Bringing Web 2.0 to Web Lectures

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ABSTRACT

At many universities, web lectures have become an integral part of the e-learning portfolio over the last few years. While many aspects of the technology involved, like automatic recording techniques or innovative interfaces for replay, have evolved at a rapid pace, web lecturing has remained independent of other important developments such as Web 2.0.

Web 2.0 is an emerging trend that among other things aims at integrating user generated data from different systems in order to enhance the user experience. This article discusses the benefits web lecturing could gain from a Web 2.0 perspective. It also introduces a prototypical interface for the virtPresenter lecture viewer that enriches web lectures by Web 2.0 features, such as a specialized player that can be integrated in blog or wiki sites and multi-medial links that can be used to reference arbitrary passages of a web lecture from an external blog, wiki, forum or other websites. The article also describes how authentication can be realized transparently when the system is used in conjunction with a learning management system or social platforms and how usage data is gathered to realize social navigation features. It concludes with a brief discussion of user acceptance of the stand-alone version of the interface and the embed-player.

Keywords: Lecture Recording, Web Lectures, Web 2.0, Wiki Webs, Social Navigation, Podcasts

1. INTRODUCTION

During the last years, web lectures have become more and more important for universities. Web lectures can be created at low cost by simply recording a lecture that is part of a curriculum anyway (Dickson et al., 2008; Hürst et al., 2000; Zhang et al., 2005; Ziewer & Seidl, 2002). Thus, the amount of recordings and exported media files is constantly growing. The virtPresenter project at our university is just one of many examples. In the beginning of the project at the University of Osnabrück in 2003 only two or three courses were recorded per term. Now, by the beginning of 2009, the total number of automatically generated recordings representing a single course session in the university's publicly accessible multimedia content repository (http://www.lernfunk.de) is around 1200. Moreover, the fully automated recording system and the user interface described in this paper are being used or

field-tested at the Universities of Bielefeld, Lüneburg, Oldenburg, Paderborn, Würzburg as well as at the Universities of Pittsburgh and Tel-Aviv.

With the growing number of available web lectures, more and more lecturers and universities want their lectures to be recorded and more and more students ask for lectures to be available online. With the rising acceptance of the recordings, lecturers also increase their use of the recorded content in novel didactic scenarios (Hermann et al., 2006; Zhang et al., 2006). For a discussion of four archetypical application scenarios for web lectures see (Mertens et al., 2007).

Certainly, learning does not only occur in lecture rooms or using a web lecture interface. Nowadays, both students and teachers use several (web based) systems for exchanging information (Knight et al., 2002; Wichelhausen et al., 2008). The use of learn management systems, student blogs, group wikis, instant messengers, chatrooms and other systems is steadily growing at universities and off-campus With these tools and web based systems data exchange is easy, fast and convenient.

By 2008 at the University of Osnabrück, there were more than 500 university blogs available in the so-called blog farm. These blogs are used by students as well as lecturers to discuss seminars or simply augment ongoing lectures. Most of the provided content in these blogs is naturally static and text-based because web lectures could not be integrated in a proper fashion (Ketterl et al., 2008). In a text based blog, users can cite text-based material on a word by word basis or via hyperlink. In analogy, users need to be able to embed specific passages of videos in a blog. Contemporary approaches only provide for embedding the whole video. Another requirement is that the dual nature of slide based talks (i.e. a slide based web lecture consists of both slides and a video stream) must be supported. Considering a main aspect of Web 2.0 technology, sharing user and application data as a major aspect (Bebo 2005), it is necessary to integrate web lectures (or parts out of different web lectures) in a better way in other web based learning systems. Otherwise, web lectures remain isolated from this new rapidly changing user driven Web 2.0 landscape which plays an increasingly important role in e-Learning.

This paper presents three approaches that aim at integrating ideas from Web 2.0 with web lectures and making web lectures compatible with current Web 2.0 applications such as blogs and wikis. These approaches have already been realized in the context of the virtPresenter web lecture system (Ketterl et al., 2007 b).

The remainder of the article is organized as follows: In section 2, the paper gives a brief overview of application areas for web lectures. It also outlines difficulties and alternative content delivery channels. Section 3 presents related work in the field of combining web lectures and Web 2.0. Section 4 describes three Web 2.0 features for web lectures; in detail these are social footprints, user created bookmarks and a special embed-player that can be integrated in other websites. Authentication and integration with other systems as well as a comparison of different user interface versions and other distribution channels with respect to how usage data can be collected for further use is outlined in section 5. Section 6 briefly discusses how users have accepted the different interface versions. The article concludes with section 7 that briefly summarizes the work presented in this article.

2. WEB LECTURE APPLICATION AREAS

The internet is growing on a daily basis. Especially Web 2.0 applications are becoming increasingly popular. So-called mashup websites (websites that combine data from different sites), social network websites (e.g. Facebook) or video internet repositories (e.g. YouTube) try to attract people to spend time online. For universities it is not easy to decide whether this kind of popular websites is an adequate place to include or present high quality learning content. Yet, platforms like Apple's iTunes university project (iTunes U) or YouTube education serve as a good marketing place for universities to attract prospective students or research partners for projects or for the university itself.

For many universities, going public with educational content is presently disputed and a challenging process. Besides legal grounds concerning copyright issues and further points, there are great fears on the lecturers' side about how (their) content will be used outside. It is often quite unclear, e.g. in the lecture recording field, what "open for the public" implies and which platforms (or how many potential users) are included.

At the University of Osnabrück only about 20% of the lecture recordings are open for public use. Other recordings have to be kept hidden from the public in the university's learning management system and can be accessed by internal students only. Other universities appear to have similar problems concerning content usage.

User authentication and access control to a registered group, watermarks in lecture videos, online editing functions or additional university branding mechanisms can help to protect the content and limit the ways in which it can be used. These measures also increase lecturers' acceptance.

In order to identify application areas for web lectures and to study web lecture usage, the produced content is used in experimental settings within different platforms and varied productive settings inside as well as outside the university. Currently, content produced with the virtPresenter lecture recording framework can be found in the following platforms:

- Episodes are available via public course websites.
- Episodes are available as podcast versions in the Apple Music Store (Schulze et al., 2007; Morisse & Ramm, 2007).
- Public and also access-restricted material can be found within a public university audio and video content management system (www.lernfunk.de).
- LMS internal: Recordings are only accessible to students who are enrolled in the respective courses or recordings are available for all LMS participants.
- Selected virtPresenter recordings are available for users in the Facebook community.
- Lecture recording selections are available in the YouTube platform.
- Web lecture snippets are embeddable inside Wikipedia to enrich static content.

One strength of virtPresenter is the easy integration of recordings with other systems and that it even provides transparent authentication for some systems (Emden, 2008). Another strength is that most of virtPresenter's Web 2.0 features are also available when the web lecture player is used within other systems, as described in the further course of this article (like collecting usage statistics in form of social footprints for example).

3. CONTEMPORARY APPROACHES BRINGING WEB 2.0 TO WEB LECTURES

This article presents the adaptation of three different Web 2.0 features to web lectures. This section briefly describes the state of the art known to the authors in these fields. Only few web lecture systems have been developed that support wikis, blogs or blog-like features. In a study presented in (Day et al., 2005), technology support for linking a student question to distinct slides is found as a requirement for web lecture systems. The system used in that study, however, does not support this feature. Mu (Mu, 2005) describes a browser for video learning objects with an integrated chat feature. Chat messages can be linked to arbitrary time indices in the video objects. However, it does seem as though the system only supports marking discrete time indices so that passages cannot be marked. Also, the feature can only be used in the application not allowing for integration with external systems like a blog.

In (Bateman et al., 2007), a prototype of the iHelp Presentation multimedia video presenter is described. This system enables users to highlight important parts in the recorded lectures' slides and to add annotations and tags to a recording. Lauer et al. (Lauer et al., 2005) present an interface for web lectures in which collaborative notes can be attached to passages of the lecture in a time-based fashion. These notes can also be positioned spatially on the screen. The notes can be exchanged among students in order to serve the purpose of electronic discussions. In (Lauer & Busel, 2006) the concept is extended with speech based notes.

While all these approaches feature excellent possibilities for working with web lectures collaboratively, they cannot be integrated into traditional blogs or other outside systems. Students do thus have to start yet another application.

The notion of "cutting out" arbitrary parts of lecture videos and rearranging these parts in custom collections has been realized in an approach described in (Miyahara, 2002). Nevertheless, the approach does not feature a means of exporting these passages and exchanging them with parts from other students or learners from outside.

The idea of logging other users' interaction with a lecture video as social footprints has been proposed by Ponceleon and Dieberger (Ponceleon and Dieberger, 2001) in the context of movieDNA. In that project, however, no such feature was practically implemented. Another approach that combines ideas of Web 2.0 with web lectures can be found in Knowledgebay (Sporer et al., 2005). There, the recording process does not deliver structured content overviews. In order to produce indexed tables of content (TOC), students can produce a TOC in a wiki-

like fashion when consuming the lectures. Esponda and Jancivic (Esponda & Jankovic, 2008) introduced an approach that records user interaction with a virtual camera in a 360 degree recording of a classroom and uses the recorded data from all users to generate automatic camera perspectives and zooming.

4. WEB 2.0 FEATURES IN VIRTPRESENTER

This section describes three web 2.0 features that have been integrated in the University of Osnabrück's virtPresenter. The feautres are social footprints in web lectures, multimedia bookmarks that can be exchanged among users and blog integration of web lectures. These three examples show that and how web lecturing and web 2.0 can be brought together.

SOCIAL FOOTPRINTS IN WEB LECTURES

Most of the lecture recording episodes at the University of Osnabrück have a typical duration of 1.5 hours. It is not surprising that in such a long period of time, certain parts of a lecture are more important for learners than other sections.

In order to identify relevant parts in virtPresenter web lectures, information from other learners left in the user interface can be used. Figure 1 depicts the virtPresenter main web interface (Ketterl et al., 2007a). Besides the lecturer's video, corresponding presentation slides and a video slider for a time based navigation in the web interface, one can find a slide title list that can be used to navigate directly to a section or a list of available recordings (or a personal recording playlist) beneath the lecturer video. Additionally, it is also possible to search through the available recordings.

The video slider can also be used to visualize user activity over the lecture's time period in the form of so-called user generated footprints (see (Mertens et al., 2004) for detailed discussion of the footprint concept for individual users).

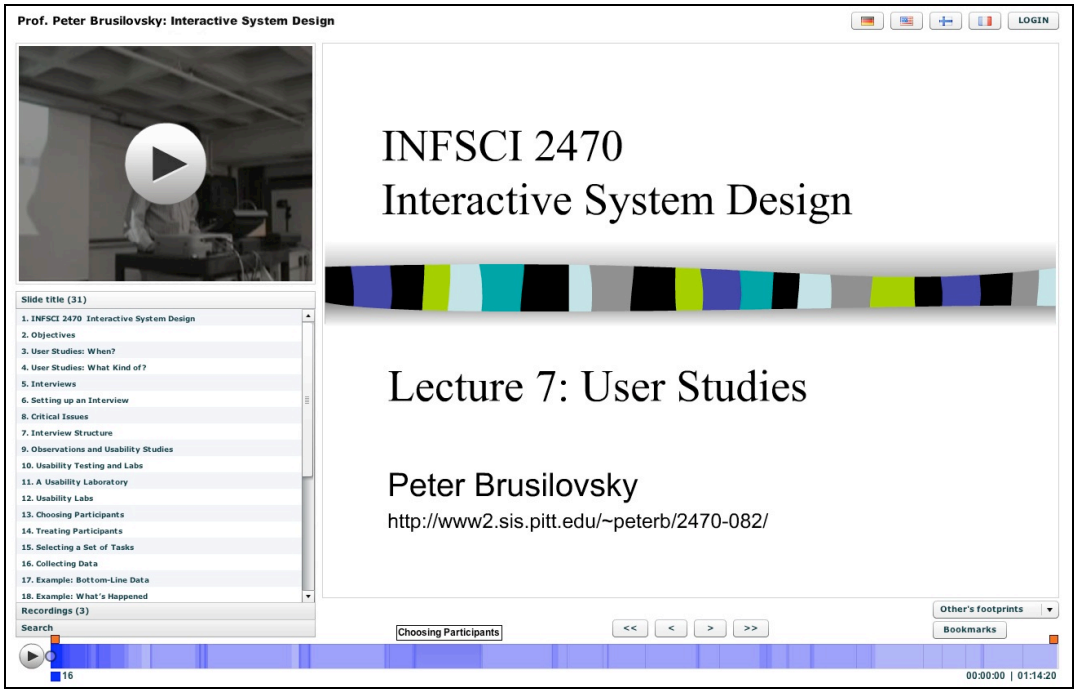

Figure 1: virtPresenter web interface with active user footprints

These footprints are displayed in the video slider and come in different colors and density shading corresponding to the frequency of user visits per lecture part in the web interface (see figure 1 bottom and figure 2 respectively). Darker areas identify parts that have been watched more often. Further, a user can also compare own footprints with the parts other people have watched in the recording by dividing the interface footprint bar in two parts (figure 2).

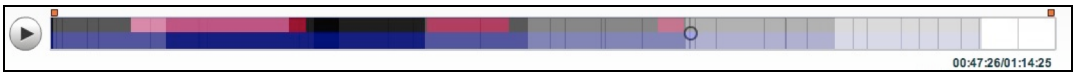

Figure 2: Personal footprints (upper half) and social footprints (lower half) in the timeline

The upper half visualizes one's own personal footprints while the lower half shows footprints of others in a web lecture. Different colors for personal and public footprints respectively make it easier to compare own learning characteristics with those of others'.

Certainly, navigation features like the one presented can only be an indicator of what might be more important than the rest of a lecture recording. Currently, we use these interface features in combination with social navigation in selected user experiments. More information about social footprints in web lectures can be found in (Ketterl et al., 2008; Mertens et al., 2006).

LINKING TO USER CREATED WEB LECTURE BOOKMARKS FROM EXTERNAL WEB 2.0 APPLICATIONS

Within the interface shown in figure 1, it is possible to mark essential parts of the recording and reuse these snippets externally in other web systems. Users as well as lecturers can edit public web lectures online in the virtPresenter interface and can bookmark the edited parts in their web lecture user profile or use the edited parts externally in educational blogs, wikis or other web pages. The basics of virtPresenter's bookmark concept are described in more detail in (Mertens, 2007).

Whenever users decide to bookmark a part of a recording for later use, they can cut out that passage online in the interface by using two small markers and adding the generated lecture snippet to the personal bookmark section (see Figure 3). These bookmark selections can then also be exported as a hyperlink to external systems like a course wiki, a group blog, the regular bookmark space of a web browser or also to social bookmarking services like del.icio.us. The links can be used like normal hyperlinks but encode a start and also an end point in the recording to reference exactly the passage selected by the user. Figure 3 illustrates how to take a lecture snippet and to put it directly to the user's personal bookmark section.

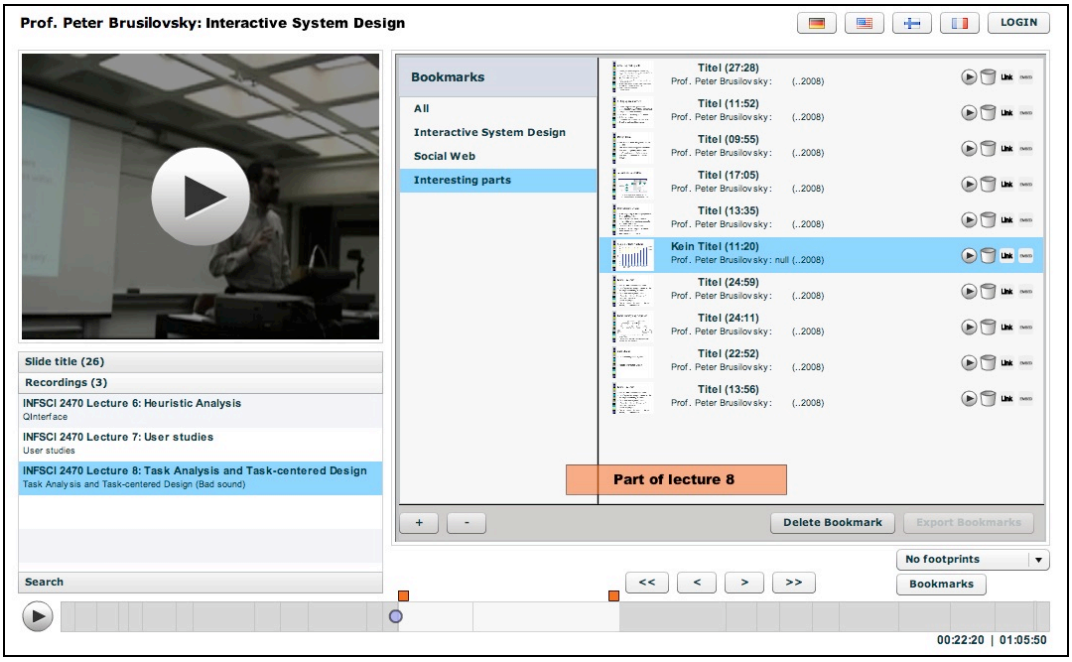

Figure 3: A passage of a web lecture is extracted. The selected snippet is marked blue in the time scale.

In order to select more relevant parts for personal bookmarking or for further automatic recording export, the social navigation features described in section 4 can be used as a helping guideline. Figure 5 depicts the necessary code parts for embedding lecture parts in external systems.

WEB LECTURE PARTS IN UNIVERSITY BLOGS

The virtPresenter interface can be used for enriching educational blogs, wikis and other web based learning systems with fine-grained full searchable lecture recording snippets. Each of these lecture snippets has navigation functionality and user access control. Figure 4 depicts the virtPresenter embed-player which is simply an alternative user interface created with the virtPresenter framework. The player shows the lecture video or the corresponding slides (if available) of the cut out lecture part respectively. If the information in the video snippet is not sufficient the user can change to the full version of the lecture episode (by pressing the virtPresenter home button). The timeline-based navigation features (Ketterl et al., 2007b) of the embed-player are similar to those used in the normal main interface (see figure 1). One major difference is that users cannot edit the blog episodes within the embed-player. This is only possible in the main interface.

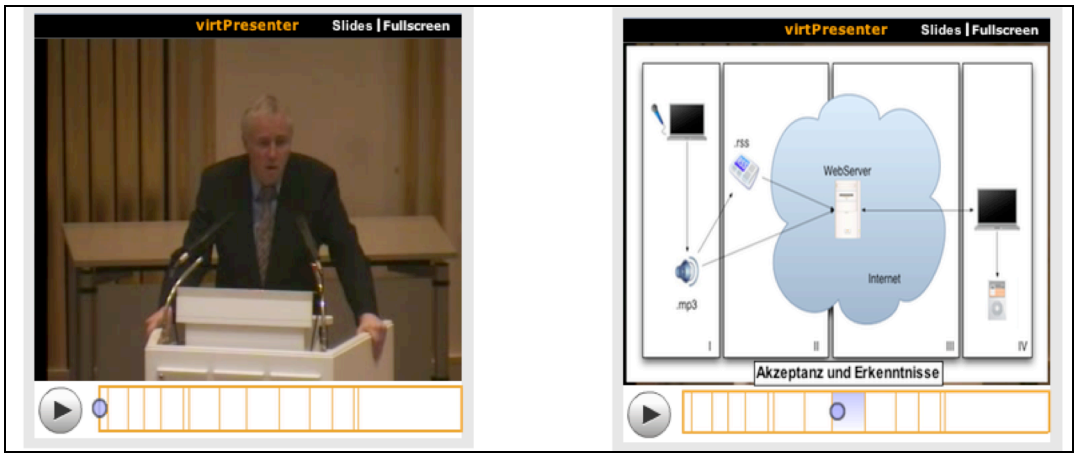

Figure 4: virtPresenter blog player in video mode (left) and slide mode (right)

When a user creates a lecture snippet, no new media files are created or converted. The base material remains the same. The embed-player uses only new time information for the cut-outs. The embed-player is a Flash application based on the same code base than the virtPresenter main application in figure 1 and can hence be integrated in a simple web page or wiki based site by pasting a link in the HTML source (see figure 5 right hand side "HTML Embed Code for web lecture snippets"). This link contains the address of the embed-player base application as well as an identifier of the video to be played and optional parameters for a start and end point in the video. When a user exports a bookmark as an embed-player link for a blog, it is wrapped in an embed-tag and copied to the user's clipboard. Wordpress based blogs (used in the university blog farm) do not provide the possibility to simply include HTML, object or embed code fragments without installing additional plug-ins. Free plugins that can be used to include additional data inside a blog entry are the EmbedIt plugin (EmbedIt, 2009) to include any HTML based syntax or the Kimili Flash Embed plugin (Kimili, 2009) to directly import any flash files for example. With the help of these plug-ins it is possible to integrate a lecture snippet in a blog discussion by just copying the bookmark link into the blog editor as shown in figure 5 left hand side. The embed-tag on the left hand side in figure 5 is formatted according to the Kimili Wordpress plug-in requirements installed in the university blog farm and thus differs from the HTML or the simple link fragment on the right hand side.

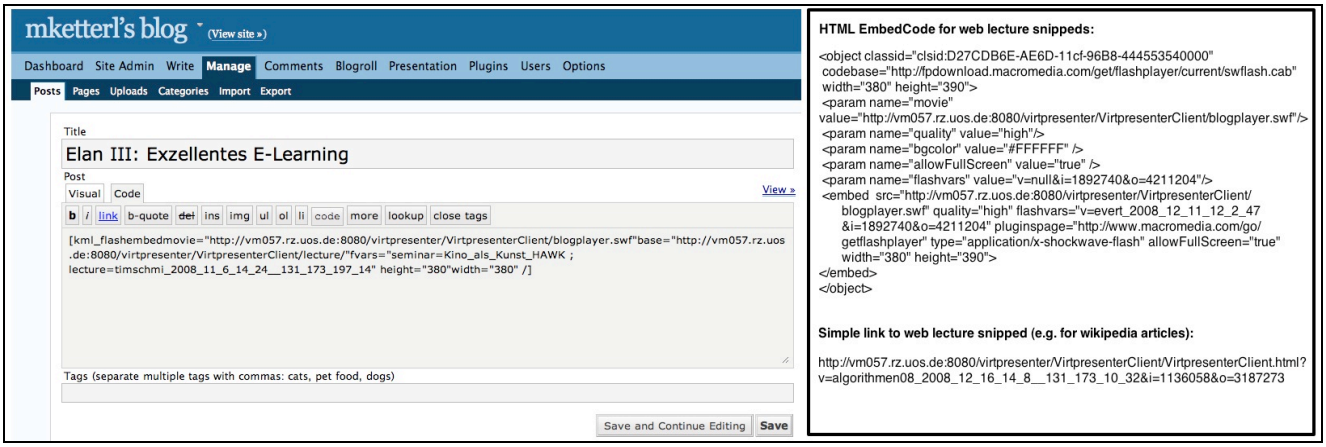

Figure 5: Embedding virtPresenter web lecture parts in external applications

The embed-player is based on the same technology as the standard virtPresenter main player and uses its bookmarks mechanism for parsing links with start and end points. The main benefit of this approach is that there is no need to convert videos, slides etc. again which can be very time-consuming, making users wait until the new (short) episodes are finished and available. Arbitrary lecture parts can be bookmarked, cited, exported and used immediately in new scenarios. An example of a blog discussion about an integrated web lecture part is shown in figure 6.

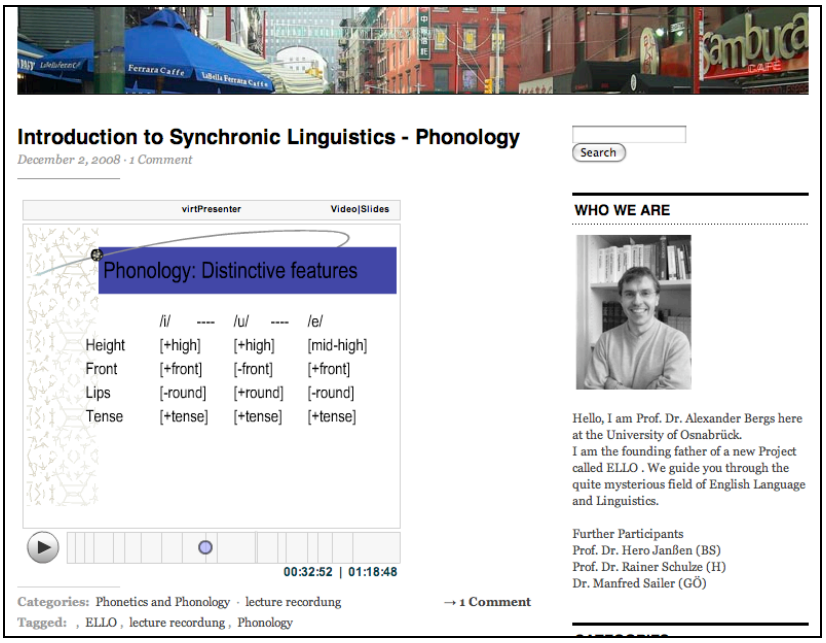

Figure 6: Web lecture snippet in a university blog

5. IMPLEMENTATION PERSPECTIVE

This section describes how common problems that arose during the implementation of the features described in the previous section can be solved. In particular, user administration and collecting data from user interaction has shown to be recurring problems. While this user administration might be a commonplace problem for most applications, they gain importance when users can interactively modify recording (e.g by creating, arranging and publishing their own bookmark collections). Collecting user interaction data from multiple views as well as multiple platforms (LMS, can be considered a special problem of bringing together web lectures and web 2.0.

WEB 2.0 AND AUTHENTICATION: SINGLE SIGN-ON

Whenever the Adobe Flex 3 based virtPresenter web frontend is started, it connects to the virtPresenter server backend which starts a connection that remains alive as long as the frontend is connected. If users want to access

content that is in any way access restricted, such as a non-public lecture, they have to log in. Users also have to log in to use their personal footprints or their bookmark collections.

In order to realize a single sign-on strategy and to facilitate user administration as well as content management, virtPresenter is coupled to the university's LMS Stud.IP as well as the university's content management system lernfunk.de (Mertens et al., 2008). A similar virtPresenter integration solution for the popular Moodle LMS platform is currently being developed. Figure 7 shows the relevant steps for user authentication in virtPresenter as described in (Emden, 2008). When a user is not logged in and tries to access an access-restricted lecture, the virtPresenter client requires the user to enter his or her access credentials. Then the latter are transmitted to the virtPresenter backend where a user session is started. This backend session in turn communicates with the LMS to authenticate the user. In case the access credentials are correct, it returns a token that identifies the user as a valid LMS user. This token can then be used to identify the user in a second authentication step. This two step implementation was chosen to simplify user authentication in case the user is already logged in the LMS and uses a bookmark link or the embed-player in an outside system.

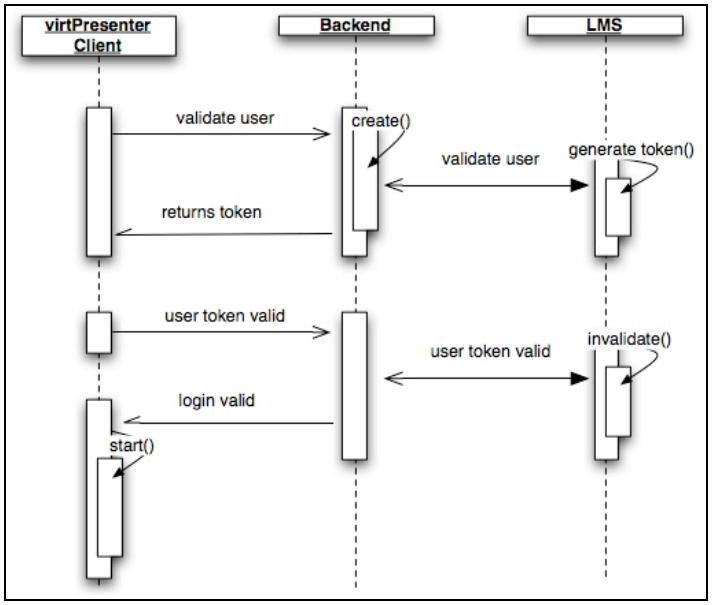

Figure 7: User authentication in virtPresenter

In these cases, the above described authentication process is simplified in that the user is already authenticated in the LMS. Hence, the virtPresenter frontend can be started with a valid authentication token. The backend session can thus handle user identification automatically without users having to enter their login credentials a second time (Emden, 2008).

When the token is validated by the LMS, a confirmation message is returned to the backend session. A positive confirmation message from the LMS Stud.IP web service contains a unique ID that enables the backend session to identify the user in its content database. This way, the backend server grants the user access only to the content he or she is allowed to watch.

BEHIND THE SCENES: COLLECTING INTERACTION DATA FROM MULTIPLE VIEWS

Lecture recordings created with the virtPresenter framework can be included in blogs and other web systems, as described before, as well as in other external platforms like YouTube and the iTunes music store (iTunes U) or as social network application inside Facebook. In order to design the web lecture interface to be as reusable as possible, virtPresenter implements the entire authentication, statistics and navigation functionality described in this article. Depending on the preferred content distribution channels, different kinds of data can be collected that help content providers identify how the material is used. Table 1 gives a brief overview about distribution channels for virtPresenter lecture recordings and also shows which interface versions are used. In addition, it also examines whether additional data (like how students work with the material) can be collected when a channel is used for distribution. Interaction data can be collected through the player software itself and is sent to a central

server for further analysis. Examples for collected data are: which platform is used, content playtime, search terms, additional links, user questions, how many users are online and also user feedback.

Distribution channel	*Main Interface*	*Embed-Player*	*Interaction data*	*Additional data*
public course websites	✓	-	✓	-
LMS (Stud.IP)	✓	✓	✓	✓
audio/video repository	✓	✓	✓	-
Blog	-	✓	✓	✓
Wiki	-	✓	✓	✓
Facebook	✓	-	✓	✓
YouTube	*	-	-	✓
iTunes Store (U)	*	-	-	-
podcast use / RSS	podcatcher	-	-	-
podcast in Blog, Wiki or LMS	Other plug-ins	-	-	✓

* closed platform

Table 1: Different content use scenarios

Table 1 depicts which player state is used in which platform to best fit to the system needs. Beside the information inside which system they are used and where the users come from, both player states (main interface and embed-player version) collect additional anonymous information like generated footprints that can be used to figure out content playtime, percentage of content use, which parts are viewed, a full web lecture or only a lecture snippet etc. This data can be organized in a database enabling further statistics that can be used in combination with data mining strategies or for social navigation (Dieberger et al., 2000; Mertens et al., 2006). As shown in the table 1, popular platforms like YouTube or iTunes do not provide feedback on the level of interaction data. Hence, gathering this kind of information requires the special virtPresenter player.

With the possibility to collect additional data (last column in table 1) the recordings can be enhanced with further information like useful links to other material or user comments and discussions. This is not only helpful for the students but also for the lecturer because new ideas and additional material can be included in future lectures.

Different lecture podcast versions created with the virtPresenter framework were also available during the project time (Ketterl et al., 2006) over rss subscription and different podcatchers. iTunes offers a ranking mechanism for content within the Music Store. With the latter a comparison between different podcast offers from educational institutions and others was possible. This has led to some kind of weekly competition. Apple itself never gave any advice concerning their internal ranking mechanism over the years. Sometimes the ranking appeared arbitrary and not transparent. In 2007, video podcasts available over iTunes produced a load of 1.3 TBytes every week for the university network. Due to the fact that (lecture) podcasts are mostly used standalone with podcatcher software (like iTunes) without any connected backend system, it is currently a great effort to gather feedback from the users. This is despite the fact that most of the students use them at home on their normal Internet connected computers (see Schulz et al., 2007) and not on the go with mobile devices like iPods. The university content providers do not know how the content is used outside without using special content players like the one described in this article.

With university wide single sign-on for university systems and web 2.0 mechanisms it becomes possible to use the best features from external platforms to improve the use of web lectures without re-implementing all features for our user interfaces.

6. USAGE ANALYSIS

Since 2008 the virtPresenter system has collected a comprehensive set of log data to give lecturers as well as developers the chance to see how web lectures and the involved technology is used in university and outside systems. Besides typical web application usage data, like video and web server statistics, the system collects

data based on socially generated footprints that can be used to calculate and compare the content usage within different systems.

The evaluated data set for the analysis described here consists of student users from eleven different lectures as well as users from outside, watching approximately 110 available lectures and conference recordings. All analyzed recordings were publicly available. Most of the users (~400) came from a first semester computer science course. The others were a mixture of different students and people from outside the university.

Figure 8 (left-hand side) depicts which platform the users typically use to watch the recordings. The Main Interface is described in more detail in section 4 of this article. The embed-player is used in university blogs, course wikis and inside the LMS. Figure 8 (right-hand side) shows the weekly average playtime of the available web lectures in hours from November 2008 through March 2009. For example, approximately 250h of material have been streamed to student users every week from November 2008 to the holiday break in December and again in January 2009. The decline towards the end of the year can be explained by the holiday break. The highest peak (540h content playtime) could be identified in the student exam phase in the beginning of February. More interesting is the fact that the weekly content use of the lecture recordings is generally high. The recordings are not only used in the exam preparation phase. The weekly playtime shows also that students use the content to compensate missed lectures or to solve exercises.

The data depicted in figure 8 on the left illustrates two things. First, it reveals that the embed-player is used in 23% percent of all accesses even though it is relatively new. This fact suggests that the embed-player is already well accepted by both students and lecturers.

Second, the Facebook integration is currently not that important for content delivery. One of the reasons could be that this version is in an early development state without much promotion. Another reason might be that Facebook is still not that popular in Germany especially within the group of student users. They typically use other social community platforms (like StudiVZ). Nevertheless, the virtPresenter version inside Facebook developed by the Social Network Application Group of the University of Osnabrück implements new and interesting features concerning user awareness and opens up contemporary possibilities to learn together in groups. Within the Facebook version it becomes possible, for example, to see if your friends are also online and whether they are watching certain parts of the recordings with you. Questions can be answered quickly with the help of the built-in Facebook chat.

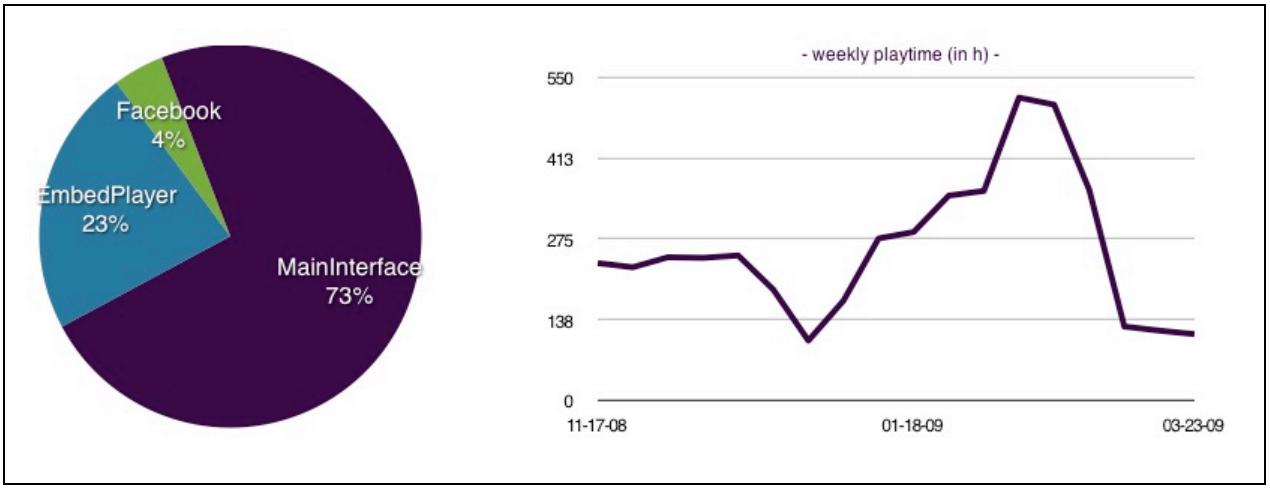

Figure 8: Lecture usage diagrams

7. CONCLUSION

Web 2.0 is widely considered one of the most important contemporary developments in the context of the World Wide Web. This article has briefly described current trends at the University of Osnabrück that show the importance of Web 2.0 for universities in general and e-Learning in particular. Given the impact Web 2.0 has on every-day life and on modern learning styles, adopting Web 2.0 ideas to web lecturing and integrating web lectures with Web 2.0 will make web lectures more attractive to users and supposedly more effective for learners.

This article has introduced three ideas that combine web lectures and Web 2.0 in order to show the feasibility of merging these two conceptually different realms. The basic bookmark feature has already been successfully

employed in earlier versions of the virtPresenter interface. The extended bookmark features described in this paper have to be evaluated during the next months. Social navigation is currently being evaluated in a two-term study. Blog integration is a feature that has just left prototype status.

Time will tell whether the combination of web lectures and Web 2.0 really is a worthwhile endeavor. However, first experiences gathered with the virtPresenter user interface, as well as the success of Web 2.0 based video portals such as YouTube, indicate that it is.

The main contribution of this article is a demonstration of feasible approaches that enable the connection of web lectures with Web 2.0 technologies. The article has not only shown how Web 2.0 interfaces for web lectures can be realized, it has also demonstrated how web lecture systems can be integrated with learn management systems and other platforms.

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