Chapter 29
A Semantic Portal for Publication and Exchange of Educational Online Laboratories

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ABSTRACT

This chapter presents the research results focused on defining a general model for online laboratories and a Web repository based on Semantic Web technologies to facilitate the use of new tools to publish and exchange online laboratories and other related resources. The developed model is based on existing and well known standards like dc and FOAF, but new vocabularies also had to be created to describe the more specific resources related to online laboratories. Online laboratories are becoming important educational resources because of their increasing availability and diversity. Online laboratories also provide a flexible training option because they can be shared and are available on a 24/7 basis. Modern technologies in the area of online engineering are often prohibitively expensive and the possibility of sharing resources and sharing laboratory facilities is an increasingly attractive option, particularly for universities and other institutions with more limited financial resources. Furthermore this chapter describes in detail the Lab2go Web repository and its functionalities developed to facilitate the creation of semantic content and the search for online laboratories and other related resources.

INTRODUCTION

The growing access to broadband Internet connections during the last decade has caused many research groups to explore new ways to support and facilitate learning. One outcome of this research is online laboratories. Today, many universities, schools and other organizations have programs that offer, in addition to their traditional laboratories, a wide range of online laboratories in different scientific fields. Online laboratories are fundamental for home experimentation because they are especially designed for students

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to acquire introductory hands-on experience and familiarize themselves with real-life phenomena from outside the traditional confines of the traditional laboratory setting. Online experiments can be found in different scientific fields, including electronics, mechatronics and informatics, among others (Auer, 2010).

For several years now, different initiatives have been proposed to make online laboratories more broadly available and scalable to support a growing number of users. Several projects initiated by leading institutions have focused on making online laboratories available to an increasing number of institutions by developing software architectures that make sharing online laboratory resources more readily accessible to others. Some well-known projects include the iLab Shared Architecture (iSA) (Haward, 2004) developed by the Center of Educational Computing Initiatives (CECI) at MIT (Massachusetts Institute of Technology), and the Sahara (Lowe, 2009), a platform developed by the University of Technology in Sydney, Australia. Sahara and iSA provide standard services to manage and maintain laboratory sessions and remotely share equipment. Along with advancing technology and improving the usability of online laboratories, a third major challenge has been how to make finding specific online laboratory activities on the Web easier for potential users. Currently, most users are students who receive information and access rights to an online laboratory directly from their lectures, exactly as it has always been done in traditional hands-on laboratories. Online laboratories offer an important advantage over traditional labs because users can access them at any place and any time, as long as there is sufficient bandwidth and the connection is stable. Programs like the "Lifelong Learning Programe: education and training opportunities for all," developed by the European Commission for Education and Training, promotes developing learning resources to allow learners to train themselves. Because of their flexibility, online laboratories can become a significant resource, but there are still important barriers to overcome before they can reach their real teaching potential and a wider audience. The time users need to identify and access the online laboratory activity they require represents the first barrier for users. An important problem is that there are many hidden online laboratories available on the Web, but they are often not easily accessed because of a lack of information. While other learning resources on the Web are described with metadata to allow search engines or systems to more easily locate them, the great majority of online laboratories are not described with additional metadata. The following sections of this chapter will present a potential solution for this problem.

BACKGROUND

Semantic Web

The Semantic Web is an enhancement to the classical Web, which emerged in 1989 and was developed by the European Organization for Nuclear Research (CERN). The original idea of the Web and its main goal was to efficiently exchange scientific documents. In the following years, this network grew steadily and quickly became a huge network of interlinked documents without any underlying schema. The documents in the network primarily contained textual information that was mainly unstructured and not machine readable. Web 2.0 extended the original concept of the Web to some large information silos, usually backed by relational databases for storing specific content. Two examples of this are YouTube for videos and Flickr for photos. This concept allowed users to start collaborating and sharing information of certain specific content types, but the data remained centralized. Because of the steadily growing size of the network, new ways to organize and handle information had to

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