Universally Accessible Lifelong Learning by User and Device Profiling Adaptation

Carlos A Velasco, Yehya Mohamad and Stefan Carmien

Fraunhofer Institute for Applied Information Technology (FIT)
Schloss Birlinghoven, D53757 Sankt Augustin (Germany)
{Carlos.Velasco,Yehya.Mohamad,Stefan.Carmien}@fit.fraunhofer.de

Abstract. We present in this paper our initial approach to support Universally Accessible eLearning, by customizing our previous experiences on personalization of content via user and device profiles to the Lifelong Learning Domain. In particular, we introduce our initial ontology of services that will support the adaptation process, when combined with user and device modeling.

Keywords: accessibility, eLearning, lifelong learning, user profiles, device profiles, CC/PP, content adaptation

1. Introduction

As business and society become more and more dependent on information and communication technologies as well as embedded software systems, the impact of the Digital Divide caused by accessibility to the new technologies could grow by widening differences in educational chances, job market situation, interaction with public administration and government, and quality of life. Living in this changing world implies adapting to changing circumstance and opportunity, in a word, learning.

A designed solution to this problem must incorporate the use of the mediating tools of mainstream education: the computers, the Web and the various user agents that mediate content to the learner. Within this context, it is important not to forget that authoring services and tools must also be enhanced to support these users.

The goal of such a solution would be to present the right information in the right fashion and in the right sequence for this user. This work is framed under the work of the EU4ALL Integrated Project, combined with previous research efforts of the authors (Velasco et al. 2004).[1] EU4ALL aims at supporting Accessible Lifelong Learning (ALL) by uniting 3 key assertions: 1) That the technology that mediates lifelong learning does so by accommodating the diversity of ways people interact with technology and the content and services it delivers; 2) That this technology

1 http://www.eu4all-project.eu/

can be used to bring support services to disabled learners. 3) By providing support services and technical infrastructure that enable teaching, technical and administrative staff of educational institutions can offer their teaching and services in a way that is accessible to disabled learners.

2. An Architecture for Accessible eLearning

A new architectural solution to eLearning content delivery is proposed under the scope of the project. At a minimum, computationally mediated learning consists of the material (content) presented over time, in a specific fashion throughout a user agent to a student. The material needs to be specifically tailored to be used in this learning environment, and expertise in the design as well as support to do this (e.g., learning models, content editors) is required.

This architectural model (see Fig. 1) consists of a user model, a model of the user agent and its device, a service ontology (the service model), and a framework for designing and delivering content (the content model).

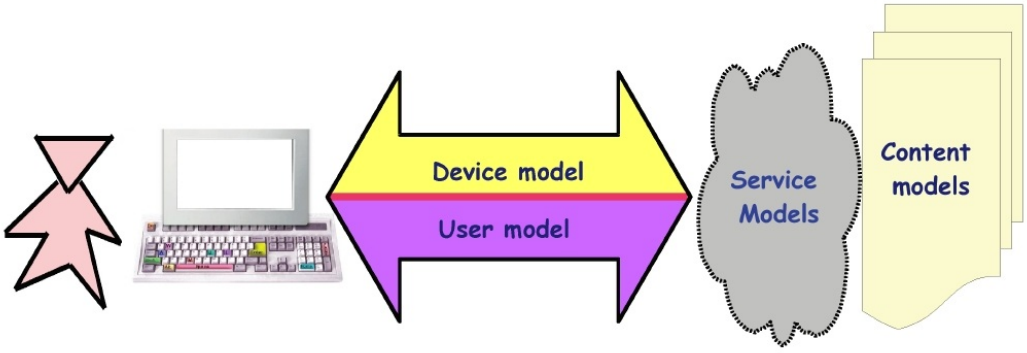

Fig. 1. EU4ALL Accessible elearning Architecture.

The user model is designed to facilitate specifying the content and presentation of eLearning material specific to the user. Our approach to creating a user model is to focus on the user's functional ability and needs (the social model), which allows a description of the user without being mired in diagnosis (the medical model) or the universe of one[2] dilemma. We create an ontology of users characteristics and needs. This ontology is to be generated based on an iterative process of initially defining the methodologies for eliciting user requirements and studying existing user models in this domain (see, e.g., Kobsa, 2001, Fisher, 2001, and Velasco et al. 2004). From this analysis an ontology of user profiles will be generated.

2 The universe of one describes a person with disabilities as having a unique set of abilities and needs, so completely unique that every complete universal usability solution can become a separate programming requirement tailored for that individual

Closely coupled with the user model is the device model. The device model defines the abilities of the user agent and the device where it runs into. These elements together provide a blended mapping of metadata to the service component to appropriately support content adaptation.
The process of creating a useable framework for describing devices consists of an initial state-of-the-art analysis for existing device models and associated frameworks of application interfacing, leading to prototype development and integration of the device model architecture. This work is built upon existing industry standards like CC/PP (Klyne et al. 2004), which makes use of Semantic Web technologies (Lassila & Swick, 1999).
The next layer of the architecture is the services model. Services are defined in this context as the various acts and systems that support delivery of the appropriate content to the user's user agent. Services range from completely computer mediated systems, such as a text to speech transcriber, to complex human supports such as requesting a human sign translators of lectures. Like the user model, the services framework is expressed in the form of an ontology built up by collecting examples of services from domain experts. Using this preliminary ontology, existing services will be categorized to facilitate discovery and use of existing services. The ontology will also be used as a guide in creating Web Services versions of non-computer mediated services.
Finally the architecture requires formalization of content creating, storing and retrieval. This content modeling is to be based on existing eLearning systems and learning models.

3. Future Work

This set of models is a design approach to respond to the universe of one problem, which states that for many persons with disabilities, their needs and abilities are complex collections that are unique to the individual. On one hand, there are simple configuration approaches that do not adapt the system deeply enough to make it workable for them; on the other hand there are systems that are literally coded to fit the individual, but at an expense that limits wide availability. By using a functional approach to disability accommodation, in concert with device and service matching, a solution can be created without falling into either of the above unworkable traps.
The ongoing work intends to address the following issues:

— Extension of existing standards in the area of user and device modeling to be coupled with the other components of the architecture.
— Analysis of interface modeling standards like URC (Zimmermann et al. 2003) and research in the area of fluid computing to complement the adaptation process.
— Application and extension of Semantic Web and Web Services technologies to integrate meaningfully the different architectural components.

References

1. Fischer G (2001) User Modeling in Human–Computer Interaction. User Modeling and User-Adapted Interaction, **11**, pp. 65—86.
2. Klyne G, Reynolds F, Woodrow C, Ohto H, Hjelm J, Butler MH & Tran L (eds) (2004) Composite Capability/Preference Profiles (CC/PP): Structure and Vocabularies, W3C Recommendation 15 January 2004. World Wide Web Consortium. Available at: http://www.w3.org/TR/CCPP-struct-vocab/
3. Kobsa A (2001) Generic user modeling systems. User Modeling and User-Adapted Interaction, **11**. pp. 49—63.
4. Lassila O & Swick RR (eds) (1999) Resource Description Framework (RDF) Model and Syntax Specification, W3C Recommendation 22 February 1999. World Wide Web Consortium. Available at: http://www.w3.org/TR/1999/REC-rdf-syntax-19990222/
5. Velasco C A, Mohamad Y, Gilman A S, Viorres N, Vlachogiannis E, Arnellos A & Darzentas J S (2004) Universal access to information services—the need for user information and its relationship to device profiles. Universal Access in the Information Society, **3**, pp. 88—95.
6. Zimmermann G, Vanderheiden G & Gilman A. (2003) Universal Remote Console - Prototyping for the Alternate Interface Access Standard Universal Access. In: Carbonell N & Stephanidis C (ed.), Theoretical Perspectives, Practice, and Experience: 7th ERCIM International Workshop on User Interfaces for All, Paris, France, October 24-25, 2002. LNCS 2615/2003, pp. 524—531.