Chapter 5

Architectural Models for Reliable Multi-User Interfaces

Mario Ciampi
ICAR-CNR, Italy

Antonio Coronato
ICAR-CNR, Italy

Giuseppe De Pietro
ICAR-CNR, Italy

Luigi Gallo
ICAR-CNR, Italy

ABSTRACT

Virtual Environments are complex systems in that they involve the crucial concept of sharing. Users can share knowledge of each other’s current activities, environments, and actions. In this chapter, the authors discuss about interaction interoperability, intended to mean the ability of two or more users to cooperate despite the heterogeneity of their interfaces. To allow such interoperability, formal methods to formalize the knowledge and middleware solutions for sharing that knowledge are required. After introducing the state-of-the-art solutions and the open issues in the field, the authors describe a system for providing interaction interoperability among multi-user interfaces. Rather than focusing on the decoupling of input devices from interaction techniques and from interaction tasks, this chapter suggests integrating interactive systems at higher level through an interface standardization. To achieve this aim, the authors propose: i) an architectural model able to handle differences in input devices and interaction tasks; ii) an agent-based middleware that provides basic components to integrate heterogeneous user interfaces. The chapter also presents a case study in which an agent-based middleware is used to support developers in the interconnection of monolithic applications.

DOI: 10.4018/978-1-61350-516-8.ch005
INTRODUCTION

In recent years, Virtual Environments (VEs) have become increasingly popular and used for a variety of contexts, such as entertainment, scientific visualization, training, education, art. People from different countries, with different cultures and different languages should be able to collaborate each other in these computer-based simulated environments by using user-centric interfaces. The domain, the task, the input and the output device used have to be considered to provide a usable interface for a specific user in a specific virtual environment. This chapter is focused on interoperability, the ability of two or more software components to cooperate despite differences in language, interface, and execution platform (Wegner, 1997). In greater detail, we discuss interaction interoperability that is the ability of two or more users to cooperate despite differences in input devices and interaction techniques.

To the best of our knowledge, this question has recently been raised in (Ahmed, Gracanin, & Abdel-Hamid, 2008b). In this paper, the authors propose a framework to support interaction interoperability, the main benefit of which is the ability to use ontologies to define interaction tasks and techniques without specifying how these tasks should be accomplished. By using ontologies, the framework binds tasks to the user’s preferred interaction techniques and then to available input devices. In other works by the same authors, (Ahmed, Gracanin, Abdel-Hamid, & Matkovic, 2008) and (Ahmed, Gracanin, & Abdel-Hamid, 2008a), the framework capabilities are further described. Interoperability is granted by using a standardized taxonomy built with the Ontology Web Language (OWL). The framework they propose should also be able to choose the best input device for a particular user by analyzing her/his preferences in the interaction. The idea of decoupling interaction techniques from interaction tasks and input devices is also described in (Bowman et al., 2006), in which the authors explore the integration of different technologies to support co-located collaborations.

From the point of view of an interface programmer, decoupling interaction techniques from input devices may not be worthwhile. As Poupyrev et al. outlined in (Poupyrev, Weghorst, Billinghurst, & Ichikawa, 1998), similar interaction techniques vary depending on the particular implementation. Studies of the particular implementation of a technique may not be easily applied to other implementations of the same technique. Therefore, decoupling interaction techniques from input devices and mixing them according to user patterns could reduce the usability of the interface.

In light of these considerations, assuming that a formal description of interaction tasks is still necessary, we propose to let interaction designers plan ITs coupling them strictly to the particular input devices used. In the approach, we propose that different ITs and input devices are handled in a common framework in the same way as black boxes. We suggest using an agent-based middleware to provide interaction interoperability in Collaborative Virtual Environments (CVEs). This middleware is built upon an architectural model in which the typical system layers have been extended to provide interface standardization between different systems. The aim is to allow both interaction designers to plan ITs, coupling them with the corresponding input devices, and users to collaborate by using the combination of ITs and devices they prefer.

Rather than focusing on the de-coupling of input devices from interaction techniques and from interaction tasks, we suggest integrating interactive systems at higher level through an interface standardization. To achieve this aim, we propose: i) an architectural model able to handle differences in input devices and interaction tasks; ii) an agent-based middleware that provides basic components to integrate heterogeneous user interfaces. We also present a prototype of an agent-based middleware able to support developers in the interconnection of monolithic applications and
Related Content

Online Synchronous vs. Asynchronous Software Training Through the Behavioral Modeling Approach: A Longitudinal Field Experiment
[www.igi-global.com/chapter/online-synchronous-asynchronous-software-training/18285?camid=4v1a](www.igi-global.com/chapter/online-synchronous-asynchronous-software-training/18285?camid=4v1a)

Exploring the Factors Influencing End Users' Acceptance of Knowledge Management Systems: Development of a Research Model of Adoption and Continued Use
[www.igi-global.com/chapter/exploring-factors-influencing-end-users/18191?camid=4v1a](www.igi-global.com/chapter/exploring-factors-influencing-end-users/18191?camid=4v1a)

A Comparison of Foreign Government Computing Policies
Rick Gibson and Mary Alice Mcdonough (1996). *Journal of End User Computing* (pp. 3-10).
[www.igi-global.com/article/comparison-foreign-government-computing-policies/55729?camid=4v1a](www.igi-global.com/article/comparison-foreign-government-computing-policies/55729?camid=4v1a)

A Social Capital Perspective on IT Professionals’ Work Behavior and Attitude
[www.igi-global.com/article/social-capital-perspective-professionals-work/49659?camid=4v1a](www.igi-global.com/article/social-capital-perspective-professionals-work/49659?camid=4v1a)