IPML: Structuring Distributed Multimedia Presentations in Ambient Intelligent Environments

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ABSTRACT

This paper addresses issues of distributing multimedia presentations in an ambient intelligent environment, examines the existing technologies and proposes IPML, a markup language that extends SMIL for distributed settings. It uses a metaphor of play, with which the timing and mapping issues in distributed presentations are covered in a natural way. A generic architecture for playback systems is also presented, which covers the timing and mapping issues of presenting an IPML script in heterogeneous ambient intelligent environments. [Article copies are available for purchase from InfoSci-on-Demand.com]

Keywords: Ambient Intelligence; Distributed Multimedia; Play; Software Architecture

INTRODUCTION

Ambient Intelligence (AmI) is introduced by Philips Research as a new paradigm in how people interact with technology. It envisions digital environments to be sensitive, adaptive, and responsive to the presence of people, and AmI environments to change the way people use multimedia services (Aarts, 2004). The environments, which include many devices, will play interactive multimedia to engage people in a more immersive experience than just watching television shows. People will interact not only with the environment itself, but also with the interactive multimedia through the environment.

For many years, the research and development of multimedia technologies have increasingly focused on models for distributed applications, but the focus was mainly on the distribution of the media sources. Within the context of AmI, not only are the media sources distributed, the presentation of and the interaction with the media will also be distributed across interface devices. This paper focuses on the design of the structure of multimedia content, believing that the user experience of multimedia in a distributed environment can be
enriched by structuring both the media content at the production side and the playback system architecture at the user side in a proper way. We refer to the adaptation at the user side as the mapping problem. One important aspect of the mapping problem is sketched in Figure 1. The content source and the script should be independent from the question which specific devices are available at the user’s side. This may vary from a sophisticated home theater with interactive robots (left) to a simple family home with a television-like device and a lamp (right). There is no a priori limit to the type of devices, for example PDAs and controllable lights are possible as well. The playback environment need not even be a home; it could be a professional theater or a dedicated installation. The structure should enable both the media presentation and the user interaction to be distributed and synchronized over the networked devices in the user environment. The presentation and interaction should be adaptive to the profiles and preferences of the users, and the dynamic configurations of the environment.

As El-Nasr and Vasilakos (2006) point out, there is very little work that allows the adaptation of the real environment configuration to the cognitive spaces of the artists, in our example, the authors of the content and the script. The area of Cognitive Informatics (Wang, 2006, 2007) provides interesting insights into this issue. In particular this is a field studies the mechanisms and process of natural processing and intelligence, including emotions, cognition, decision making, and its application to entertainment, engineering, educational, and other applications. On the one hand, the users and the authors should not be bothered by the complexity hidden behind the surface of the ambient intelligence; on the other hand the ambient intelligent environment should be able to interpret the user’s needs in interaction and to adapt to the author’s requirements in presentation. The common part that the users and the authors share is not a particular user’s environment, but only the media content. The media content should be structured in such a way, that the requirements from the both sides can meet. To structure the media content, the following issues need to be addressed:

1. By what means will the authors compose the content for many different environments? The authors have to be able to specify the following with minimized knowledge of the environments: (a) Desired environment configurations; (b) Interactive content specification for this environment.

2. How can the system play the interactive media with the cooperation of the user(s) in a way that: (a) makes the best use of the physical environment to match the desired environment on the fly; (b) enables context dependent presentation and interaction. Here the term “context” means the environment configuration, the application context, the user preferences, and other presentation circumstances; (c) synchronizes the media and interaction in the environment according to the script.

This paper first examines existing open standards for synchronized media. Then the notion of “play” is introduced as a unifying concept, first in an informal way, later formalized through the design of the language. The language is developed in two steps: first an existing scripting language and then the language IPML which takes full advantage of the notion of play and addresses all of the aforementioned issues. The latter language is based on a generic architecture for the playback system that covers the timing and mapping problems.

Then we discuss the three main architectural design elements which are needed to bring the plays, written in this language, to live: distributed agents, an action synchronization engine, and an IPML mapper. It is through this design that we validate the concepts and thus prove the feasibility of IPML and demonstrate its value.
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