The Web as Personal Learning Environment

K.Žubrinić[1], D.Kalpić[2]

[1] University of Dubrovnik, Dubrovnik, Croatia
[2] University of Zagreb, Zagreb, Croatia

Abstract—**Today, the lifelong learning has become a necessity in most professions, especially in computer science where people are constrained to follow fast developments. This learning is predominantly informal, based on self-studying. Internet has turned into the most important source of all kind of information. Many Web sites provide tools and services for exchange of knowledge between people sharing a common concern, and that has a significant influence on self-studying. Personal learning environment provides an opportunity for the user to create and manage his or her environment for learning and knowledge exchange. This article describes a model of personal learning environment based on available free Web services.**

Index Terms—**e-Learning, mashup, personal learning environment, Web 2.0**

I. INTRODUCTION

Nowadays, much information published in books and magazines is already obsolete at the moment of publication, because of the time needed for reviewing, revising and publishing [1]. The state of the art information is published on Internet where authors place it at the moment of creation. Information related to science and technology has a very short life span. An aftermath of this trend is the need for constant renewal of knowledge after having completed formal education. The process is known as lifelong learning. As the state of the art information is placed on Internet, it makes Internet an inevitable learning resource. According to a few studies concerning learning in adult age, between 70% and 80% of learning is informal [2][3][4], mostly managed by learners, it is intentional and self-directed.

Currently, the dominant learning environments are Learning Management Systems (LMS). Their main function is to simplify course management aimed for numerous learners. The learning process in LMS is usually uniform and the learning path is directed in the instructor's way. In order to achieve the goal, the learner must pass through all topics in a given order. Usually, the materials inside of LMS are locked and available only during the course and only to the learners registered for a specific course. It is opposite to lifelong learning principles where materials should be available constantly to learners during their lifetime. Besides, every person has his or her own learning style and for some of them the learning style offered by LMS is not acceptable.

Internet no longer relies only on textual information. It grew up and has become an environment where users exchange all kind of information and participate in collaborative activities. The learner uses the knowledge of a community and at the same time contributes with his or her own knowledge.

Learners can reach functionality that exists inside LMS using different tools available on the Web, such as weblogs and wiki systems. Most of the learners use these tools in their everyday life. Created materials are available to learners as long as they want. This approach allows learners to aggregate resources from Internet for use in their learning.

II. RESOURCES FOR PERSONAL LEARNING AVAILABLE ON THE WEB

Many resources that can be used in the learning process are available on the Web as Web applications [5]. Using the Web applications, the user can create his or her personal environment for learning. It is a very popular development area, there are many applications with similar purpose and the user can choose between them. For example, if somebody doesn't like *Gmail*, he or she can easily switch to *Yahoo* mail. In this chapter, we shall present some of the Web applications that can be used in the learning process.

At the early stage of Internet, the Web mostly served as storage for textual Web pages, and people on the Internet mainly communicated by sending e-mail messages and reading newsgroups. Small number of writers was creating Web pages for a large number of readers. As a result, people could get information directly from the source. Over time, the situation has changed and more and more people started writing content in addition to reading it. The Web has become the most used Internet service and Web applications were developed to enable easy and efficient creation of contents for everyone. Web browser was a sufficient tool for using Web applications. Users quickly detected the new possibility and started using it. In the last few years, that trend was significant and the term Web 2.0 [6] was accepted in 2004, on the O'Reilly Media Web 2.0 conference. The main feature of all Web 2.0 applications is the possibility for communication and cooperation among users. As the creator adds a new content, it is bound into the global structure of the Web. Other users can find that content, put some tag or note on it, and link their own materials to it. People are using communication technology to access information, to transform it and exchange it with others. A good indicator of content quality can be the accessing frequency or the average grade point, based on a larger number of users. In that way, the Web is rapidly becoming a global repository for large parts of human knowledge, and the Web 2.0 sites are the most popular places on the Web [7].

The most significant advance in Web architecture is technology called syndication. Syndication allows someone to subscribe to a Web page. Every time the page changes, subscribers obtain information about the change. RSS and Atom are two main families of syndication

technologies. Using syndication, Web browser is not just a tool for viewing Web pages; it becomes a contents aggregator and an interface to Web applications.

One of the most popular Web 2.0 features is the increasing number of users writing weblogs. Weblog is a personal diary on the Web page. With syndication technology, any piece of information from somebody's weblog is immediately available to all subscribers. Authors can very easily manage the content. Readers through comments can give immediate feedback to the author and help him or her to improve his or her writings. This feature has turned weblogs into the most up-to-date source of information.

Wiki is the simplest content management system on the Web. It is a Web application that allows the user to create and edit a Web page content using any Web browser. Wiki has simple text syntax for creating new pages and links among internal pages and other Web resources. By using wiki it is very easy to create an electronic portfolio or an electronic version of a book that can be edited by all the members of a community. *Wikipedia* is a well known example of that approach. It is an online encyclopedia that currently (January 2008) contains more that 2 million articles and any Web user can add or edit an entry in it. In environments where many users generate contents, information is sometimes not reliable because there is no traditional review process. The large number of users is a corrective element, but despite that, the exposed materials should be taken with reserve and information should be checked from multiple sources.

Hyperlinks are the foundation of Web. When a user wants to access some content he or she has to write its address in the Web browser or click on a hyperlink on Web page. These addresses are usually stored locally as Web browser bookmarks. A much better solution is to store bookmarks on the Web in a special repository which allows the user to access the same bookmarks from any computer and add bookmarks from anywhere. The Web sites of that kind are called social bookmarking websites and they gather community of users who store and share bookmarks on the Web.

Today, the Web is flooded with repositories for different kinds of contents. Some repositories are specialized for holding electronic books, and most of scientific magazines have electronic versions. One of the most popular repositories, *Youtube* is specialized for video contents. The others are intended to store different kind of contents like audio data, presentations, etc. Users of those Web sites are also organized into a community. They can put their own materials in the repository and make them available to others for using, commenting and grading.

Nowadays, there are many Web office applications whose functionalities are similar to functionalities of desktop office applications. An advantage of using Web office applications is in easy access and in offering cooperation to multiple authors of the same contents. A learner can easily use this kind of applications for making notices.

Amazon is a popular company that sells books and other products. The basic information about selling items provided by vendors is supplemented by users' reviews and recommendations. All information is stored in *Amazon's* database. When a potential buyer searches some information, the search engine will not retrieve only the information provided by vendors. The search will include all the contents that the community has created and the information collected by tracking users' behavior on the Web site. Recommendations offered by *Amazon* are a combination of real facts, like number of sold items or usual consumer basket contents, and user's opinion on purchased goods. This business model has been very successful and it helped in bringing *Amazon* to the top of the Web selling companies.

Electronic identity is very important for application users in cooperative environment. Tracking users' contribution can help categorizing them into specific groups according to their knowledge and experience. Users have individual usernames and passwords for accessing different Web applications. Exceptions are applications from the same vendor. In that case, the user can usually use the same login and password for access to all the applications provided by the same vendor. A user mostly visits more than one Web application and it is not unusual to use dozen usernames and passwords. He or she has to memorize all of them. Implementation of an integral authorization system for all or for majority of Web applications can solve that problem. OpenId [8] is one of those systems. It is an open and decentralized identity system enabling to use a single digital identity across the Web. With a single OpenId the user can login to all favorite websites and this system is today supported by nearly ten thousand Web sites. The problem lies in big Web companies that are usually very slow adopters of new technologies, although in the last year a few big companies like *Microsoft*, *Sun Microsystems* and *Yahoo* joined that initiative and started to actively contribute in development of the OpenId standard. Since majority of Web sites have not yet accepted OpenId, the problem remains.

III. PERSONAL LEARNING ENVIRONMENT

For a more efficient use of Web resources, learners need an environment that will aggregate different Web resources and thus give them additional value. This environment should be very simple for maintenance and administration, and users should not need specific technical knowledge.

That kind of environment is named Personal Learning Environment (PLE).

PLE is a system that helps learners to take control of and manage their own learning. This includes providing support for learners to set their own learning goals, manage their learning; managing both content and process, communicate with others in the process of learning, and thereby achieve their learning goals. A PLE may be composed of one or more sub-systems. As such, it may be a desktop application, or composed of one or more web-based services. [9]

According to S. Downes [10] every PLE should satisfy three main principles: 1) interaction, 2) usability, 3) relevance.

Interaction is the ability to communicate with other persons interested in the same topic, or using the same resources available on the Web. During the communication process, learners are collecting new information, and what is more important, they refine their previously known information. In the classic model of learning, communication proceeds mostly one-way and
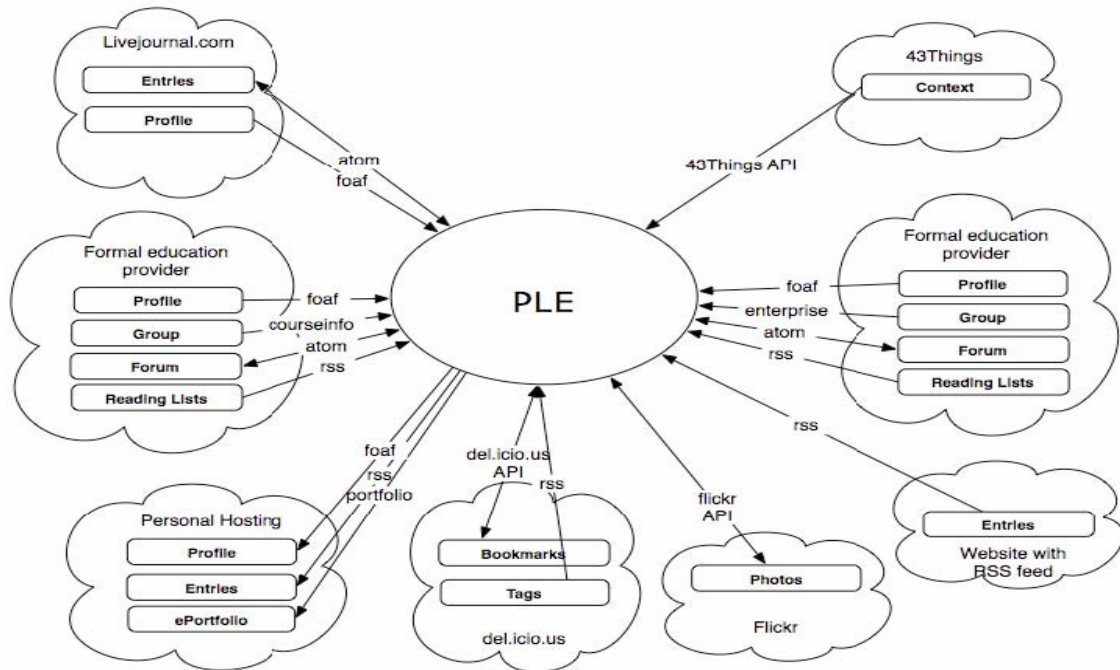
Figure 1. Conceptual model of PLE

the learners rely on their instructor to direct their learning and answer their questions.

During informal learning, learners no longer rely on instructor, but on their peers. They have to create their own network, maintain connections with other learners and communicate in such a way to support each other's learning. Every learner in that environment is at the same time an instructor.

Applications used in PLE should be very simple for use and should ensure fulfillment of the learning goals. A very important characteristic is that all the addressed applications can connect and mesh its contents with each other. The simplest way is by using syndication, and many new Web 2.0 applications provide a special Application Programming Interface (API) that ensures direct communication and two-way manipulation with contents. Every learner using his or her PLE should have freedom of choice in selection of specific tools because in a PLE there is neither a wrong tool nor a wrong learning style.

The most important ingredient of the learning process is information. Learners should get all the needed information at the moment they want and at the place they choose. This kind of information is of high quality, otherwise it appears of low quality or obsolete. Subscription to contents provides an opportunity for receiving information at the moment of creation, and syndication allows users to receive all subscribed contents in their own environment.

A PLE that supports all the three principles should enable the user to set up his or her learning goals and to determine learning paths. The Web is a good environment for PLE application and storing of data, because learners can access it using Web browser from any computer connected to Internet.

In order to start learning, it requires creating of a learning plan. After that, the learner starts with fulfillment of that plan. He or she is collecting materials, creating proprietary contents and communicating with other learners. All information created during this process should be stored inside PLE. This environment works as an aggregator for all contents relevant to the learning subject.

Different resources connected to a common environment offer learners more than a set of functionality of individual tools. Loosely coupled resources in PLE will ensure modular development of the system and offer the possibility of using different tools for the same purpose. In order to build an application from independent resources, there is a need for a main component that will glue all parts of environment into a whole. PLE can be observed as a concept and not as an application. Figure 1 illustrates the concept of PLE [11].

The required PLE functionality can be created in different ways. The simplest way is an individual using of products where some tools can be on the Web, and the others can be desktop applications. This is not the most efficient way of using, but if this "environment" satisfies the user's needs, it is a PLE. The other way of creating PLE is using only Web applications in the Web browser environment.

In that model, the Web browser's bookmark map is a contents aggregator. Sites are organized in categories within folders, by topic or by site type. This organization is done in a way that makes sense to the learner, and it can be changed very easily as user conceptions change [12].

Using simple social Web application like weblog, wiki or Web portal, the user can connect components within an environment, and at the same time add new value putting them in the learning context [13][14]. Modern Web 2.0 weblog or wiki applications like *Wordpress* or *Mediawiki* can integrate any kind of contents with user's own content. Web portals are applications created especially for putting different contents into one envelope. Their base
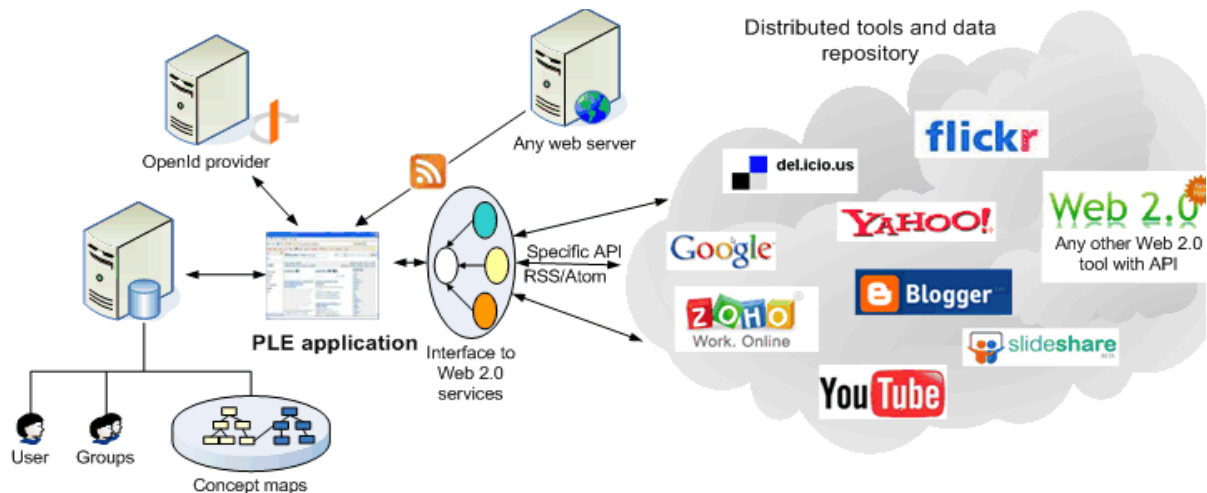
Figure 2. Model of PLE based on free Web services

functionality is contents aggregation, using syndication technology. Besides syndication, in the portal usually there are specific modules designed for a special purpose (e.g. a notebook for making notes or a simple webmail interface).

The most complex environment that ensures full resources integration putting it in the learning context is a special mashup PLE application used for aggregation of different contents [12][15]. Mashup is a relatively new concept of Web applications that aggregate data from more than one source. This concept can be efficiently applied in creation of a PLE.

Using a Web 2.0 application in PLE depends on vendor's business model. Basically, all business models of Web 2.0 are based on user created contents. Almost every application offers its basic functionality for free, but for advanced functionality the user has to pay a fee. Providers that syndicate user-created contents usually create an open API that enables access to user's data from external applications. A part of such an application has turned into Web service and everyone can use it through provider's API. Having the others building useful applications on top of their contents, they increase its value. External users can use their functionality from own environment. E.g. on a Web page there is a form with text as input element. When the user inputs some text in that field and presses the submit button, the text from the Web page will be saved in a distributed database using API functions. This approach makes possible mixing of contents and creation of composite Web applications based on distributed services.

A potential problem in using Web 2.0 applications is the fact that many of them are in a constant beta status. One of the reasons derives from importance of launching a preliminary version of new Web application as quickly as possible. Input from users help developers in further development although the changes made during the beta status can cause many problems for users, especially if the change is made on an API. In that case, the problem will arise in all external applications that rely on the changed API.

There are different PLE applications that enable contents aggregation on different levels. The difference among them is their functionality and way of realization.

Through years of technology change, these applications have evolved from standalone desktop application, over closed client-server environment to mashup applications based on Web 2.0 social approach [12].

IV. MODEL OF PERSONAL LEARNING ENVIRONMENT BASED ON WEB SERVICES

In this chapter, we shall describe the model of PLE based on free available Web services. PLE based on Web services is a Web application that allows users to manage their own learning process using distributed resources. Functionality of application is based on the model proposed in [10][11] and [12]. The application should make possible: 1) creation of a learning plan, 2) storing of learning contents in electronic form, 3) cooperation and exchange of information with other users, 4) creation of a knowledge map. The application is user's interface to external Web services. It should be simple to use and to facilitate maintenance of user accounts on all the used Web services. Figure 2 presents the described model of PLE.

At very beginning of the learning process, the learner should create a learning plan, which is graphically presented in the form of a concept map [16]. The concept map is a diagram showing relations among concepts, represented as nodes. Every node of the concept map is a learning cell. The learner can create his or her own learning plan based on previous domain knowledge. Learners who are not able to create their own learning plans can use an existing plan prepared by the community. Using a learning plan created by the others is a natural process for most of the learners, because during their formal education they mostly followed some learning plan created by their educator. During the learning process, the learner finds online content and links it to some concept. Users can contribute to the community by sharing their contents and learning plans, although they can remain private. As learning progresses, plans can be changed. Filling with contents, the concept map is transformed into a knowledge map and it becomes a permanent knowledge repository. The learner can use and alter contents of this repository after his or her learning terminates.

A PLE consists of the client and the server part. The client part is a Rich Internet Application (RIA) that

communicates with Web services. With a rich user interface, an application provides features and functions that lead to a more flexible and productive working environment. The server part is a Web application with internal administration services. These services are used in managing of all the data stored locally on the PLE's Web server.

The authorization system used by this PLE is OpenId and the user does not have to create another username. The user can configure the PLE to suit his or her needs. The configuration includes creating of a personal account, of interest groups, choosing and adjustment of all tools that will be used inside PLE. All the configuration data recorded during this process, such as usernames and passwords needed for user's authorization on used Web services will be stored in a relational database on PLE's Web server. If required, there is a possibility to store also other materials, although the general principle is that every material should be stored on a distributed location of the service provider. At the moment of writing this article (January 2008), the most popular place for storing video contents is *Youtube*. But, there are other, less known providers such as *Teachertube* specialized for storing educational video. For storing audio contents there is *Odeo*, links are placed on the *Delicio.us* and presentations on *Slideshare*. In addition to these places, there are plenty of other Web 2.0 applications that can be used inside of PLE.

Contents in a PLE can be presented in two ways. Materials only for viewing are brought in by using syndication protocols. In the case of sending contents to the provider's database, specific APIs are used (e.g. writing of textual contents in *Zoho* office using *Zoho* writer API, or using *Mebo* API for creating chat functionality). The application has a special layer used as interface for modular connection to different Web services. Configuration files based on Extensible Markup Language (XML) provide necessary functionality for connection between different APIs and the application. Basic users use prepared configuration files for some of the most popular Web services. Power users are able to modify or create new configuration files using the same XML dialect. They have the possibility to include new Web services in their environment or to change some implementation details of current Web services.

A very important feature of PLE is the possibility to create learning groups. Learners can easily create groups, find other members interested in the same field and communicate with them through textual messages, or interactively chatting. Notes of communication can be easily stored as materials that complete the learning contents.

V. CONCLUSION

In this paper we have presented the concept of PLE and a model of PLE based on Web services. The main function of PLE is to help learners to manage and self direct their learning through communication and cooperation with a learning community. PLE based on Web 2.0 services offer the learners a well known environment where they can easily achieve their learning goals.

Our plan for future work is to proceed with development of a PLE based on the presented model and to test its functionality.

REFERENCES

[1] D. Kalpić, J. Anzil, H. Zoković, From the Traditional to a Digital Academic Library, CoLIS3, Zagreb, Benja, pp.317-321, 1999.

[2] K. Dobbs, Simple Moments of Learning, Training v37, No. 1, pp. 52-54,56,58, January 2000.

[3] M. Harrison, 13 Ways of Managing Informal Learning, Kineo Insight, Kineo, 2005. http://www.kineo.co.uk/publications/insight-reports-home-page.html [27.12.2007.]

[4] J. Quarter, H. Midha, Informal Learning Processes in a Worker Co-operative, Ontario Institute for Studies in Education of the University of Toronto, Toronto, NALL Working Paper No. 37, 2001.

[5] W. Richardson, Blogs, Wikis, Podcasts, And Other Powerful Web Tools For Classrooms, Corwin Press , Thousand Oaks, CA, 2006.

[6] T. O'Reilly, What Is Web 2.0, http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html [01.11.2007.]

[7] Global statistics of top 500 Web sites, http://www.alexa.com/site/ds/top_500/ [04.02.2008.]

[8] OpenId http://openid.net/ [02.01.2008.]

[9] M. v. Harmelen, Personal Learning Environments, http://octette.cs.man.ac.uk/jitt/index.php/Personal_Learning_Environments [07.11.2007.]

[10] S. Downes, http://www.downes.ca/ [07.11.2007.]

[11] S. Wilson et al., Personal Learning Environments: Challenging the dominant design of educational systems, ECTEL Conference, Crete, 2006, http://hdl.handle.net/1820/727 [02.11.2007.]

[12] M. van Harmelen, Design trajectories: four experiments in PLE implementation, Interactive Learning Environments, Volume 16, Issue 1, pp.35-46, April 2008.

[13] J. Farmer, A. Bartlett-Bragg, Blogs @ anywhere: High fidelity online communication, Proceedings of Ascilite 2005 conference, Brisbane, pp.197-203, 2005.

[14] M. Martin, Exploring Personal Learning Environments, http://michelemartin.typepad.com/thebambooprojectblog/exploring-personal-learni.html [02.11.2007.]

[15] C. Severance, J. Hardin, A. Whyte, The coming functionality mash-up in Personal Learning Environments, Interactive Learning Environments, Volume 16, Issue 1, pp.47-62, April 2008.

[16] J. D. Novak, A. J. Canas, The Theory Underlying Concept Maps and How to Construct and Use Them, Technical report IHMC CmapTools 2006-01 Rev 01-2008, http://cmap.ihmc.us/Publications/ResearchPapers/TheoryCmaps/TheoryUnderlyingConceptMaps.htm [7.11.2007.]

AUTHORS

K. Žubrinić is Assistant Lecturer at the Department of Electrical Engineering and Information Technology, University of Dubrovnik, Ćira Carića 4, Dubrovnik, Croatia (e-mail: krunoslav.zubrinic@unidu.hr).

D. Kalpić is Full Professor at the Faculty of Electrical Engineering and Computing, University of Zagreb, Unska 3, Zagreb, Croatia (e-mail: damir.kalpic@fer.hr).