

Integrating Heterogeneous Learning Spaces through Portable Education Portfolios

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Abstract. The digital age has given rise to new kinds of learning spaces, where learners engage in different kinds of learning activities. A key challenge is how to systematically collect those heterogeneous learning activities into well organized education portfolios. In this paper, we propose the use of Portable Education Portfolios (PEPs) to record and organize learners' experiences. A prototype environment for PEPs has been developed to integrate together open source project contributions and formal course work into unified education portfolios.

1 Introduction

The use of education portfolios has started in late 1980s to provide tangible evidence of learner achievements [Mil05]. The goal of education portfolios is to represent and certify different artifacts or learning activities achieved by learners. Portfolio techniques are generally used by disciplines such as history and science to promote critical thinking which assesses learner's progress. One popular adoption of the portfolio concept in universities has been the use of electronic portfolios (i.e. e-Portfolios) which allow students to track and record their progress throughout their formal studies [Bha07].

With the success of Open Source Software (OSS) development model, however, there has been increased interest in open education beyond the doors of formal educational institutions. Open education adapts many of the open source principles such co-development and reuse of artifacts. Accordingly, a number of open educational frameworks (e.g. openSE - open education framework for computer science and software engineering [openSE]) have emerged to provide learners with different kinds of open learning projects, allowing learners to achieve recognitions based on given reputation systems.

Furthermore, from open source perspective, there have been calls to integrate open source project contributions, as a new kind of learning activity, into learning portfolios. In this regard, open source projects are seen as a new kind of learning space. Despite the recognized need, no good solutions for such integration exist yet.

In this position paper, we introduce the concept of portable education portfolios (PEPs) as a mechanism to collect different kinds of learning activities, including open source project contributions, into one scalable and secure space. We also report on the early experimental application of PEPs within the openSE environment. The approach has been developed in the context of a course on open source software development, given at Tampere University of Technology.

2 Background

A learning space [Obl06] is an environment where learners engage in learning activities, probably interacting with other learners. Traditionally, learning spaces play an important role in supporting and encouraging students by providing adequate mechanisms and tools. Learning spaces can either be physical and formal, such as classrooms and laboratories or virtual and informal such as online and networked courses [Chr05]. With the advent of ICT, new kinds of learning spaces are emerging, such as online certification programmes and community-driven development projects.

Furthermore, learning has become an activity that is no longer set within programmed schedules and slots. In modern societies, citizens may choose to engage in a life-long learning process (LLL) [Asp07], consisting of formal, non-formal, and informal learning activities.

Formal learning activities: Learning that belong to formal education and can be achieved through universities, colleges and schools.

Informal learning activities: Learning that occurs in a variety of places, such as at home, at work, through daily interactions, and by means of shared relationships among members of society.

Non-formal learning activities: Learning that involves workshops, community courses, interest-based courses, short courses, or conference style seminars.

From a learner perspective, all the above activities complement each other and contribute to the overall learning experience, despite the fact that those activities are carried out within different kinds of learning spaces. Documenting and organizing those heterogeneous activities into proper education portfolios may be a good vehicle for recording recognition and showcase expertise. This is important for job search for example. There are different types of education portfolios tailored to different purposes [Hen95]. The main ones include documentation portfolios, process portfolios, showcase portfolios, evaluation portfolio, and composite portfolio (see Table 1).

Electronic portfolios, known as e-portfolios [Bha07], have been one of the main digital tools to show evidence of learners' achievements in well organized learning portfolios. E-portfolios, however, have been mostly applied to formal education settings. With the rise of open education resources such as open source communities and other online informal programmes, we argue that another generation of education portfolios, called Portable Education Portfolios (PEPs), is needed. The main difference to such earlier e-Portfolio works is

perhaps that PEPs are well integrated within a well-defined approach towards open education. Two central questions emerge within PEPs: how to support as many learning spaces as possible in a smooth, highly interoperable way and how to ensure the credibility and soundness of recorded information.

Table 1. Types of education portfolios

Category	Description
Documentation portfolio	It represents a gathering of how much work a student has put over time and her improvement during that time. It can comprise almost everything from brainstorming activities to drafts and completed goods. This approach is the best way to track the best and weakest parts of a student work.
Process portfolio	It documents all phases of the learning process and provides a progressive record of the evolution of students. They are particularly useful in documenting the students' overall learning process.
Showcase portfolio	It records the students' very best work. In this portfolio, only accomplished work should be involved.
Evaluation portfolio	It shows the scores of included work. This is not suitable for all works.
Composite portfolio	It has things from all other kinds of portfolios.

3 Portable Education Portfolios

PEPs are portable education portfolios which are used to import learning activities from different learning spaces (see Figure 1). They provide an authenticated way to import the learning activities of learners from separate learning spaces. It is a system to provide authenticated or certified details of learners to their portfolio.

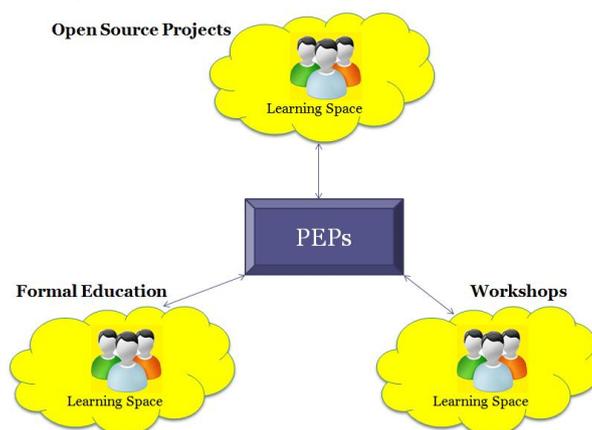


Figure 1. PEP system interacting with different learning spaces.

PEPs can import all kinds of learning activities: formal, informal or non formal learning, supporting LLLP. While importing the details from a learning space a PEP system asks the learner to authenticate. Then PEP imports learning activities from the given learning space. So the details obtained are authenticated and thus authenticity for evidences is provided. With the help of PEP system the user can create different views of her portfolio and can give access to others to view her portfolio.

Learners can participate in different learning spaces and can have different credentials for different spaces. It is hence problematic for the learners to remember all the credentials of different learning spaces. This problem is solved by introducing the OpenID authentication [Xia10]. OpenID is an URL, user-centered, open and decentralized standard for authenticating users. With the help of OpenID users do not have to remember the multiple usernames and passwords. In order to login into a system, a new user always has to register and also to different sites. Single Sign On (SSO) concept, means user logs into the system once and access to all the systems without giving login information again and again. As a solution to SSO, OpenID can simplify the user's operation process and reduce the resource provider overhead. i.e., OpenID has the single sign on procedure to reduce redundant, multiple accounts and passwords. Thus, the OpenID technology provides a secure and unified authentication mechanism to improve the anonymity of users.

PEPs support the interoperability of different learning spaces. They could show all types of artifacts that have been created by the learner, like for example assignments that they have completed and how educators or peers have assessed those, internships that they have completed, contributions to open source projects, certificates obtained, and other course interactions. In addition, PEPs could synchronize such information across the technical solutions provided by the different learning spaces. Thus PEPs can be thought as an implementation of composite portfolios.

In summary the benefits of PEPs include:

1. Connecting courses and programs to learner-created artifacts and to the underlying discourse and to synchronize them across technical solutions, thus allowing for re-usage and learning from what others have achieved;
2. Allowing for non-formal ways of recognition of learning outcomes within free / open learning by for example clearly showing learning outcomes and how those have been evaluated by peers or educators;
3. Providing a base for service providers to offer individual assessment and formal certification, as well as allowing service providers to build up their reputations;
4. Allowing for the connection of numerous education spaces and to take all kinds of information across such spaces. PEPs therefore could create a new model that allows learners and educators to carry education across institutions and other educational spaces; and therefore dovetails with lifelong learning.

4 Implementation

We have developed prototype tool support for PEPs, addressing the aforementioned requirements. From an architectural point of view, a PEP system is composed of the following components: PEP GUI, Learning space module, Learning space GUI, and OpenID module. Figure 2 shows the architectural design of the learning space environment. User interacts with the learning space through a PEP GUI. The learning space also provides a GUI for users to authenticate with their OpenID. If authentication is successful then the user is redirected to the PEP system and also the learning details from the learning space are saved into the PEP database.

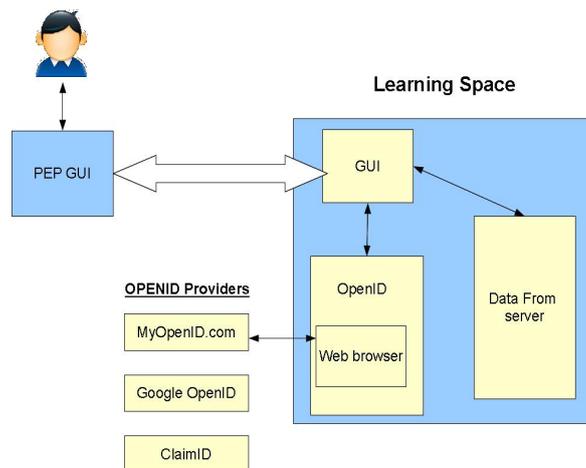


Figure 2. Architecture of PEP system.

The PEP engine collects user activities from learning spaces, designed using an extendible generic data model. The generic data model is developed in XML and typically contains information about the learner and the corresponding learning projects. The PEP engine implements an XML parser to parse data and saves the data in the PEP database.

PEP interacts with various learning spaces. In order to interact with learning spaces the user at least needs to have the following details:

- Address of learning space

The administrator of a learning space has to provide an URL which locates the learning space. The user has to provide this URL to the PEP system for PEP to be able to locate the learning space.

- Identify the user

The users have to associate OpenID with their learning space credentials. When the PEP system locates a learning space the user can authenticate with their OpenID. If the authentication process is successful the user gets recognized.

- Type of web service

The PEP system provides a sample data web service model. The administrator of a learning space has to provide the learning activity details of users in the same format of the model.

The PEP system provides an interface to users to specify the address of a learning space. The address is a Universal Resource Locator (URL) which is given by the administrator of that learning space to users. This is shown in Figure 3.

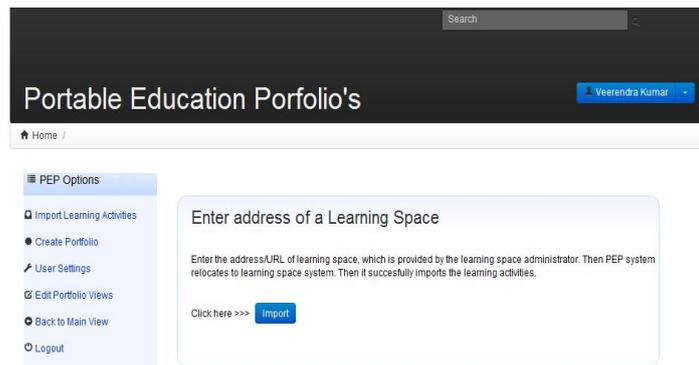


Figure 3. Interface to specify learning space location by user.

When the user successfully authenticates at a learning space the learning activity details of the user are saved to the PEP database. The PEP system provides a GUI named as PEP viewer which shows all the learning activities. This is depicted in Figure 4.

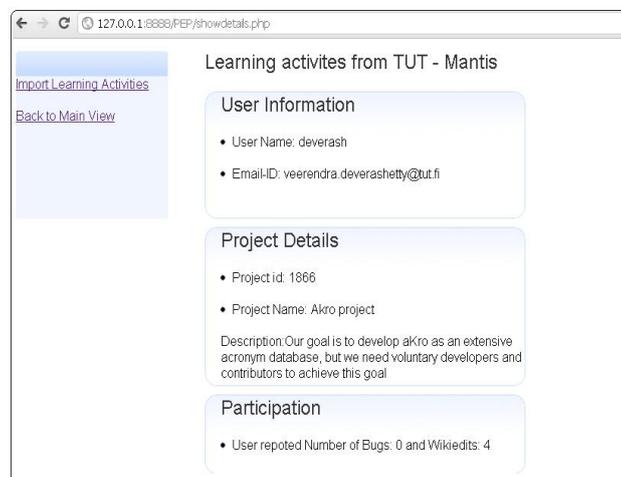


Figure 4. PEP viewer showing learning details of user.

We have applied the developed PEP environment to integrate together three different learning spaces. The first is an open source project that uses Mantis bug tracking system [Mantis]. The second learning space is a formal education setting that uses Moodle [Moodle] as a course management system. The third

learning space is the OpenSE [OpenSE] environment, which offers different kinds of learning projects such mentored internships and educational games.

Figure 5 and 6 show respectively sample data collected from Mantis and Moodle technical solutions. The two sample data is structured according to a well-defined data model.

```
<learningproject>
<lpid>ohj-1866</lpid>
<lname>TUT-Mantis</lname>
<name>deverash</name>
<email>veerendra.deverashetty@tut.fi</email>
<projectname>Akro Project</projectname>
<projectdesc>Our goal is to develop akro as an extensive acronym
database,
but we need voluntary developers and contributors to achieve this
goal </projectdesc>
<participation>user reported: Number of Bugs: 0 and wiki edits: 4
</participation>
<recognition>number of hats:1</recognition>
<grade>good</grade>
<certifiedby>Imed Hammounda and Terhi kilamo</certifiedby>
</learningproject>
```

Figure 5. Sample data collected from TUT-Mantis learning space.

```
<learningproject>
<lpid>project1</lpid>
<lname>Moodle</lname>
<name>veerendra</name>
<email>veerendra.deverashetty@tut.fi</email>
<projectname>C++ Quiz</projectname>
<projectdesc>This is an c++ programming language quiz
</projectdesc>
<participation>number of times quiz taken: 5
</participation>
<recognition>Highest score: 19/20</recognition>
<grade></grade>
<certifiedby>Moodle org</certifiedby>
</learningproject>
```

Figure 6. Sample data collected from Moodle.

5 Conclusions

In this paper, we have presented an approach to integrate heterogeneous learning spaces known as Portable Education Portfolios (PEPs). PEPs allow learners to collect different kinds of learning activities into unified education portfolios. The approach uses a generic data model that handles different types of web service platforms and ensures credibility of learning records.

Early experiences from a prototype environment for PEPs, that has been developed and used at Tampere University of Technology, have been promising. Using OpenID technology as authentication mechanism and XML-based data models, contributions from open source projects and formal course activities have been integrated into unified education portfolios. The adoption of the approach however required tuning of the technical solutions provided by the learning spaces. Finally, the PEP concept is not bound to learners. One could imagine the same concept applied to the context of teachers, with the goal in this case to record teaching, mentoring, and supervision history.

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