

BLENDED LEARNING: CONCEPTS AND FRAMEWORKS AND TOOLS

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Abstract: *Blended Learning* (also known as *Hybrid Learning*) has currently attracted strong attention specifically at universities where pure e-learning is considered not to be the right solution to increase flexibility and effectiveness of teaching and learning by electronic means.

However, Blended Learning because of its dynamic and open nature poses specific requirements on the supporting tools. Tools built on Service-oriented Architectures, if constructed properly, fulfill these requirements best. Based on Web Services, the *CEWebS* system is being developed at the University of Vienna, Faculty of Informatics. It can provide the students several non-standard services like support for on-line team building, peer-to-peer evaluation of students' projects, and other collaborative tools. In the frame of the international cooperation with University of Vienna, the *CEWebS* framework has already been tested and will be deployed also at Masaryk University, Faculty of Informatics in Brno. It will help to unify the runtime environment for many services that are currently planned, such as several Natural Language Processing or Semantic Web tools, while preserving the freedom of choose of development platform because of web services interoperability.

Keywords: blended learning, Web Services, *CEWebS*, REST, Natural Language Processing, Semantic Web

1 INTRODUCTION

As e-learning becomes a strategic tool also for university education where it is not acceptable to fully replace traditional forms of teaching such as in-class lectures, practices, labs, etc., new forms of electronic support are needed. This trend combining face-to-face teaching and electronic support is often referred as *blended-learning*.

However, the strong concentration not just on the content but also on process and social dimensions makes the classical e-learning tools (LMS) not suitable for blended-learning. Primarily, legacy LMS do not usually enable this kind of capturing and supporting successful blended learning practices [Motschnig-Pitrik] neither they allow to reuse design experiences inherent in the existing learning management systems in the form of reusable patterns [Derntl and Motschnig-Pitrik]. Secondly, the existing LMS are not flexible enough to support fast deployment of “quick-and-dirty”, ad-hoc implemented tools.

1.1 *CEWebS* – Platform for Person-Centered Learning

To target these issues, a flexible Web Service based framework *CEWebS* allowing to interactively combine components in order to meet the situation-dependent, dynamically changing requirements of blended learning, is being developed at the University of Vienna, Faculty of Informatics, see [Mangler].

The architecture is based on open standards – Web Services – enabling to use mixture of programming languages to quickly and independently develop a service that is just needed.

1.2 The CEWebS Architecture

Figure 1 shows the overall system architecture of the CEWebS Framework [Mangler]. The architecture is fully based on SOAP Web Services. The most important components are the

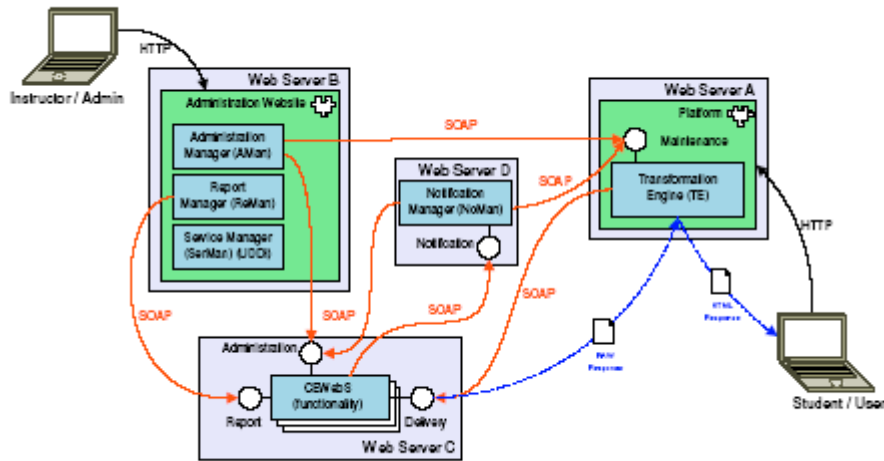


Figure 0 The CEWebS Architecture

Managers: Administration Manager, Report Manager, Service Manager, Notification Manager and the Transformation Engine. The user interacts with the system via the Transformation Engine that translates requests coming from the user agent (ordinary web browser) to SOAP messages targeted to Web Services themselves. The Service Manager that registers new services with the system finds the appropriate Web Service for the user request. The response from the service (in SOAP XML format) is then translated into user-agent readable HTML in the Transformation Engine, too.

1.3 CEWebS Sample Services

During the development, several dozens of services deployable in CEWebS have emerged. The services helping to support the Person-centered learning approach are probably the most important. They include mostly communication and collaboration tools like:

- *Discussion Fora* – enable posting messages, editing them and tracking changes.
- *Wiki* – due to collaborative nature of Person-centered approach, Wiki-like tools are very popular among students enabling collaborative work on text documents and, currently, also on graphical output via an online “blackboard”.
- *Diary* – team projects need management of tasks, roles and schedules. A shared diary allows keeping this information at one place, accessible for all.
- *Team-Building and Communities* – the first one allows to set up the team for a project online. The team leader can pick up the future team members from an online community.
- *Bug Tracking* – is indispensable for distributed development of students’ projects as well as other community-driven software development.
- *(Peer-to-peer) Evaluation* – enables active participation of students in various roles: as project team members (i.e. authors) and also as peer evaluators. It increases their responsibility.

1.4 Fostering Active Students' Participation

The student of relevant courses (such as *Web Development*, *Markup Languages* or *Enterprise Applications in Java*) can not only employ existing services but also participate in the development of new ones. A peer-to-peer evaluation of such services is supported by the system, too.

1.5 Exploiting the Distributed Nature of CEWebS

Since the spring 2005, the CEWebS framework is installed also at the Masaryk University in Brno, allowing Master students, among others, to verify their web services development skills by creating new CEWebS services. The measurements in [Mangler] have clearly shown the viability of remote access to CEWebS's web services deployed at geographically distant locations. Accessing service located in Vienna from Brno took less than half a second thus allowing seamless integration of services placed virtually anywhere on the web.

2. Extending and Reengineering CEWebS

2.1 Access to Ontologies

The crucial role of Semantic Web techniques in e-learning has recently been recognized, see [Smrž]. A set of ontology-based tools for e-learning is currently under development at the Faculty of Informatics and will become an important extension service of the present CEWebS architecture [Gregar and Pitner]. Many years of experience with natural language processing at FI MU make it possible to work also with ontologies in Czech.

2.2 Integrating Search Services

The universities often use pre-paid access to significant, high quality on-line information resources in Computer Science, like *ACM Digital Library*, *IEEE Computer Society Digital Library* or *SpringerLink*. Searching in several such sources via different web user interfaces is uncomfortable and often leads to frustration. At the Faculty of Informatics, an integrated meta-search engine *vezmu* [Pavlovič] accessible via Web Services has been developed. As the technological base of *vezmu* and CEWebS is identical, the integration of *vezmu* services into CEWebS is facile and currently under development.

2.3 Personalization and Adaptation

Currently, there are several systems satisfying the criteria for being adaptive and personalized – such as *ELM-ART*, *KBS-Hyperbook*, see [Brusilovsky and Peylo]. However, integrating adaptation and personalization into loosely-coupled systems like CEWebS allows orthogonal affecting functionality into all components – metasearch service, collaborative services and ontology-based services. This is why integrating personalization and adaptation into CEWebS represents an essential improvement.

2.4 RESTifying the Architecture

The REST (REpresentational State Transfer) as presented in [Fielding] takes a different approach to building Web Services. The Web Services needn't follow the complex and non-elegant SOAP-based Web Services standards but use well known, easy to use, plain HTTP-based communication, usually exchanging XML messages. REST represents an architectural style rather than a set of APIs, formats or protocols. An architectural style is a named,

coordinated set of architectural constraints. REST basic concepts include *resource* identified by URL and accessed by HTTP calls (GET for reading, POST for creating new resource, PUT for modifications and DELETE for removing the resource). REST helps to build robust and easily reusable Web Services faster, with lower entrance barrier than SOAP-based ones. So, “RESTifying” the CEWebS architecture represents another important goal in the development of CEWebS at FI MU.

3. SUMMARY

Blended-learning and, specifically, Person-centered approach are perspective directions of e-learning in the university-level education. However, traditional LMS cannot help due to their inflexible architecture. The CEWebS Framework originating at the University of Vienna has been developed to overcome these limitations. Its further development will be realized also at the FI MU in Brno and will include also search service integration, access to ontology tools in Czech language, as well as incorporate personalization and adaptation services.

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