Live Annotation and Content Discovery in Personal Learning Environments

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Abstract. Personal Learning Environments (PLEs) are gradually gaining ground over traditional Learning Management Systems (LMS) by facilitating the lone or collaborative study of user-chosen blends of content and courses from heterogeneous sources, including Open Educational Resources (OER). Our work is focused on the social aspect of PLEs, and particularly on live interactions between learners, real-time annotation of OER and content discovery. This paper describes Gravpad, a service for sharing live annotations, and showcases how it can contribute to social learning within a PLE.

Keywords: personal learning environment, open educational resource, live annotation, content discovery

1 Introduction

Personal Learning Environments (PLEs) have recently emerged as an answer to the growing need for ubiquitous and flexible learning environments. PLEs follow a learner-centric approach, allowing the use of lightweight services and tools that can be accessed and customised from a variety of devices, such as PCs, netbooks, smartphones, etc. Rather than integrating different services into a centralised system, PLEs provide the learner with a variety of services and hand over control to her to select and use these services the way she deems fit [1].

In the context of the European project ROLE (Responsive Open Learning Environments[1]) we are working towards the transformation of OpenLearn[2], which is currently a public, course-centered LMS, into a PLE. The goal is to enable learners to easily construct and maintain their own learning environment, consisting of mash-ups of their preferred learning tools, services and resources, including:

- an e-portfolio describing learner goals and achievements,
- tools for collaborative authoring,
- tools for real-time meetings, and
- portals/aggregators connecting each learner to other learners and to additional external resources.

1 http://www.role-project.eu
2 http://openlearn.open.ac.uk/

There are some thematic critical questions to ask at the outset. The answers will frame our approach in the following sections.

Question 1: What makes a "personal learning environment" special?

The idea is that extra value can be delivered to the student by observing the way they interact in the PLE, and adapting the system's behaviour based on these observations.

Question 2: Where will the aggregated content in the PLE come from, and how can we be sure it is useful?

To the greatest extent possible, the PLE should be truly personalized by its users: not only should they be empowered to share content and ideas, but also to change the defining features of the system itself.

Question 3: What is different about providing a collection of community-curated content on the one hand, and simply advising learners to use the internet as a whole on the other?

The difference lies in the social aspect of working on topics of common interest. Search engines exist to provide access to information, but typically they do much less in the other direction, i.e. when it comes to sharing information with the world. This gap is partially filled by blogs, mailing lists, and so forth. However, we believe we can do better, by creating a service that adapts not only to the preferences and behaviour of individuals, but also to the behaviour of groups who share common interests.

In this paper, we will expand on these ideas through the particular example of Gravpad, a modified version of Etherpad[3] that can be used to make and share annotations to web content in real time. We will discuss the ways in which Gravpad relates to the other PLE elements mentioned in the bullet points above. First, we will review the PLE idea by looking at a particular learning scenario.

2 Personal Learning Environments: The OpenLearn scenario

The following scenario showcases the use of widget mash-ups in the context of collaborative authoring between OpenLearn users. Let us consider Ann, a student at the Open University, who is taking a course on sustainable energy (T206 - Energy for a sustainable future[4]). One of her group assignments is on the 10:10 climate change campaign. In order to assist the class in this assignment, her tutor has setup a special page in OpenLearn, with introductory OER from Open University learning units, iTunesU albums, and YouTube videos[5].

3 http://code.google.com/p/etherpad/
4 http://www3.open.ac.uk/study/undergraduate/course/t206.htm
5 http://labspace.open.ac.uk/course/view.php?id=5177

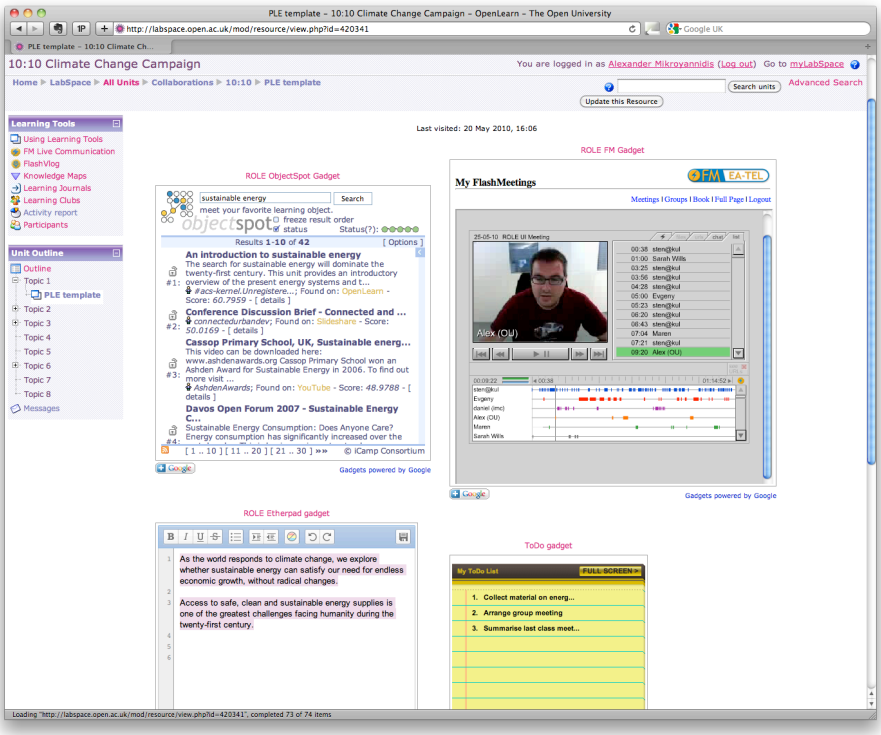

Figure 1. An OpenLearn PLE template for the climate change student[6]

Ann studies this material first, and then decides to explore some more. Her tutor has suggested a set of widgets within the OpenLearn PLE template shown in Figure 1. Ann starts off with the ObjectSpot search widget to discover more OER on sustainable energy, coming from OpenLearn courses, iTunesU, Wikipedia, SlideShare, and YouTube. She takes notes on the EtherPad widget, which she shares with her group members. She then has a videoconference with them, through the FlashMeeting widget, revising their joint notes on the EtherPad widget at the same time. Ann adds some figures about carbon emissions from the carbon emissions gadget into the group's EtherPad notes, and she and others in her group look for references to web pages about airlines that offer carbon offset services. Finally, Ann's group is ready to create their report for the assignment, by expanding and formatting their notes.

6 http://labspace.open.ac.uk/mod/resource/view.php?id=420341&direct=1

2.1 Swarms: A sense of co-presence

Suppose Stan is also on the same course, but in another group. Because the Etherpad widget is set up with Gravpad extensions, he is able to follow changes from other students in real time. For example, the URLs that Ann's group found about carbon offset programmes are drawn into a link aggregator shared by all course students. This is useful to Stan because his group has decided to focus on the impact of national polices around climate change, and he notices from Ann's notes in the link aggregator that carbon offset services tend to conform to the requirements of various national programmes. His group uses Gravpad to make further annotations attached to the pages Ann's group found, as shown in Figure 2.

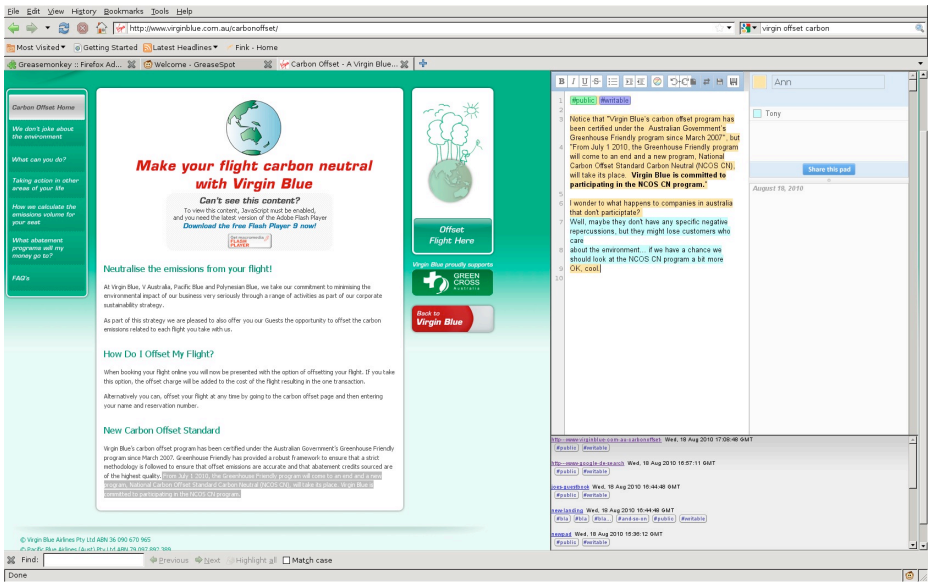

Figure 2. Group annotations and discussions via Gravpad

In the mean time, Ann's group has finished a first draft of their report. Before submitting, they check for activity in the course and find several key points they hadn't considered have been discussed in the notes attached to the pages that comprised their key references. They decide to make another round of revisions in light of the new things they've learned.

3 Implementing Gravpad

We saw in the previous example how social interactions can shape a learning landscape. Indeed, the central idea for Gravpad is precisely to "bend" a collection of existing content to one's purpose.

In a way, this idea is already present in the PLE concept. Annotations are just one example of a paradigm of social-semantic knowledge management. Gravpad operates as a recommender system applied in a real-time context; a variety of data streams in addition to web annotations could be used. For example, in [2], Wolpers et al. sketch out a broad scheme for making use of Contextualized Attention Metadata (CAM). This scheme resolves at a level of detail that includes things like the links followed in a given browsing session, or the programs used together in a given editing session. Gravpad should allow us to dive into interactions at a very fine-grained level, e.g. to make interventions on a word-by-word basis.

The current Gravpad implementation [3] has been built on top of the Greasemonkey[7] plugin for Firefox. This plugin allows the Javascript code of a modified Etherpad to be executed in the selected web page, offering a real-time, shared pad alongside the web page, as shown in Figure 2. The idea of using Etherpad to offer real-time writing advice is part of another contemporary research project (Dana Chandler, personal communication). Future implementation work around Gravpad will develop its usefulness in resource discovery, real-time context awareness, and social networking.

3.1 Free culture as motivator

Aaron Krowne writes in [4]:

> *"I contend that free culture is so compelling that users will be drawn to virtual places that allow them to work with it, use it, manipulate it, and bring it into the context of their lives and their interests."*

Krowne cites the work of Brusilovsky *et al*. on web annotation (cf. [5], [6]) as one example of a "free culture" trend.

Comparing Etherpad and the Web, we see the difference between a radically open/free production model (given the URL of a pad, anyone can contribute) and a more closed, ownership-based model (I control what happens on my domain, my blog, my course, etc.).

We also see how these two models fade into one another (e.g. Etherpad's "pro" setting allows the user to create a password-protected collection of pads, and blogs are typically open for comments). Even so, Etherpad seems paradigmatic for today's "open web". Gravpad mashes up this new radically open model and the more staid model of Web 1.0.

The resulting ability to make comments on anyone's web page without their explicit or implied permission, combined with the ability to filter out comments and pages based on various user-definable and extensible criteria, including content-based, time-based and social metadata, all serves to suggest that Gravpad may be "web annotation done right" – at least from the point of view of free culture. If user freedom is indeed a strong incentive for participation, will be what counts.

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[7] https://addons.mozilla.org/en-US/firefox/addon/748/

3.2 Buy-in and scalability

Now that Etherpad is available as an easy-to-install open source tool, it can be deployed on any GNU/Linux-based server, and mixed with any collection of tools to gather and manage data about interactions.

Accordingly, Gravpad could be used "internet-wide" – or on a very small scale. New features in Etherpad and Gravpad allow for fine-grained management of access and event notifications. As mentioned above, Etherpad is only one of many potential sources of content that could be exploited by a Gravpad server in order to make high-quality recommendations.

Of course, syndicating operational transform data is more intensive than syndicating lightweight status changes. In the current demonstration version of Gravpad, recent changes are just published as JSON data. In principle, a distributed collection of Etherpad instances could be polled for changes in a similar manner, and their recent changes lists aggregated. The Salmon Protocol[8] provides a way for "annotations to swim upstream to original update sources", which could remove the need for active polling in favor of a push-based mechanism.

Future challenges in include federating Gravpad servers (perhaps taking the Wave federation protocol as a starting point[9]); becoming increasingly proficient at noticing implicit connections, in order to create explicit annotations; and developing additional tools to measure the "closeness" and mutual attraction of resources and activities, and the appropriateness of recommendations using these measures.

4 Related work

Google Wave is the most well known related example. We can learn several things from the course of development taken by Wave.

1. *Don't try to do everything on one centralized server*. As noted, Wave was designed with federation in mind, but Etherpad is perhaps already ahead of the game simply by being easy to install on your own server.

2. *Do one thing and do it well*. Etherpad seems to get perfect marks here. Wave may have suffered from being too complex for both users and developers.

3. *Be compatible with the way people already work*. For example, Jan Moringen and Joe Corneli have been working to integrate Emacs and Etherpad in a branch of the Rudel project[10]. At the opposite extreme, Wave wasn't directly connected to more popular Google tools like Gmail, which seems like a missed opportunity.

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8 http://www.salmon-protocol.org

9 http://www.waveprotocol.org/

10 http://www.emacswiki.org/emacs/Rudel

At the same time, despite being discontinued as a stand-alone project, Wave's legacy may be with us for a long time, either in the form of Google API-based products (like social widgets), or the Novell's Wave-like and Wave Federation-compatible Pulse[11].

In any case, real-time collaboration is here to stay. People have used the idea of operational transform since 1989 [7] to synchronize content ranging from digital designs to raw data [8]. The literature on personalization and recommendations is too large to review here, but one can begin with a recent book [9]. Finally, new standard for syndicating semantic information about real-time interactions has been coming into its own recently in the form of "Activity Streams"[12].

Current Web 2.0 practices in user-generated annotations can also provide us with useful directions. A popular way for organizing content in Web 2.0, is tagging it with descriptive terms. This bottom-up collaborative process results in social classifications known as folksonomies [10]. An important aspect of a folksonomy is that it does not contain a hierarchy, or any directly specified parent-child or sibling relationship between its tags. Nevertheless, there exist relations that cluster tags referring to common resources. Compared to ontologies, folksonomies offer greater flexibility and adaptability in organizing information. A similar approach can be adopted in this project for organizing the annotations users produce in real time.

5 Conclusions and Future Work

We have seen that Gravpad gives people the opportunity to share context, whether temporal (co-editing a document in real time) or spatial (comments appear in-place, attached to the objects of interest). We also saw in an example how Gravpad can spread interactions out over time, bringing new resources to light and new creating opportunities for multimodal interaction in a shared PLE. Our future efforts will be directed towards integrating Etherpad with other social gadgets in the PLE, and on refining our recommendation algorithms accordingly. Finally, a key theme of this paper has been that interaction tools should be tailored to their users (and not the other way around), and we will endeavor to make Gravpad, like Etherpad, easy to customize and extend.

Acknowledgements

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[11] http://www.novell.com/products/pulse/

[12] http://activitystrea.ms/

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