Personal Learning Environments for Higher Education: A Mashup Based Widget Concept

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Abstract. Due to the enormous growth of distributed applications, services, tools and resources, it is not easy for end users to come across existing services, manage and use them in a matter which is customized according to their personal needs. Mashups can be a very interesting approach to overcome challenges of distributed (unknown) services. Using mashups in a Personal Learning Environment (PLE) can help to connect resources and applications in one environment customized to the needs of individual users. In this paper a first approach and the concept of a PLE especially for higher education is described. The technological concept is introduced and design issues are pointed out as well as the first prototype is described.

Keywords: PLE, Personal Learning Environment, Widget, Mashup, e-learning

1. Introduction

Since Tim O'Reilly [1] pronounced for the first time the so-called Web 2.0 the relation between people and their content changed dramatically. Interactivity strongly increased Sharing and collaborating by using social software has become a common task since then. The ubiquitous availability and pervasive use of the WWW dominates more and more our social life, our working environment as well as our learning and teaching behaviors [2], [3]. Downes defined the use of Web 2.0 technologies as e-learning 2.0 [4] and numerous research works carried out, how it can be used within different didactical settings [5]. Disregarding the type of web based software – Wikis [6], Weblogs [7] or Podcasts [8] – the integration of these establish new potentials for creating new learning environments. Nowadays not only social software such as Facebook or Twitter gain more and more importance [9], but also platforms for sharing different kind of media such as YouTube (video), Slideshare (presentations)

or Del.icio.us (bookmarks) are an integral part of innovative teaching approaches and strengthen informal learning [10].

Due to the enormous and fast grow of different applications for different purposes it can be stated that managing such tools becomes more and more sophisticated. It is easy imaginable that teachers as well as learners were quickly swamped by these possibilities. Different studies on the use of Web 2.0 technologies by university freshman pointed out that a lot of (popular) applications are even not known yet [11].

Particularly to overcome the challenge of distributed and potentially unknown resources as well as tools and the related information overload, mashups become interesting [12]: The possibility to connect different resources from different Web servers within one environment should help to maintain overview of all activities. mashups merge content, services and applications from multiple Web sites in an integrated, coherent way [13]. Concerning learning issues, mashups are seen as precondition for a new form of a personalized learning environment [14].

At Graz University of Technology (TU Graz) first steps have been done towards a Personalized Learning Environment (PLE) for higher education institutions. In this publication the need for PLEs, the technological concept, the first layout as well as the first running Graphical User Interface (GUI) is described. Bearing the multiple possibilities of meaningful integration of services and applications offered by a university in mind, we aim to provide our first research results.

2. The Genesis and Idea of "Personal Learning Environments"

The challenge and possibility to connect and mashup different Web based applications were the cradle for a new concept in field of technology enhanced learning: The idea of a "Personal Learning Environment" comes up [15]: Existing technological concepts of learning and teaching in the Web, such as Learning Management System (LMS), are mainly developed to support managerial teaching needs such as student management and course organization. In contrary, the PLE concept takes the individual learner and his/her personal learning interests serious: Within a PLE (s)he arranges and uses Web (learning) resources and Web based (learning) tools in a way that it supports her/his personal knowledge management and learning.

Not surprisingly, the concept of PLE is a young one [15]: One of the first who described the idea of a personal learning environment had been Olivier and Liber (2001) [16]. Some years later, Wilson (2004) [17] sketched an image of a future "virtual learning environment" integrating also external services and applications. Starting in 2006, PLE starts to get more and more attention, as an analysis of the occurrence of the search term "personal learning environment" in Google Insights illustrates [18] and several publications points out [19], [20].

According to the current definitions of PLE, they can be described as learning applications, where the learners can integrate and organize distributed online information, resources and contacts as well as also to provide content and other things developed in the PLE for other (external) online environments [15].

PLEs are not the first approach to personalize learning content. In contrary, there is a long tradition of Instructional Design and adaptive learning, building on so called intelligent systems. Instructional Design follows the idea of the possibility to foster learning, in well dosed, sequenced instruction bits. Particularly in the domain of artificial intelligence the possibility of automatic "personalization" of the content is considered as an automatic adaptation of the learning content by the system, pre-defined by an expert model. For several reasons, these former ideas seem to be out of date or not fitting [21]: (i) learning content is mainly dynamic, permanently under development and only shallowly categorized (miscellaneous); (ii) referring to current learning theory the learner is to be seen as an active, self-organized creator of his/her learning environment and (iii) social involvement and interaction is crucial for learning. Additional arguments for the new forms of personalized learning focus on new ideals and ideas of learning as stated in [14]: learning to learn is more important than (re-) constructing domain-specific knowledge, therefore the establishment of a (networked) learning environment can already be seen as learning outcome. From a more pragmatic point of view, a system that was built on emergence should be more powerful than "programming" by rules (ibid.).

Due to new possibilities, perspectives, insights and challenges the concept of PLE seems to be an interesting, but not very well developed or elaborated concept for an innovation within technology enhanced learning; also in higher education.

3. Technological Concept

The students should be empowered to manage and organize their learning environments personally according to their own needs. This could reduce the management overhead and resource negotiations while enhancing the self-management, self-organization and self-coordination of students [31]. The customization of GUI is important to give learners a personalized look-and-feel. Besides that, the users should be able to use and customize the various decentralized learning applications and university services on the Web in their PLE. In order to meet these requirements a mashup of widgets can be used. Widgets are small embedded applications that can be included in HTML pages. The detailed description of widgets can be found in [23]. A PLE realized as a Rich Internet Application (RIA) and widget container obtains a flexible design structure which would simplify the design customization enormously. On the other hand a mashup of different widgets can serve as front-end applications for distributed learning objects and services in a mashup based PLE. Hoyer [24] introduces some existing mashup tools with different emphasis such as Yahoo Pipes and Microsoft Popfly. Aumüller and Thor [25] describe three main components of a mashup application: Data extraction, data flow and presentation. They categorize different mashup tools to one or some of these components. At TU Graz a PLE is being developed that resembles the vision of "Future VLE" described in [32]. It bases on a mashup of widgets and can be classified to the end-user mashups as described in [26]. It contains a widget engine, implemented in IST Palette project [27] to load and handle the widgets according to the W3C Widget 1.0 Specifications. While the data extraction is carried out on the

server side, the data flow and presentation components are handled by the widget engine on the client side as depicted in figure 1.

The W3C 1.0 family of specifications consists of some specifications which is a step forward to a standard for widgets. The W3C Widgets 1.0 Packaging and Configuration [23], for instance, introduces a zip-packaging format, containing the widget source files. It specifies the folder structure, the XML-based manifest file and the mandatory as well as none mandatory elements. The W3C Widgets 1.0 APIs and the Events Specification [28] deal with the functionality of widgets. It defines some APIs to access the meta data in widget configuration file and events related to the view state of widgets.

The Palette Service portal which is implemented by IST Palette project [27] acts as a widget container and contains a widget engine to install, load and handle the widgets according to [23] and [28]. The widget manifest file described in [23] is extended to some additional preferences to facilitate widget customization by the users. This feature is required in a PLE to achieve personalization. There are also some new extensions related to [28] to realize interactions between widgets such as a drag and drop effect. This enables the data flow between widgets which is needed in a mashup tool. The ability to also load remote widgets in Palette platform makes it possible to use distributed learning services which are generated dynamically on remote servers. According to these features the widget engine of Palette is used as the basis for the designed PLE at TU Graz.

4. Design Issues and Technologies

As described above, the Palette project [27] provides a widget engine that is used in PLE development. There are some performance issues that are overseen in Palette project. Special attention is paid to these issues during this work.

All CSS and JavaScript files have to be packed or minimized dynamically to reduce the load size. Using GZIP compression could speed up the JavaScript code if the browser accepts such encoding. All minimized CSS and JavaScript files are put dynamically into one output buffer respectively to reduce the number of browser requests. It means the browser only needs one request for each CSS and JavaScript content to load. On the other hand the CSS and JavaScript libraries which are not required at the start of the application are loaded later on demand per Ajax-request to decrease the load time at the beginning. Caching is another important issue which shall not be overseen.

For the sake of cross-browser compatibility the last jQuery library[1] and jQuery UI versions are used. They are lightweight, CSS 3 compliant and support most common used browser versions. The jQuery library provides based on a unique CSS framework a ThemeRoller tool and a theme gallery which makes customizing the look and feel of the PLE very fast and easy.

Another important issue is the possible use of JavaFX[2]. The widgets body can be implemented by JavaFX instead of pure HTML and JavaScript. The great advantage

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[1] http://jquery.com/ [last visited: 20.07.2009]
[2] http://www.sun.com/software/javafx/ [last visited: 20.07.2009]

of this technology is the Drag-to-Install feature of JavaFX which enables the user to drag the widget out of PLE and drop it onto the desktop as a standalone desktop application. This could be a step towards the realization of the widgets according to the widget definition in [23].
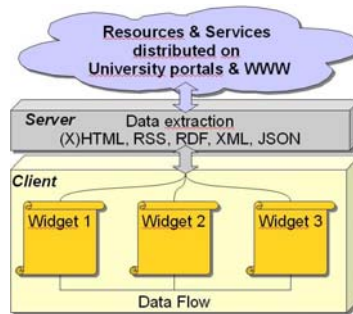

Fig. 1. Mashup structure of PLE describing data extraction from distributed resources, data flow between widgets and presentation components in PLE.

5. First Prototype

All design aspects and the main GUI elements of the PLE are described in detail in our paper at ICL09 [29] for further reading. The implementation of the first prototype is still in progress. The goal is to offer a logged-in user a mashup of widgets containing all kind of university services and information personally required by that user. The many services and information distributed on different university portals and institutes are centralized and offered in one mashup portal. The scenario could be as follows: The student opens a widget representing the list of courses he is already registered in. Selecting a course would invoke another widget containing the e-learning materials and the eventual Podcasts related to that course. If wanted, some supplementary widgets, such as a time table and a location widget can be auto-synchronized in the background to offer information on the place and time schedules of the course. An alert widget can inform the student as soon as a course is canceled or a new notification is received. The role of widgets is not restricted to the university services. They can include any kind of learning objects or remote applications existing in the WWW. The content can be implemented using any conventional methods such as HTML and JavaScript, Flash, Java applets or JavaFX.

6. Discussion

During the design study, the usability tests [29] as well as the development of the first prototype of the PLE different crucial factors appeared:

(i) Personalization: The first crucial factor deals with the question „Can a system basing on mashups support the idea of a Personal Learning Environment?“ The answer is divergent. On the one hand personalization means full control by the end-user or with other words (s)he has to choose the tools needed for learning. On the other hand from the teacher's perspective learning occurs within a specific didactical setting and with the aid of appropriate tools. Due to these facts the described prototype should provide a huge amount of possibilities but not too many.

(ii) Individuality of the interface: The usability study [29] pointed out that a complete changeable interface would not be an optimal solution for especially novice users. At least at a first level learners must become familiar with the concept of distributed applications combined by a complex mashup system. An important principle is to reduce the overload at the beginning, to make users comfortable with the environment. As a consequence users will get predefined interfaces which can be adapted incremental appropriate to their needs and knowledge.

(iii) Learning environment and Information environment: A serious discussion must be started whether a PLE supports learning processes or helps to refine information on the Web more according to specific needs or preferences. It will be necessary to provide students as well as teachers general information about their university or their booked courses. In this case the environment acts as clearly arranged information environment. But furthermore the environment serves also as a learning one if it used for learning purposes including any different resources. The mashup principle allows acting as both.

(iv) Flexibility destroys design: The last aspect points out the controversy that during the paper based mock-up process and the first sketches the flexibility of using widgets in any size and at any place is critical for the Web design of the application. The design strongly follows concepts of usability to enhance the handling as well as the appearance of the environment. If end-user can do anything, especially resizing applications dimensions, this principle cannot be fulfilled. As a consequence widgets can only be arranged within a predefined grid.

7. Open Questions and Next Steps

It can be concluded that Personal Learning Environments are a big and important step towards the future of technology enhanced learning, but a lot of future research must be carried out.

Concerning our own concept and the idea of PLE in general we need to understand how learners deal with it and how teachers can implement it within their didactical approaches. As PLE should give appropriate support for learners, including recommendation for different potential learning resources as content, tools, people (e.g. other learners or experts). This is a quite new challenge for research and implementation (e.g. [30]). We have to work out the way of how we can support this in our PLE solution. From the technology point of view it is recommended for the future to apply HTML 5 features in a mashup implementation. The drag & drop functionality between widgets and event handling for data flow can be realized in HTML 5. Another issue is the HTML 5 offline cache possibility which provides tools

to implement the same features as Google Gears has provided to store data on the client side. If this applied, some parts of the mashup portal can run offline too.

In this publication we discussed the concept of a Personal Learning Environment from a specific point of view: How can a mashup concept work within a higher education institution? The design study as well as the prototype [29] carried out that nearly endless individuality assumes experienced users or in case of learning environments learners. We suggest that learners must be led to this expertise step by step. Furthermore from an educational institution's perspective we have to support applications that are proven as appropriate for learning processes. However the next step will be to roll out the prototype and merge the World Wide Web with the university.

References

1. O'Reilly, T.: Web 2.0: Stuck on a name or hooked on value? Dr Dobbs Journal, 31, 7, p. 10 (2006)
2. Holzinger, A., Nischelwitzer, A. K. & Kickmeier-Rust, M. D.: Pervasive E-Education supports Life Long Learning: Some Examples of X-Media Learning Objects (2006) http://www.wccee2006.org/papers/445.pdf
3. Klamma, R., Chatti, M. A., Duval, E., Hummel, H., Hvannberg, E. T., Kravcik, M., Law, E., Naeve, A. & Scott, P: Social software for life-long learning. Educational Technology & Society, 10, 3, pp. 72-83 (2007)
4. Downes, S.: E-learning 2.0. ACM eLearn Magazine, 10 (2005)
5. Ebner, M.: E-Learning 2.0 = e-Learning 1.0 + Web 2.0?, Second International Conference on Availabilty, Reliability and Security, ARES 2007, IEEE, pp. 1235-1239 (2007)
6. Augar, N., Raitman, R., & Zhou, W.: Teaching and learning online with wikis. In: Atkinson, R., McBeath, C., Jonas-Dwyer, D., & Phillips, R. (eds.). Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference, pp. 95-104, December 5-8, 2004, Perth, Australia (2004)
7. Farmer, J.; Bartlett-Bragg, A. (2005). Blogs @ anywhere: High fidelity online communication, Proceeding of ASCILITE 2005: Balance, Fidelity, Mobility: maintaining the momentum?, pp. 197-203
8. Towned, N.: Podcasting in Higher Education, Media Onlinefocus 22, British Universities Film & Video Council (2005), http://www.bufvc.ac.uk/publications/mediaonlineissues/moF22_vf61.pdf
9. Ebner, M., Maurer, H.: Can Microblogs and Weblogs change traditional scientific writing?, Proceedings of E-Learn 2008, Las Vegas, pp. 768-776 (2008)
10. Mason, R. & Rennie, F.: Using Web 2.0 for learning in the community. Internet and Higher Education, 10, pp. 196-203 (2007)
11. Nagler, W., Ebner, M.: Is Your University Ready For the Ne(x)t-Generation?, Proceedings of 21st ED-Media Conference, pp. 4344-4351; World Conference on Educational Multimedia, Hypermedia and Telecommunications (2009)
12. Kulathuramaiyer, N. & Maurer, H.: Current Developments of MashUps in Shaping Web Applications. ED-Media 2007, Vancouver, pp. 1172-1177 (2007)
13. Tuchinda, R., Szekely, P. & Knoblock, C. A.: Building Mashups by example. Proceedings of the 13th international conference on intelligent user interfaces. Gran Canaria, Spain, ACM (2008)

14. Wild, F.; Mödritscher, F. & Sigurdason, S.: Designing for Change: Mash-Up Personal Learning Environments. eLearning Papers, 9, (2008), http://www.elearningpapers.eu/index.php?page=doc&doc_id=11939&doclng=3

15. Schaffert, S. & Kalz, M.: Persönliche Lernumgebungen: Grundlagen, Möglichkeiten und Herausforderungen eines neuen Konzepts. In K. Wilbers & A. Hohenstein (eds.), Handbuch E-Learning. Expertenwissen aus Wissenschaft und Praxis - Strategien, Instrumente, Fallstudien. (Gruppe 5, Nr. 5.16, pp. 1-24). Köln, Deutscher Wirtschaftsdienst (Wolters Kluwer Deutschland) (2009)

16. Olivier, B. & Liber, O.: Lifelong learning: The need for portable Personal Learning Environments and supporting interoperability standards (2001), http://wiki.cetis.ac.uk/uploads/6/67/Olivierandliber2001.doc

17. Wilson, S. Future VLE - The Visual Version. January 25 (2005) http://zope.cetis.ac.uk/members/scott/entries/20050125170206

18. Google Insights: Search term "personal learning environment" (2009-07-20).

19. Attwell, G.: The Personal Learning Environments – the future of eLearning? eLearning Papers, 1, 2 (2007)

20. Liber, O. & Johnson, M.: Special Issue on Personal Learning Environments. Interactive Learning Environments, 16, 1 (2008)

21. Schaffert, S.; Bürger, T.; Hilzensauer, W. & Schaffert, S.: Underlying Concepts and Theories of Learning with the Semantic Web. In: Marco Kalz, Rob Koper, Veronika Hornung-Prähauser & Michaela Luckmann (eds.): TSSOL 2008, Technology Support for Self-Organized Learners, Proceedings, EduMedia Conference 2008, Salzburg, Austria, May 26, pp. 67-83 (2008)

22. Schaffert, S. & Hilzensauer, W.: On the way towards Personal Learning Environments: Seven crucial aspects. In: elearning Papers, 9 (2008)

23. Widgets 1.0 Packaging and Configuration - W3C Working Draft, http://www.w3.org/TR/widgets/ (2008)

24. Hoyer, V.: Ad-hoc-Software aus der Fachabteilung, Report, Enterprise Mashups, iX 10, p. 98 (2008)

25. Aumueller, D; Thor, A.: Mashup-Werkzeuge zur Ad-hoc-Datenintegration im Web, Datenbank-Spektrum, 8. Jahrgang, Heft 26 (2008), http://dbs.uni-leipzig.de/file/aumueller-thor-2008-mashup-werkzeuge.pdf

26. Gamble, M.T.; Gamble, R.F. (2008). Monoliths to Mashups: Increasing Opportunistic Assets. IEEE Software 25, 6, pp. 71-79 (2008).

27. Pedagogically sustained Adaptive Learning through the Exploitation of Tacit and Explicit Knowledge, http://palette.ercim.org/ (2008)

28. Widgets 1.0 APIs and Events - W3C Working Draft, http://www.w3.org/TR/widgets-apis/ (2009)

29. Taraghi, B; Ebner, M; Till, G; Mühlburger, M.: Personal Learning Environment – a Conceptual Study, International Conference on Interactive Computer Aided Learning, September (2009, in print)

30. Drachsler, H.: Adaptation in Informal Learning Environments. Presentation at IATEL Conference. June, 19-20, Darmstadt, Germany: TU Darmstadt (2009).

31. Wilson, S; Griffiths, D; Johnson, M; Liber, O.: Preparing for disruption: developing institutional capability for decentralized education technologies, Proceedings of ED-Media, pp. 1386-1395, (2007).

32. Wilson S.: Future VLE – The Visual Version, http://zope.cetis.ac.uk/members/scott/blogview?entry=20050125170206 ,(2005) (last visited 15.09.2009).