Chapter 11
Flexible Orchestration of Tools in E-Collaboration:
Case Studies Analyzing the Developer, the Teacher, and the Student Perspectives

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ABSTRACT

Relevant literature has emphasized the lack of a "tool orchestration" framework in e-collaboration environments (either for work or learning purposes). In this chapter, the MAPIS3 software architecture is suggested as a flexible solution to manage the key problem in tool orchestration, which is the efficient data transfer among various tools used in e-collaboration activities. The proposal is assessed by two case studies of flexible e-collaboration scenarios that cannot be implemented automatically with any known architectures or tools. These scenarios entail transfer and transformation of students' collaboration data through an IMS-LD compatible "player." The data emerge originally to a specific tool and are transferred to another tool. The overall implementations were evaluated from the developers', the instructors', and the students' perspectives. Results indicate that MAPIS3 supports seamless data flow among tools efficiently and flexibly. In particular, teachers are supported in monitoring the e-collaboration process by flexible visualizations of peer/student interactions.

INTRODUCTION

Previous research work (Dillenbourg et al., 2011) has identified the multifaceted benefits emerging from collaboration either at work or educational settings. E-collaboration (or technology-supported collaboration) is usually considered as an advantage to the toolbox of a company or educational organization (Prinz et al., 2010). However, it has been also highlighted that integrating advanced e-collaboration

technologies into a traditional workplace or classroom is a complex procedure (Dillenbourg et al., 2011). Among others, one technological factor that reasons such difficulty is what we call the "tool orchestration" problem. This problem denotes the requirement of supporting a seamless communication and data flow pattern among the various tools that may be included in a specific e-collaboration scenario.

In this work, we start by analyzing the tool orchestration problem and we present the MAPIS3 architecture to address this problem. We limit this work's scope and avoid tackling other technical issues such as security concerns (Bracher & Padmanabhan, 2012). Then, we challenge our proposal with other similar solutions presented in the literature, emphasizing the expected benefits and possible limitations. Moreover, we provide architecture evaluation data based on two case studies, exploring the developer's, the instructor's and user's perspective. This is an enhanced work of an already published study (Magnisalis & Demetriadis, 2015) which was based on case study 2 of the current manuscript. Case study 2 is also included here, yet enhanced with the viewpoint of the instructor, including requirements for visualizing peer interaction data that occur during e-collaboration. Focusing on case study 1, we present the development of a technological system that deploys visualized peer interaction data from a Moodle forum and supports mobility (i.e. a widget application in mobile devices). We discuss: a) the information model used to represent the peer interaction data, and b) the visualization implementation in order to support end users (focusing on teachers) in monitoring some key online discussion parameters. We also highlight future application of such a system which connects e-collaboration tools in order to both support monitoring of the discussion stream and beneficially affect collaboration outcomes.

BACKGROUND

The Tool Orchestration Problem and Proposed Solutions

E-Collaboration activities, either in the work environment (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 or script.

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 & Zirus, 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 "flexibility" (i.e. adaptation) is needed for learner-tailored activities (Dillenbourg et al., 2011). A learning environment can adapt in order to scaffold interactions or to provide individual support. In doing so, the environment has to model parameters and modify them in real time. Such parameters maybe the

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