ReMashed – Recommendations for Mash-Up Personal Learning Environments

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Abstract. The following article presents a Mash-Up Personal Learning Environment called ReMashed that recommends learning resources from emerging information of a Learning Network. In ReMashed learners can specify certain Web2.0 services and combine them in a Mash-Up Personal Learning Environment. Learners can rate information from an emerging amount of Web2.0 information of a Learning Network and train a recommender system for their particular needs. ReMashed therefore has three main objectives: 1. to provide a recommender system for Mash-up Personal Learning Environments to learners, 2. to offer an environment for testing new recommendation approaches and methods for researchers, and 3. to create informal user-generated content data sets that are needed to evaluate new recommendation algorithms for learners in informal Learning Networks.

Keywords: recommender system, mash-up, personalisation, personal learning environments, MUPPLE, informal learning, emergence, learning networks.

1 Introduction

Nowadays, Internet users take advantage of Personal Environments (PEs) like *iGoogle* or *Netvibes* to create a personal view on information they are interested in. The existence of PEs inspired researchers in Technology-Enhanced Learning (TEL) to explore this technology for learning purposes. As a consequence Personal Learning Environments (PLEs) were invented for learners [1, 2]. Because of the combination of various Web2.0 sources in a PLE they are also called Mash-Up Personal Learning Environments (MUPPLEs) [3].

MUPPLEs are a kind of instance of the Learning Network concept [4] and therefore share several characteristics with it. Learning Networks consist of user-generated content by learners who are able to create, comment, tag, rate, share and study learning resources. Due to the large amount of learning resources and learners the Learning Network can show emerging patterns. Learning Networks are from the bottom-up driven because their content is not created by paid domain experts but rather by their

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members. These networks explicitly address informal learning because no assessment or accreditation process is connected to them.

MUPPLEs also support informal learning as they require no institutional background and no fees. Instead the focus is on the learner independent from institutional needs like student management or assessments. Although, they are most appropriate for informal learning, educational scenarios are imaginable where MUPPLEs become integrated into formal courses as well. MUPPLEs are used to combine different information from the web that is supportive to the individual learner regarding the personal competence development. Most of the time, the sources are free to use and selected by the learner.

A common problem for PEs and MUPPLEs is the amount of data that is gathered in a short time frame. The learners can be overwhelmed by the information they receive or they might have problems selecting the most suitable learning resource for their personal competence development. Therefore, we developed a recommender system that offers advice to learners to find suitable learning resources for their individual competence development. The main purpose of recommender systems on the Internet is to pre-select information a user might be interested in. The motivation for a recommender system for MUPPLEs is to improve the 'educational provision'; to offer a better learning goal attainment and to spend less time to search for suitable learning resources [5].

In the following section we first discuss related work (section two). After that we introduce the ReMashed system (section three) and finally discuss future research (section four).

2 Related Work

Nowadays, 'mashing' information becomes a widely used activity on the Internet. Various tools (Yahoo Pipes, Dapper, Openkapow etc.) provide the opportunity to combine information from other websites in a new way. Users do not need special programming skills to use the tools in order to combine different Internet sources. The users can make advantage of public APIs of Web2.0 services and standardized XML formats like *Jason* to mash data in a new way.

In TEL several European projects address these bottom-up approaches of creating and sharing knowledge. The TENCompetence project addresses learners in informal Learning Networks [6]. The iCamp project explicitly addresses research around MUPPLEs [3]. They created an easy programmable and flexible environment that allows learners to create their own MUPPLE for certain learning activities.

However, these systems face the problem that the emerging behavior of these bottom-up approaches gathers large amounts of data. With the ReMashed system we want to offer navigation support for such emerging bottom-up MUPPLEs to help learners to find the most suitable data for their learning goals.

In recommender system research, extensive studies is going on to take advantage of tags for recommendations [7, 8]. Single systems like Delicious or Flickr offer recommendations to their users based on their data and also researchers take advantage of single Web2.0 services to create recommender systems [9]. However, the combination of different Web2.0 services to recommend information based on mashed tag and

rating data has not been attempted so far and especially not for learners in MUPPLEs. Thus, ReMashed offers a new approach by mashing data of learners from various Web2.0 services to provide pedagogical recommendations.

3 The ReMashed System

A prominent example of ReMashed from a different domain is the MovieLens project created by the GroupLens research group. They offer a movie recommender service where people can rate movies and get recommendations for movies. Besides this attractive services GroupLens created a frequently used data set for the development of recommender systems and related research [10]. Likewise ReMashed has three main objectives: 1. to provide a recommender system for MUPPLEs to learners, 2. to offer an environment for testing new recommendation approaches and methods for researchers, and 3. to create informal user-generated-content data sets that are needed to evaluate new recommendation algorithms for learners in informal Learning Networks.

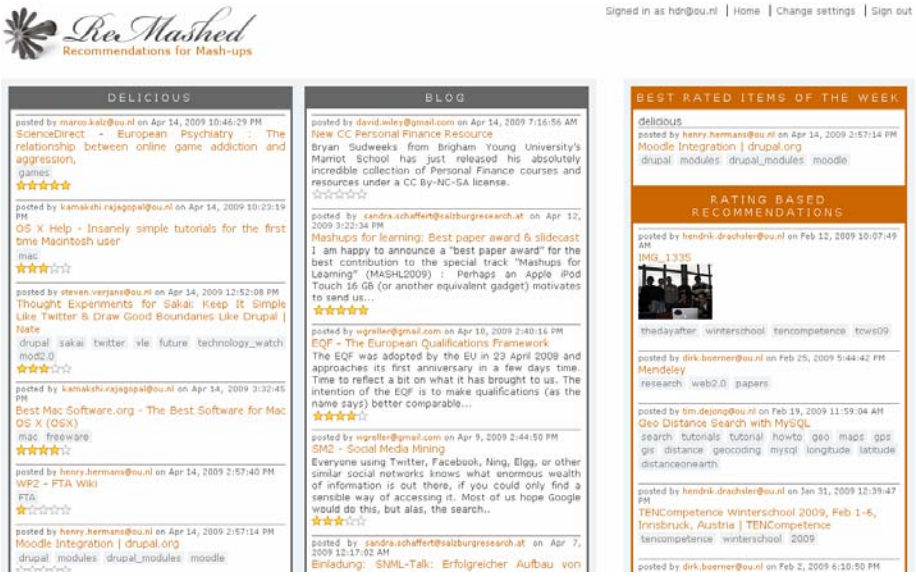

Fig. 1. The user interface of the ReMashed system. On the left side, the mashed information from delicious and blogs are shown. On the right side, the rating based recommendations for the current learner are presented.

In order to test our recommendation approach for MUPPLEs we designed a Mash-Up that enables learners to integrate their Web2.0 sources (see Fig 1). The system allows the learners to personalise emerging information of a community to their preferences. They can rate information of the Web2.0 sources in order to define which contributions of other members they like and do not like. ReMashed takes the preferences into account to offer tailored recommendation to the learner. ReMashed uses

collaborative filtering [11] to generate recommendations. It works by matching together users with similar opinions about learning resources. Each member of the system has a 'neighborhood' of other like-minded users. Ratings and tags from these neighbors are used to create personalised recommendations for the current learner. The recommender system combines tag and rating based collaborative filtering algorithms in a recommendation strategy. Such a recommendation strategy reacts on certain situations by using the most suitable recommendation technique. The recommendation strategy is triggered by certain pedagogical situations based on the profile of the learner or available learning resources [12].

In the initial state of ReMashed, learners have sign up for the system and have not rated any learning resources. ReMashed identifies the cold-start situation of the recommender system [11] and recommends resources based on tags of the Web2.0 sources of the current learner. It computes the similarity between the tag cloud of the current learner with other learners and learning resources. After the learner started to rate resources above a certain threshold a rating based Slope-One algorithm provides additional recommendations to the learner.

ReMashed is an Open Source project based on PHP5, Zend Framework 1.7 with the Dojo Ajax framework, MySQL database, Apache Server and the Duine recommendation engine. ReMashed is following the Model-View-Controller programming concept and is therefore fully object oriented. It consists of five sub-systems (see Fig 2), a user interface, a data collector, a user logger, a recommender system and the Duine prediction engine [13].

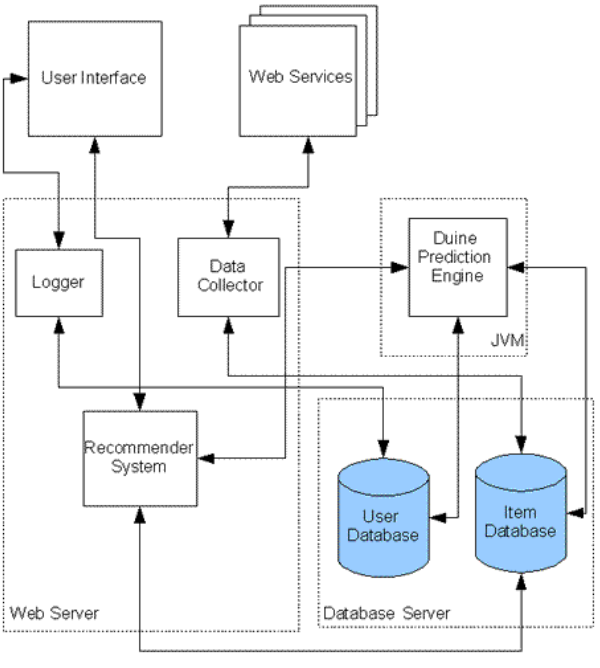

Fig. 2. Technical architecture of the ReMashed system

- The *User Interface* is responsible for user interaction, authentication of users, registration of new users and updating of user data.
- The *Data Collecto*r establishes the connection between the Web2.0 services and gathers new data into the ReMashed database via a CRON job that runs every hour.
- The *Logger* offers logging methods to the other subsystems. It stores log messages and monitors user actions in the system.
- The *Recommender System* composes the recommendations for every user and puts them into the database. It allows implementing new recommendation algorithms in PHP but it also provides a connection to the Duine 4.0 prediction engine based on JAVA that can be used to compute recommendations for the learning resource.
- The *Duine Prediction Engine* offers extensive options for configuring various recommender algorithms. It provides a sample of most common recommendation algorithms that can be combined in algorithm strategies, thus it is possible to create new recommendation strategies that follow pedagogical rules.

We tested the system in an usability evaluation in a group of 49 users from 8 different countries [14]. The evaluation phase ran for one month and was concluded with an online recall questionnaire. In that timeframe 4961 resources were collected, 420 resources were rated and 813 recommendations were offered. The overall satisfaction with the system was positive. Nevertheless, the participants suggested particular improvements we will take into account for the future development of the system.

4 Conclusions and Future Research

This article presented the ReMashed system, an evaluation tool for recommender systems for learners in informal Learning Networks. The article showed the design and implementation of a recommender system for MUPPLEs.

The future developments of ReMashed rely on an end-user perspective and on a researcher perspective. Regarding the end-user perspective ReMashed needs to integrate additional Web2.0 features (i.e. integrating social networks like facebook). This may improve the isolation of informal learners towards the organisation of learning communities. Retrieved information from social networks can be used to improve the recommendations and strengthen the communities; for instance, learners that have certain social relationships will likely want to share their learning resources with their community. The type of relationship between learners can affect which kinds of recommendations are given. In addition, ReMashed should provide a widget interface to enable learners to integrate recommendations from ReMashed into their MUPPLEs. Such a widget has to provide the recommendations and the possibility to rate learning resources to further personalise the needs of the learners.

From a researcher perspective, ReMashed opens the possibility to provide user-generated-content data sets of various domains. Comparable to the famous MovieLens data set, a standard for the evaluation and development of recommender system algorithm in TEL can be created. Further, when considering different ReMashed communities in health, education or public affairs, data sets from theses domains can be used to develop solutions for the cold-start problem of recommender system by providing an already rated data set for a particular domain.

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