Collaborative Storytelling in the Web 2.0

Yiwei Cao, Ralf Klamma and Andrea Martini

RWTH Aachen University
Information Systems
Ahornstr. 55, 52056 Aachen, Germany
{cao|klamma|martini}@dbis.rwth-aachen.de

Abstract. Non-linear storytelling has been an effective means of knowledge sharing and learning in organizations and societies for a long time. With the advent of the Web 2.0 user generated content like digital videos in YouTube and digital images in Flickr.com have become particularly interesting. The idea for PESE (Personalized Storytelling Environment) is to combine classic multimedia production environments for non-linear stories with Web 2.0 environments for user generated content. The bridge between both worlds is built by an integrated user model, a profile-based story search algorithm, a Web 2.0 feedback and rating system and an expert finding algorithm. The system evaluation reveals the principle usefulness of the presented approach.

1 Introduction

Prosuming is one of the magic activities of the Web 2.0. The idea that media consumers can become media producers has been validated with all its pros and cons in systems like YouTube and Flickr.com. There is a re-newed discussion about expert and amateur cultures or even cults [3]. Especially, making movies was thought to be an area where only teams of highly specialized experts equipped with a lot of money can produce high quality movies with a world-wide audience. But next to Hollywood other production centers emerged like "Bollywood" in India or "Nollywood" in Nigeria with local practices. YouTube has proven that amateurishly produced content can fascinate people on the Internet.

We want to combine both worlds, multimedia production knowledge and Web 2.0 production knowledge shall be united for serving the knowledge sharing needs for a society who has not forgotten the power of stories, yet. In learning processes, the substantial challenge is also maintaining and extending learners' expertise and knowledge. As stated in [2], way that people get information to solve problems is through their social networks. Moreover, people rely on other people to get information and learn. Some knowledge is easy to be acquired and mastered when it is not impersonal, because emotions might be involved and motivation is more clear. Storytelling is an efficient means to fulfill learning goals [11]. Knowledge is exchanged within communities when stories are told. Non-linear storytelling is kind of interaction between communities and media, in order to keep people by certain tasks motivated. Unlike blockbuster film plots

made by Hollywood, storytelling for some learning purpose doesn't work in a universal way, but in certain context. Community of Practice [13] is such a context in which storytelling methods can be well integrated.

Web 2.0 empowered social network sites have been already considered as a platform for storytelling, e.g. iReport by CNN and YouTube. Some of them is also used for e-learning and vocational training. A new testimonial is distributed by the project QUEST (Quality Employment Through Skill Training), a sectoral workforce development program (cf. http://youtube.com/watch?v=QtzIc6PQpUc). In the Web 2.0 a user could play the both roles at the same time, being an amateur as well as an expert.

The rest of the paper is organized as follows. Section 2 gives a brief review of the related work in this research area. We introduce the PESE solution using Web 2.0 technologies and the Community of Practice concept in Section 3. The implementation and evaluation results of the PESE prototype is discussed in Section 4. Section 5 concludes the paper with an outlook on the ongoing research of collaborative storytelling in Web 2.0.

2 State of the Art

In our previous research, we have developed a media integrated storytelling platform (MIST) [11]. Non-linear digital storytelling approach can be used as a cultural heritage learning platform. However, it is a standalone Java application and each user needs to install the client program. So MIST does not support collaborative storytelling by different users. Users can create their own stories. However, how the story is further used by other users is not traced at all.

With the problems of MIST in mind, we propose a PESE approach to collaborative storytelling within community of practice using Web 2.0 technologies.

The term *Web 2.0* has been formed by Tim O' Reilly in 2005[6]. "Web 2.0 is the network as platform, spanning all connected devices; Web 2.0 applications are those that make the most of the intrinsic advantages of that platform: delivering software as a continually-updated service that gets better the more people use it, consuming and remixing data from multiple sources, including individual users, while providing their own data and services in a form that allows remixing by others, creating network effects through an *architecture of participation*, and going beyond the page metaphor of Web 1.0 to deliver rich user experiences"[7].

A Community of Practice (CoP) consists of a community of persons who have a common goal and act practice oriented. The members are mutual engaged and interact with each other. Joint enterprises in form of mutual accountability, interpretations, local response is also characteristical for CoPs. A third typical attribute of a CoP is a shared repertoire which is produced within this community.

The activity within a CoP produces members that extend their knowledge and get experts. In contrast to that within a Web 2.0 community no experts but amateurs act and provide their knowledge. The idea of Web 2.0 is that every person can contribute his little knowledge to get a great total system.

With CoPs and Web 2.0 two "worlds" with different ways of thinking meet each other. Although they seem to be oppositional we will try to find a middle course with the system introduced in this paper. Aim is to combine the advantages of a Community of Practice and of Web 2.0.

Telling a story offers the possibility to transport facts in an emotional and thrilling way. Stories can be linear or non-linear. For a linear story there exists only one story path. It exists exactly one begin, one middle and one end. In contrast to this a non-linear story can contain many different story paths. So there exist different story versions which can have different ends. If more than a person is involved in the story creation process we talk about collaborative storytelling.

In this paper the focus is set on digital storytelling. This term stands for creating a story with help of digital media like pictures, video or text. There are several uses for storytelling. It can be used in the educational area because facts connected with emotions can be easier stored in the listener's brain ([12]). Another application field is Web 2.0 because Web 2.0 applications offer reams of possibilities creating and publishing a story.

Stories can be created in different ways. For example a video or a slide show can be a story. To support a systematic story creation MIST has been developed [11]. This application enables the creation of stories which follow an extended MOD paradigm [9]. Basic elements of a story are story units SU. Every SU is an atomic or an non-atomic story unit (CSU). Every SU can have a title and a description and a multimedia object can be assigned. CSUs are divided in three story units called begin, middle and end. Every story has exactly one non atomic story unit, which is called root.

Expert finding describes the process of finding a qualified user in a specific context. This method can be used in learning environments. A Learner needs help at a special topic. The systems searches for experts who answer the learners questions.

To work properly and classify the experts knowledge the system needs to have information. One possibility is that the user itself specifies what he knows and what is interesting for the system. But that can be problematic [1]. To regard that older adopted knowledge is not as present as new knowledge, weight reducing function can be executed [5].

3 PESE: A Web 2.0 service for collaborative storytelling

In order to combine approaches of Web 2.0, communities and storytelling, we have developed a prototype called PESE. In Figure 1 an overview of this new web service is given. Additionally to storytelling functionality an expert finding service is integrated. Web 2.0 techniques as tagging and giving feedback allow a dynamic classification of experts. A role model is used to represent the behavior and influence of every user.

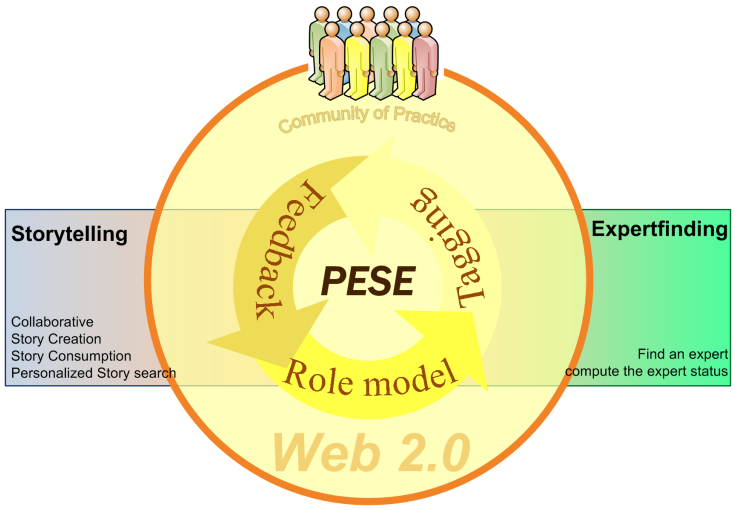

Fig. 1. PESE at a glance

PESE enables communities to have joint enterprises (i.e. story creation), to build a shared repertoire (i.e. stories) and to engage mutually (i.e. expert contacts). Therefore PESE builds a platform for a community of practice.

As mentioned above PESE uses a role model. A new PESE user becomes an *normal* user. He gets necessary rights to execute basis features like visiting, rating and searching for a story.

Experts are users who have the knowledge to help other users. There exist three different sub roles. A *PESE technician* can aid users with administrative questions. *Storyteller* know how to tell a thrilling story. And finally a *Maven* is characterized by good expertise. To become an expert an user has to give a minimum number of good advices.

Administrators have extended rights and are necessary for maintenance issues. The *system admin* is allowed to change system and configuration properties. *Story sheriffs* can delete stories and media. Additionally there exists the *user admin*. He manages PESE users and is allowed to lock or delete them.

Producer create, edit and manage stories. The producer role is divided into the *production leader* (responsible for the story project), the *author* (responsible for the story content), the *media producer* (responsible for used media), the *director* (responsible for the story) and finally the *handyman* (helper for the story project).

The role called *Bandits* is used to classify users who want to damage the system. According to their behavior they can be a *troll*, a *smurf*, a *hustler* or a *munchkin* respectively. They all make a kind of disturbance with their communication ways and storytelling behaviors.

In contrast to *bandits* there exist tow prestige roles: the *connector* and the *domain lord*. Whereas the *connector* knows many people and has a big contact

network the *domain lord* has on the one hand a great expertise and is on the other hand an excellent storyteller.

If a PESE user wants to create a story, he first has to create a story project. Due to his wishes he can invite other PESE members to join in his project. Every team member is assigned to at least one producer role. To describe stories every PESE user can tag them. Because the often used plain tagging has many disadvantages [4], semantic tagging is used. PESE allows searching for a story. Additionally to a content based search by title or tags a profile based search is offered. In Figure 2 is shown how the profile-based story search is working.

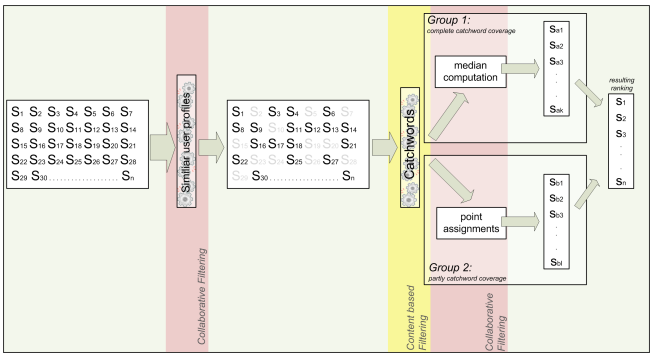

Fig. 2. Profile-based story search algorithm

Users who have questions can contact an expert. To know which user is the best fitting expert a special algorithm and useful user data are necessary to determines the users knowledge. For every user there exists an user profile which contains the following data:
Story data are generated when a user visits or edits a story.
Expert data are created with given/ received expert advices.
Personal data represent the user knowledge the user has acquired in the real world. These data are typed in by the user itself.

With these information three tag vectors are created. They will be weighted summed up and normalized. Such a vector has the following form:

$$\begin{bmatrix} taga\ valuea \\ tagb\ valueb \\ tagc\ valuec \\ \cdots \quad \cdots \end{bmatrix}$$

The final value of each tag represents the users knowledge assigned to the related tag. A value near to zero implies that the user only knows few, where as a value near 1 implies expertise at this topic.

Users can give feedback for stories and for expert advices. Feedback is very important for PESE, because it delivers fundamental knowledge for executing

the profile based search and defining the user's expert status. Furthermore the visualization of feedback results (i.e. average ratings, tag clouds)help user to get an impression of the experts/story's quality.

Explicit and implicit feedback techniques are used. After visiting a story respectively getting an expert advice the user has the possibility to fill out a questionnaire. This explicit form of giving feedback is fundamental for PESE. But not every user likes filling out questionnaires [14]. Therefore also implicit feedback is used. Although this is not as accurate as explicit feedback it can be an effective substitute [14]. In PESE the following user behavior will be considered: The more one user visits one story the more interesting it is. The more a story is visited by all users, the more popular it is. The integrated mailbox service offers the possibility to handle all necessary user interaction of the PESE community. User need to send messages when they want to ask an expert, give an expert advice, invite a new team member, etc.

4 PESE Prototype Implementation and Evaluation

In this section the PESE prototype will be described. PESE is realized as client/server system and is integrated in the LAS system [10]. The programming language is Java. The client, implemented as a web service, communicates via the HTTP protocol with the LAS server by invoking service methods. The LAS server handles the user management and all database interactions. New services like the expert, mailbox, PESE user and storytelling service extend the basis LAS features and fulfill all functionality needed by PESE. The story service extends already existing MIST features and includes methods for the management of story projects and searching for stories. The expert service contains functions for computation and management of the expert data vectors. The mailbox service manages the mailbox system. The PESE user service extends the LAS user service and offers the possibility to add and edit user specific data.

The evaluation of PESE consists of three parts. First users had the possibility to test the PESE prototype. The algorithms need many data to work properly. Because the available data were not sufficient, test data had to be generated. The PESE prototype has been installed on an web server and was available for every interested user. The user were requested to test PESE for one month. At the end of that period they were asked to fill out a questionnaire. In parallel statistical data about the PESE usage where collected by MobSOS [8]. This is a mobile multimedia testbed and is able to test, evaluate and analyze web services.

Figure 3 shows how often LAS services have been called. The story service has been used most frequently and expert service calls took the longest time.

The questionnaire has been completed by 10 persons. Figure 4 shows some results. The worst rating was given for the loading times. Additionally PESE is not user friendly enough. PESE as whole has been rated with an average score of 2.1 and corresponds to the German school grade "good". Summarizing the results PESE has been accepted by the test user but has to be improved.

	Average call duration (seconds)	Duration sum of all calls (minutes)	Call count
PESE expert service	31,24	342,8	544
PESE mailbox service	1,89	13,2	285
PESE story service	1,37	386,56	10128
PESE user service	10,79	39,15	1301
total	4,71	781,71	12258

Fig. 3. Method invocation statistics

Rating	Count	Minimum	Maximum	Average	Standard deviation
Usability					
Expert search	8	1	5	2,88	1,246
Mailbox area	7	1	5	2,71	1,380
My profile	10	1	5	2,30	1,160
Project creation	7	1	6	2,86	1,952
Project edition	7	1	6	2,57	1,813
Story edition	4	2	4	2,75	0,957
Story searcg	7	2	5	2,57	1,134
Story consum	7	2	5	2,86	1,215
PESE	10	2	6	3,10	1,449
Loading times	9	4	6	4,67	0,707
stability	10	1	5	3,40	1,075
PESE as whole	10	1	4	**2,10**	0,876

Fig. 4. Questionnaire results

5 Conclusions and Outlook

This paper introduces a collaborative Web 2.0 storytelling environment called PESE. PESE combines ideas of multimedia production with the Web 2.0 idea of prosuming users. In particular, we presented an integrated user model where one can find classic roles of multimedia production like producers and directors on the one side and Web 2.0 roles like story sherrifs and domain lords on the other side. With these user models in mind new feedback and rating mechanisms for stories based on our already existing storytelling environment MIST [11]. Based on such profiles algorithms for profile-based story search were developed. As we are following a community of practice approach to knowledge sharing and learning we bridged those new Web 2.0 mechanisms for rating content and people to model of legitimate peripheral participation and expert cultures by introducing an expert finding algorithm with is involving the different social roles in the collaboration process but also community factors like aging of knowledge and topical motives.

While the pilot demonstrator was already evaluated successfully there are a lot of already planned improvements. The physical layout of servers for the environment is rather complex and can be simplified by re-designing some of the underlying services. The integrated evaluation services can be tailored to serve better understanding of the pattern like use of the system by users. The usability of the system is most important and one of the reasons why we have not opened the system for a general audience yet. But also research topics like mobilization

of the storytelling system and geo-spatial visualization of storytellers, e.g. for massive multimedia sharing and ubiquitous gaming are on our screen.

References

1. A. Becks, T. Reichling, and V. Wulf. Supporting collaborative learning by matching human actors. In *HICSS*, page 32, 2003.
2. T. H. Davenport. *Thinking for a Living: How to Get Better Performance and Results from Knowledge Workers*. Harvard Business School Press, 2005.
3. A. Keen. *The Cult of the Amateur*. Currency - Doubleday, 2007.
4. R. Klamma, M. Spaniol, and D. Renzel. Community-Aware Semantic Multimedia Tagging - From Folksonomies to Commsonomies. In K. Tochtermann, H. Maurer, F. Kappe, and A. Scharl, editors, *Proceedings of I-Media '07, International Conference on New Media Technology and Semantic Systems, Graz, Austria, September 5 - 7*, J.UCS (Journal of Universal Computer Science) Proceedings, pages 163–171, 2007.
5. T. Reichling, A. Becks, O. Bresser, and V. Wulf. Kontaktanbahnung in Lernplattformen. pages 179–188, 2004.
6. T. O. Reilly. Web 2.0: Compact definition. Internet, http://radar.oreilly.com/archives/2005/10/web_20_compact_definition.html, 1995 [Letzer Zugriff am 01.05.2008].
7. T. O. Reilly. What is Web 2.0? Internet, http://www.oreillynet.com/pub/a/oreilly/tim/news/2005/09/30/what-is-web-20.html, 2005 [Letzer Zugriff am 01.05.2008].
8. D. Renzel, R. Klamma, and M. Spaniol. MobSOS - A Testbed for Mobile Multimedia Community Services. In *Proceedings of the Workshop on Image Analysis for Multimedia Interactive Services 2008 (WIAMIS 2008)*, page tba., Klagenfurt, Austria, May 2008. IEEE Computer Society.
9. N. Sharda. Movement Oriented Design: A New Paradigm for Multimedia Design. *International Journal of Lateral Computing (IJLC)*, 1(1):7–14, 2005.
10. M. Spaniol, R. Klamma, H. Janßen, and D. Renzel. Las: A lightweight application server for mpeg-7 services in community engines. In K. Tochtermann and H. Maurer, editors, *Proceedings of I-KNOW '06, 6th International Conference on Knowledge Management, Graz, Austria, September 6–8, 2006*, J.UCS (Journal of Universal Computer Science) Proceedings, pages 592–599. Springer-Verlag, 2006.
11. M. Spaniol, R. Klamma, N. Sharda, and M. Jarke. Web-based Learning with Non-Linear Multimedia Stories. In R. W. H. L. W. Liu, Q. Li, editor, *Advances in Web-Based Learning, Proceedings of ICWL 2006, Penang, Malaysia, July 19-21*, volume 4181 of *LNCS*, pages 249–263. Springer-Verlag, 2006.
12. K. Thier. *Storytelling - Eine narrative Managementmethode*. Springer Berlin Heidelberg, 2006.
13. E. Wenger. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge University Press, Cambridge, UK, 1998.
14. R. W. White. Implicit feedback for interactive information retrieval. *SIGIR Forum*, 39(1):70–70, 2005.