

Cloud Services within a ROLE-enabled Personal Learning Environment

Rocael Hernandez Rizzardini

GES department,
Galileo University,
Guatemala, Guatemala
roc@galileo.edu

Byron Linares

GES department,
Galileo University,
Guatemala, Guatemala
bhlr@galileo.edu

Alexander Mikroyannidis

Knowledge Media Institute, The
Open University
Milton Keynes, United Kingdom
A.Mikroyannidis@open.ac.uk

Hans-Christian Schmitz

Fraunhofer FIT
St. Augustin, Germany
hans-
christian.schmitz@fit.fraunhofer.
de

Abstract— The **ROLE** project (**Responsive Open Learning Environments**) is focused on the next generation of **Personal Learning Environments (PLE)**. In this paper, we first describe the engineering process used to create either a new widget bundle, a group of applications or service widgets. The widgets integrated in a **ROLE PLE** consist of two cloud-based services, a social networking and a mind-mapping tool, where learners can perform and collaborate on learning activities. We also modified other widgets to create a complete learning experience. The whole platform is running on a cloud-computing infrastructure and one of the services is using a cloud-based database. Additionally, we describe the initial experiences from using this cloud education environment in Galileo University, Guatemala, in a web-based course with students from three different Latin-American countries. We measured emotional aspects, motivation, usability and attitudes towards the environment. The results demonstrated the readiness of cloud-based education solutions, and how **ROLE** can bring together such an environment from a **PLE** perspective.

Keywords- *Responsive Open Learning Environments, Personal Learning Environment, Widget bundle, Cloud-based tools, Cloud Learning Activities, Cloud Education Environments.*

I. INTRODUCTION

Cloud computing is a major trend nowadays, with recent studies positioning it as one of the short-term adoption technologies for education [2]. Cloud computing is essentially about expandable and on-demand services, tools and content that are served to users via the Internet from specialized data centers. Cloud computing resources support virtualization, grow on-demand, collaboration and many applications now rely on cloud technologies.

Cloud-based tools for collaboration have the potential to engage students, by allowing them to interact and brainstorm solutions, elaborate reports, and create conceptual designs. This approach has the potential to enable and facilitate both formal and informal learning for the learner. It also promotes the openness, sharing and reusability of learning resources on the web [16].

In this work, we foster the potential of cloud-based tools into a Personal Learning Environment (PLE). The PLE enables an individual learner to access, aggregate, configure and manipulate assets of their own current educational experiences. The PLE has a student-based orientation where

the learner is provided with the facilities to incorporate the use of new services and tools in a simple manner while at the same time has the control over the environment. It is opposed to the monolithic approach on integrating all the services into a single architecture [1].

The **ROLE** project aims to enable learners to assemble and re-assemble their own learning environments which become advanced Personal Learning Environments (PLE) [3]. **ROLE** technology is centered around the concept of Self-regulated learning, aiming at creating responsible and thinking learners that are able to plan their learning process, search for the resources independently, learn and then reflect on their learning process and progress. Using **ROLE**'s techno-pedagogical infrastructure, we have built a psycho-pedagogical setting adapted to the specific needs of our course and our students.

II. CLOUD SERVICES WITHIN ROLE INFRASTRUCTURE

In this section, we briefly discuss the key points of the technical realization of the widget bundle that was specifically designed for this experience. This widget bundle involved the development of two new widgets: the mind-mapping widget that integrated the cloud service MindMeister [12] and the Facebook discussion widget, both of which are compliant with the OpenSocial specification [7]. We also proposed a number of improvements to the specifications of two existing widgets: ObjectSpot [8] and MediaList. The improved specifications regarded the addition of Inter-widget Communication and Monitoring and the testing of a fresh **ROLE** SDK installation.

In order to address the requirements of our course and provide a complete learning experience to our students, we offered them a widget bundle consisting of the following 6 widgets: ObjectSpot, Binocs Media Search, MediaList, EtherdPad, Mind Map and Facebook.

The ObjectSpot search widget allows learners to find online resources from a variety of bibliographic sources, including CiteSeer and Google Scholar. Binocs focuses on media search, allowing users to search for learning content in various Web 2.0 platforms like YouTube, SlideShare, and Wikipedia. Additionally, both widgets provide access to repositories of Open Educational Resources (OER), containing free learning material of high quality. Some of these repositories are OpenLearn

(<http://openlearn.open.ac.uk/>), OpenScout (<http://learn.openscout.net/>), and Globe (<http://www.globe-info.org/>).

The Media List Widget allows the user to create custom media lists based on the search results from the Binocs widget.

The EtherPad widget is a text editor that allows users to write a document collaboratively with their peers in real-time. When multiple authors edit the same document simultaneously, any changes are instantly reflected on everyone's screen. This is particularly useful for meeting notes, drafting sessions, education, team programming, and more.

The Mind Map widget is a tool that delivers the functionality to create collaborative mind maps and reuse previously created maps as learning resources. The Mind Map widget uses the OpenSocial specification, as well as the MindMeister embed API [10].

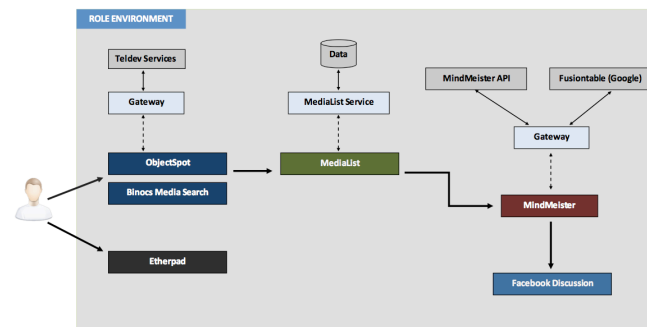


Figure 1. The widget bundle architecture.

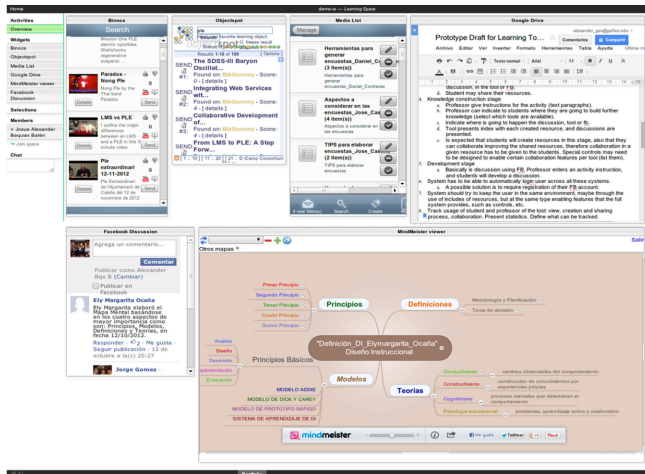


Figure 2. The widget bundle in action.

The mind-mapping editor enables the user to create and edit maps, ideas, nodes, and other different actions. To achieve the desired operation and to receive elements from other widget and incorporate them automatically into the map the Open Application specification was utilized [11]. For the publication and listening of widget events (i.e. add an item to a map, a map published for discussion, etc.), we

used the MindMeister RESTful services provided by the cloud-based application, and to be able to use them was necessary to create a middleware (gateway) web service for access the aforementioned services. Additionally, the Facebook discussion widget was implemented according to OpenSocial Gadget specification.

To push forward the envisioned ROLE real-time communication and collaboration infrastructure, it was necessary to provide communication between widgets, especially to send events originating in various widgets (ObjectSpot, Binocs Media Search, MediaList, EtherdPad) to the mind-mapping widget. Likewise in the case of the ObjectSpot widget, it was necessary to add communication through events according to the Open Application specification. In the case of MediaList widget, however, it was hoped to be able to add a new broadcast event to send items stored in a list to the mind-map and reflect them as new nodes in the map. Figure 1 shows the widget bundle architecture and Figure 2 a screenshot of the widget bundle in action.

Finally, it is worth mentioning that a complete cloud-based education environment was enabled, both at the infrastructure and the application level. The cloud-computing infrastructure of Amazon's Elastic Compute Cloud (EC2) [5] and the Google Fusion Tables [6] was used to store and manage token identity across multiple services.

III. THE TEST-BED

A. The Galileo University Test-bed

In this section we present a different test-bed for the ROLE technologies, compared to previous experiences [1]. This is the first one in Latin-American countries, and it also represents a different cultural context.

The test-bed was set up in the Institute Von Neumann (IVN) of the Galileo University, Guatemala. IVN is an online Higher Education Institute (HEI) that delivers educational programmes across Guatemala. These programmes are also available for other Spanish speaking countries around their hinterland.

B. Test-bed description

Students at IVN are mostly adult learners who also are in employment at the same time. The IVN courses are similar to any other University course, although the most significant difference is that IVN students do most of their learning during the evening or at weekends. IVN offers fully online learning programmes, which generally do not contain any synchronous sessions. Thus students are expected to spend around 10 hours for studying the supplied materials. This also includes carrying out any learning activities as well as interacting online with other students. All the courses are organized in weekly units, based on a variety of online materials (e.g. multimedia, interactive animations, etc), downloadable material in addition to the learning activities. All the course material is delivered to IVN students using a customized version of the LRN Learning

Management System (LMS) [9]. Student-to-student communication is also supported through dedicated online forums. Teachers and instructional designers are able to create and upload all teaching and learning material into the LMS.

In this test-bed, a series of experiments were deployed with respect to ROLE and a specially developed widget bundle, that was designed to support the learning activities for the course “*Building online activities*” was made available. This course is part of the e-Learning certification programme of the university. It is particularly targeted to meet the needs of practitioners, i.e. university professors, and instructors who want to create and deploy their experiences using e-Learning delivery methods. The students participating in this case study originated from three different countries: 15 from Guatemala, 6 from El Salvador, and 9 from Honduras. All students had previously used cloud-based learning activities and tools in other courses, thus they were quite familiar with online services and tools.

The Professor teaching the course introduced the students to new concepts, including the PLE, self regulated learning (SRL) and the ROLE project, with the purpose of raising awareness about the benefits of them with a premise of potentially engendering mindset change amongst them. The students were then guided to engage in an interactive learning process that was presented as having benefits for long term knowledge acquisition. It also was relevant for their forthcoming assessment in relation to the assigned learning activities [3]. This also helped to encourage them to use the ROLE system. Observation of the students’ usage of the PLE and collected feedback from both the Professor and the students, through interviews and questionnaires, also took place. It is important to note that the “students” in the group were mostly active HEI Professors in their home universities rather than conventional undergraduate students. The course lasted for four weeks.

C. Scenario

The following scenario was designed to test the ROLE cloud-based learning activities that had been defined. The Professor assembled the widget bundle for each student as shown in Figure 1. The first row shows the search widget “Binocs Media Search” and also the “ObjectSpot” widget. The third widget is the media list. The second row had the mind-mapping tool and the EtherPad widget, and the third row contained the social network widget for discussion. It had been decided beforehand to use a social networking site for discussion, based on previous experiences [13]. No further ROLE collaboration features were used in this part of the case study because of the short time available to deploy the learning activities.

During the first learning activity assigned to students, the PLE and related concepts were introduced to the students, with supportive material such as: step by step instruction, video-tutorials and user manuals custom made

for this experience. All learning activities required a research part first, therefore, the students were asked to search using the previously mentioned search widgets, then collect relevant resources in the list widget. They were then asked to create a report using the EtherPad widget, select relevant terms, and their relations then represent them in the mind-mapping widget. Finally, the “students” published their mind-maps in the dedicated course LMS space and then discussed their use of them using the social networking feature that had been provided.

D. The Learning Activities

Four learning activities were assigned to the students. The first one was searching for web services that enabled the creation of learning material or use of tools for learning activities. This task was followed by summarizing the characteristic and potential educational benefits and classifying them using an initial taxonomy given by the Professor in a shared mind-map. In addition all the “students” (who were Professors themselves) were also given the opportunity to discuss each others contributions and how they, as individuals, might apply the pedagogical approach in their own classrooms.

The second learning activity contributed to the overall research about how to measure course quality through online surveys with a target group of students. In this case study, it was decided that each student would search, list, summarize and reflect knowledge by recording them in a mind-map. This included a link to relevant (and provided) Google forms representative of the forthcoming online survey but based on a design previously proposed for the actual course survey. In this instance the mind-map to be created would be individual, and could be shared without the intervention of administrative permissions to the rest of the students. At this stage the students were asked to discuss two or three of their published mind-maps using the social network widget.

The third and fourth activities were similar in process to the second. The objective of the third learning activity was to summarize a proven process for the creation of storytelling educational activities and then to present one set of learning materials based on that process by using one of the following online tools: goanimate.com, pixton.com, xtranormal.com. The fourth learning activity focused on modelling a process for creating visually attractive digital posters with educational themes. Each student had to present his or her work and discuss an aspect of that work with each other.

E. Specific Technical Deployment

In order to facilitate the adoption and usage of the system, we decided to allow students to use Google accounts to register to the PLE, and also to the MindMeister mind-mapping tool. The Google accounts were provided by the professor to the students, and were created only with the purpose to be used on this specific course. The Facebook

authentication was done with the students' personal accounts.

F. Evaluation results

The participants to the evaluation of the ROLE-enabled PLE were asked to answer a short online survey. The purpose of this survey was to gather user feedback both specifically about the ROLE widgets, as well as more generally about the perceived usefulness and ease of use of PLEs, via questions based on the Technology Acceptance Model (TAM) [14, 15]. Since all of the participants were also teachers, the survey contained questions about the perceived usefulness and ease of use of PLEs both from the perspectives of the learner and the teacher. A total of 19 participants responded to this survey.

With relation to the perceived usefulness and ease of use of PLEs from the learner's perspective, the responses were generally positive. Interestingly the groups' strongest opinion related to the statement "*I would consider using a PLE useful for my work*" where 68% of the participants registered an agreement to this premise. Other strong opinions were also voiced in respect of the statements "*Using a PLE would improve my motivation for learning*" where some 42% agreed and "*Using a PLE would enable me to learn in an independent manner*" invited a 42% agreement to be recorded, with an additional 10% expressing strong agreement to the statement.

A negative opinion towards PLEs, however, was recorded in the statement "*I think the system was easy to use*", where 42% of the participants expressed disagreement and 21% strong disagreement. This would suggest that many of the participants recognised that using a PLE required some effort initially along with a discerning thought process but such effort would offer individuals greater benefits in the long run. The remaining statements in this question invited a more evenly spread set of responses.

With relation to the perceived usefulness and ease of use of PLEs from the teacher's perspective, the responses were much more varied. Some 42% of the participants disagreed with the statement "*I would expect a ROLE-based PLE to be useful for my students*". Similarly, 36% disagreed and 31% strongly disagreed to the statement "*I would expect that my students would accomplish their work more effectively with a ROLE-based PLE than with the learning technology they are currently using*".

Nevertheless, 42% agreed to the statement "*I expect that it would be easy for my students to use a ROLE-based PLE*", in addition to 47% disagreeing to the statement "*I expect that my students would find interacting with a ROLE-based PLE requires a lot of my mental effort*". Additionally, 42% agreed and another 10% strongly agreed to the statement "*I predict that my students would frequently use a ROLE-based PLE if they had access to it*". It can be concluded from this set of responses that the participants would expect their students to adopt and use a PLE with ease. On the other hand, the same teachers do not think that the use of a PLE would enhance effective learning for their students, and, consequently, they were reluctant to replace the learning tools their students are currently accustomed to and actively using.

IV. LESSONS LEARNED

Observations of the prescribed activities and the use of the ROLE tools indicated that the participants were somewhat overwhelmed with this new learning scenario. The reason being that this was a totally new setting for the participants - they had not previously used such an environment. Additionally, the type and style of the learning activities were also new to the participants. Unfortunately no time was made available to them to become acquainted with the ROLE technologies before executing the learning activities either. Consequently this was reflected in the participants' negative responses in the survey. In retrospect, it would have been better if the participants were introduced to PLEs and the ROLE tools ahead of the activities and be provided with sufficient documentation and guidance before attempting to complete the learning activities.

V. CONCLUSIONS AND OUTLOOK

This paper has described a test-bed of cloud-based services within a PLE. The widgets integrated in this PLE consisted of two cloud-based services, a social networking and a mind-mapping tool, where learners can perform and collaborate on learning activities. A complete cloud-based education environment was enabled, both at the infrastructure and at the application level.

The experiences of the authors in setting up this test-bed have shown that the technologies provided by the ROLE project enable the development a truly cloud-based PLE. Initial results from evaluating this PLE with students from three different Latin-American countries have shown that this is generally perceived as a useful learning platform. However, given the novelty of this approach, the need to provide guidance and scaffolding to new users was clearly outlined.

VI. REFERENCES

- [1] M. A. Chatti, M. Jarke, and D. Frosch-Wilke, "The future of e-learning: a shift to knowledge networking and social software," *International Journal of Knowledge and Learning*, vol. 3, pp. 404-420, 2007.
- [2] Retrieved from Technology Outlook for STEM+ Education 2012-2017 <http://www.nmc.org/pdf/2012-technology-outlook-for-stem-education.pdf>, 2012.
- [3] M. Friedrich, M. Wolpers, R. Shen, C. Ullrich, R. Klamma, D. Renzel, A. Richert and B. von der Heiden, "Early Results of Experiments with Responsive Open Learning Environments," *Journal of Universal Computer Science*, vol. 17, no. 3, pp 451- 471, 2011.
- [4] Juha Leino, Erika Tanhua-Piironen, Johanna Sommers-Piironen, "Adding Social Media to e-Learning in the Workplace: Instilling Interactive Learning Culture", *International Journal of Advanced Corporate Learning (iJAC)*, vol. 5, no. 3, pp. 18-25, 2012.
- [5] Barr, J., Varia, J., and Wood, M., "*Amazon EC2 Beta*," Retrieved May 3, 2011, from http://aws.ty-pepad.com/aws/2006/08/amazon_ec2_beta.html, 2006.
- [6] <http://www.google.com/fusiontables/Home/>
- [7] <http://docs.opensocial.org/display/OS/Home>
- [8] <http://www.role-widgetstore.eu/tool/role-objectspot-gadget>
- [9] Hernandez R, Pardo A, Delgado C: Creating and Deploying Effective eLearning Experiences Using .LRN. *IEEE Transactions on Education*, vol. 50, no. 4, pp 345-351, Nov. 2007.

- [10] <http://www.mindmeister.com/es/developers/embed>
- [11] http://sourceforge.net/apps/mediawiki/role-project/index.php?title=Library:Open_Application
- [12] <http://www.mindmeister.com>
- [13] Hernandez R, Guetl C, Amado H, "Facebook for e-moderation: a Latin-American experience", doi: 10.1145/2024288.2024332 S. Proc. 11th I-Know'11, 2011.
- [14] Venkatesh, V. and Bala, H. Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences*, 2008. vol. 39, no. 2, p.273-315.
- [15] Venkatesh, V. and Davis, F. D. A theoretical extension of the technology acceptance model: four longitudinal field studies. *Management Science*, 2000. vol. 46, no. 2, p.186–204.
- [16] A. Mikroyannidis, "A Semantic Framework for Cloud Learning Environments," in *Cloud Computing for Teaching and Learning: Strategies for Design and Implementation*, L. Chao, Ed.: IGI Global, 2012.