A need to be exported and processed for group formation (or role assignment to users), and the outcome to become input for tool B. Thus, data transfer and some complex computations need to be conducted to accomplish the whole task required by the specific e-collaboration scenario.

In such situations, the “tool orchestration” problem boils down to the fact that, although several e-collaboration tools exist for various purposes, there is lack of a mature (i.e. evaluated and well-established) framework for seamlessly connecting and transparently transferring user and interaction data among the various tools in e-collaboration scenarios. Consequently, we describe as “e-collaboration tool orchestration” a situation where e-collaboration activity data need to be forwarded to and processed by various tools in a transparent and unobtrusive manner for the participants.
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