A Virtual Infrastructure for Collaborative Learning

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Abstract: *The purpose of this paper is to present a cloud computing based solution for building a virtual environment for collaborative learning. The main virtual Infrastructure requirements and specifications are presented and some of the key features of Open LMS, which could be used for this purpose, are discussed.*

Key words: *Collaborative learning, Cloud computing, Virtual infrastructure, e-Learning*

INTRODUCTION

Collaborative learning is a situation in which two or more people learn or attempt to learn something together. It is an educational approach to teaching and learning that involves groups of learners working together to solve a problem, complete a task, or create a product. These include face-to-face conversations, computer discussions (online forums, chat rooms, etc) and all modern ICT tools and services, which ensure collaboration.

The question of how people can learn from each other is part of the larger question of how they work together [15].

Collaborative learning rather obviously implies learning with others - which may be better than learning on one's own, but is not in itself a particularly exciting idea. Collaborative learning becomes powerful and exciting when it occurs in the context of a community of practice. Such communities have, developed a certain level of trust and evolved sets of assumptions, practices, hierarchies, and projects, which enable their members to work together. In the real world we learn most in the process of becoming part of such a community and of contributing to what it is doing.

The purpose of this paper is to present a cloud computing based solution for building a virtual learning environment which combines a wide range of technology and tools for education.

The main advantages of applying virtual infrastructure in learning process could be generalized as follows:

- providing increased opportunities for participation;
- student engagement and access to real world learning opportunities;
- enabling quicker student feedback;
- this infrastructure allows students and staff to access virtual desktops and applications via Web, both in computer classes at the University, and for self-working at home;
- the students have access to a wider variety of courses than when they are not tied to physical distances or spaces;
- flexibility: the students can fit the studies to match with their personal life (work, family, hobbies);
- online courses make it possible to speed up the studies and graduate faster than following a traditional off-line path;
- in online courses the students have a chance to get a wider perception of the topic (vs. information given by the lecturer during a lecture), to apply the information found in internet and also to get the "big picture" of the course topic.

The main disadvantages:

- may hurt the physical class participation and engagement;
- may be perceived as a substitute of physical presence in classroom;
- sometimes it is hard to identify who is on the student computer;
- the students need to be more self-disciplined when learning online - higher drop-out rates;
- the systems and software applied are not always working as they should.

Cloud computing technologies have changed the way applications are developed and accessed. They are aimed at running applications as services over the Internet on a scalable infrastructure. Many applications such as word processing, presentations, databases and more can all be accessed from a web browser, while the software and files are housed in the cloud. Educational institutions can take advantage of cloud applications to provide students and teachers with free or low-cost alternatives to expensive, proprietary productivity tools. Browser-based applications are also accessible with a variety of computer and even mobile platforms, making these tools available anywhere the Internet can be accessed [14].

1. Concept for virtual infrastructure for collaborative learning

Current practices in virtual collaboration and infrastructure presupposes the specification of **V**irtual **I**nfrastructure for **Co**llaborative **L**earning (**VICoL**) as redundant cloud based platform [1].

Typical architecture of **VICoL** platforms includes a front-end (designed for the students) and a back-end (designed for the teaching authority and meant to let them monitor the overall progress and access the dashboards) [2].The software application model of platforms like **VICoL** is usually SaaS (Software as a Service) environment providing remote access to software and its functions.

As a typical SaaS solution [3], **VICoL** user interface will be designed to be easy to use, with understandable and intuitive access to common features and simple on-screen navigation logic. Set on the redundant clouds environment, **VICoL** will be accessible 24 hours a day, 7 days a week (undisrupted service provision), assured by selected and trusted provider of cloud services.

The open architecture of **VICoL** will provide customized interface on application layer for on-line interaction and data consolidation services [4] to and from external platforms [5], as well as existing project partners' learning management system (LMS).

Data flow between **VICoL** and the external platforms will be running on three layers:

- data base transactional layer – event-based predefined snapshots;
- XML data API's exchange;
- Joint-documents management open convention – providing detailed description of the open document environment solution, supported in VICoL.

The user interface access to VICoL relies on predefined profiles with options to assign feature-lists and automated dashboards set for on-demand learning content generation [6] and examination of ad-hoc automated dashboards [7] for the purpose of ongoing monitoring and follow-up request.

The VICoL's cloud operation environment will have generic activated middleware, tools and mechanisms for Databases and WEB Services protection against malicious access, viruses, worm propagation and other Internet threats, using state of the art technologies such as Multilayer's Firewalls, Content Analysis and Filtering and more specific mitigations.

VICoL will provide multilingual front-end user interface, including single web-based entry page (login screen), help tool, navigation guidance, on-line dashboards in English and other languages (according final design documentation).

During the first login request, VICoL will provide further basic information from students including (but not restricted to) personal data, such as their first and last names, institution of origin, email address as minimum. During the initial login procedure – it will provide this information on data protection and possibilities to accept/reject facility regarding the use of personal data.

VICoL will provide, as a back-end process, the fulfilment of requested range of fields necessary for administration data analysis and monitoring purposes in conjunction with the

service provider(s), taking into account their existing registration modules and the specific needs of the project's stakeholders.

VICoL will be designed as a powerful and highly scalable on-line service-providing platform with access possibilities for large and increasing number of users [8] without deterioration in their response time and performance.

2. Virtual Infrastructure requirements and specifications

As a typical open architecture platform VICoL will be integrated using standard-compliant codes [9] in order to ensure compatibility in a wide variety of devices environments and APIs:

- **Web browsers** - Internet Explorer 9, 10&11, Firefox 3.6 & 9.0 (with Windows 8, Firefox, version 5), Google Chrome, Safari;
- **Plugins** - Flash player 11.1.102.55, Java Virtual Machine 1.6 update 11 & higher, Java Runtime Environment (JRE);
- **Operating systems** - Windows 8, Windows 7, Windows XP, Windows Vista, MAC OS X® 10.1;
- **Applications** – MS Office (all versions), Open Office, PDF programs.

The core of VICoL will be selected by consortium an open source LMS [10].

- The most popular open-source solutions all started out primarily aimed at — and in some cases developed by — the higher education market. Both Sakai and Moodle, for example, have their roots in academia, and continue to be dominant players there [11].

Although no open-source LMS platform is perfect for every organizational situation, some of them compare quite favourably to their commercial counterparts and offer a number of advantages, including:

- Ease of customization — because their code is open, it can be easily accessed and modified to meet specific organizational needs, such as interacting with other systems.
- Extensibility through third-party add-ons.
- Ease of localization- again, the open-source code can be easily modified for use in languages that most commercial vendors would ignore.
- Flexibility to host, customize, develop, and obtain services, training, and support from a variety of vendors rather than from a single company.
- No licensing costs, leaving more budgets for system tailoring and often reducing total product lifespan costs.
- Generally faster bug fixes, new version releases, security patch releases, and feature upgrades.
- Protection from commercial product offering disruptions or discontinuations caused by vendor collapse, mergers, and acquisitions.

Powered by selected open LMS, VICoL will provide wide range of Business Intelligence (BI) tools to allow the production of online reports directly by the project management body.

3. Key features of Open LMS as a core of VICoL [12]:

- **Adaptability.** So, how can a single software deployment satisfy the distinct needs of individual organization units and regions without sacrificing the benefits inherent to a centralized deployment? The answer is Dynamic Target Groups. One option is that a single deployment could configure domains to accommodate multiple separate users. In this example, each Target Group could partition off their data, configure their own information processing logic, design their own workflows, author unique notifications specific to their domain, and provide their users with unique testing and training catalog taxonomy and change the entire user experience independent of any other domain.

Dynamic Target Group [13] was explicitly designed to enable this increasingly common scenario where -- within a single implementation -- some settings are required to be enforced globally (i.e. password expiration, access control for certain data, etc.), while other settings can be delegated to individual user group. In this example, some data will likely be shared (such as global competency lists and a set courses that are appropriate organization-wide) while other data will be available only to those that belong to a specific Target Group.

Within VICoL Open LMS solution, all objects (users, competencies, organizations, jobs, resources, activities, notifications, etc.) will belong to users of a single domain. Yet this data is subject to selective sharing across domains. In the process of object sharing with another domain, the owning domain can indicate the desired permissions (such as "view", "allow associations", etc.). VICoL will not limit the number of domains within an implementation, nor the depth within the domain hierarchy.

VICoL's adaptability will be achievable via configuration at the domain level. To VICoL, configuration means that no programming is required and that the decisions made by management user roles do not complicate upgrades.

- **Extensibility.** In addition to being highly configurable, VICoL will be also extremely extensible. Extensions provide 'hooks' that enable customers to add capabilities within the VICoL Suite or offer VICoL's capabilities in the context of other applications.

VICoL extensions will result from standards-based web services. VICoL will go to great lengths to ensure that our APIs are both forwards- and backwards-compatible. Thus, customers that implement these APIs can be reasonably certain that extensions do not need to bare addresses when upgrading to newer versions of VICoL.

- **Scalability.** The VICoL's LMS efficiently scales from a 24x7 mission critical application that supports hundreds of thousands of users, to an operation economically accommodating a peak load of several hundred users simultaneously. When the VICoL's LMS application detects multiple web servers, it automatically will synchronize all e-learning content, knowledge documents, training certificate templates, crystal reports, and other types of content that are uploaded by end users across all servers in the web farm. In order to minimize the cost and complexity of adding new hardware to, VICoL's LMS also will provide a means of asynchronously "readying" a server by replicating the required materials from a server in operation to a server that was recently added to the web form.

For users that prefer to run content from a 3rd party repository or where bandwidth is in short supply, VICoL LMS will provide an innovative Remote Content Server. The solution is to co-locate content next to the users so that bandwidth-hungry courseware is only streamed a short distance. With this solution, test ware is associated with users and users are associated with organizations within VICoL LMS.

- **Interoperability.** The collaborative learning requires that LMS will provide access to current data when and where needed. The days of accepting information islands are over. This is also true when integrating testing and learning systems with other applications.

VICoL's LMS design will include integration with at least two systems external to the learning platform. As an IT veteran would expect, these external systems vary in terms of technology and compliance with industry standards. In some cases, customers desire bi-directional and real-time integration, while in others data transfer in a single direction and a batch-type operation is accomplished. The VICoL's LMS will provides multiple options to achieve seamless and cost effective interoperability with other applications, portals, and directory services whether implemented in Java or .NET, and independent of whether they are running on UNIX, mainframe, or Windows. Through standards-based web services, VICoL's LMS is suitable for interoperability between business systems. In addition to access to hundreds of functions, VICoL's LMS will provide customers with detailed documentation and sample applications written in both .NET and Java. VICoL's LMS's

web services implementation support standards such as Extensible Markup Language (XML), Simple Object Access Protocol (SOAP), and Web Services Description Language (WSDL). This architecture enables other systems to dynamically discover, understand, and utilize VICoL's LMS's parts. VICoL's LMS's web services infrastructure is far more valuable than the time or money saved during implementation and subsequent upgrades. The real value is the business agility that achievable as result of this infrastructure. VICoL's LMS also provides a number of built-in integrations to connect to a 3rdparty e-learning courseware and enterprise communication platforms.

In addition to supporting the industries top standards (SCORM 1.2, SCORM 2004, AICC JavaScript, AICC HACP), VICoL's LMS will support Macromedia Dreamweaver, Macromedia Authorware, SkillSoft, NETg, NETg content server, Questionmark Perception, Docent CDS, Aspen LCMS, Centra, InterWise, and WebEx. VICoL's LMS also will provide built-in support for multiple silent authentication systems including NT trusted connections and support for Microsoft Passport. Many customers choose to leverage multiple authentication methods simultaneously. This is especially true for deployments beyond internal employees, to customers and partners.

CONCLUSIONS AND FUTURE WORK

Collaboration systems enable people in remote places to communicate and cooperate. The report was developed as a result from one of the outputs of the European project in the frame of Erasmus+ programme, Key Action 2: Cooperation for Innovation and the Exchange of Good Practices. The title of the project is "SOCial Competences, Entrepreneurship and Sense of Initiative Developed and Assessment Network" (SOCCES). As a result of the survey made in the frame of this project the Virtual Infrastructure requirements and specifications are specified and on the basis of them an appropriate software platform was chosen – Fair Share LMS [16].

The future work is connected with design of the virtual learning environment and development and test of 2 pilot cases for collaborative learning of students from the partnership institutions, using the chosen LMS.

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