Alternative content distribution channels for mobile devices

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Abstract: Recently, the potentials of mobile devices have stirred interest in the e-learning community. This paper explores how podcasts can be used to enhance "classic" e-learning technology as well as how content can be produced, distributed and edited in a collaborative fashion.

1   Introduction

Mobile learning (m-learning) can extend the benefits of e-learning to a much wider range of teaching and learning contexts, e.g. regarding the access to information, personalized interfaces and learning anytime anywhere. Lecture recordings for example have shown to be a cost-efficient and easy-to-use way to produce e-learning content (Lauer & Ottmann 2002) especially in university contexts. Employing lecture recordings as supplementary material in a conventional lecture has become the most widely used application scenario (Krüger 2005) even though lecture recordings can also be used in a number of other ways (Mertens, Knaden, Krüger & Vornberger 2004). If students could use lecture recordings on a small mobile device, they can use them in completely new situations, e.g. while commuting on a bus or train.
Despite the possibilities raised by mobile devices, a number of problems ranging from content distribution to adequate application scenarios have to be considered. The most

important problem is how the media can be offered to the students in such a way that most students can access them without expert knowledge or hardware they can not afford. Section 2 shows that podcasting seem to be a promising approach in this direction. Section 3 describes how podcasts can be produced using existing lecture recording mechanisms. Combining classic lecture recording and podcasts can enhance both the classic web lecture and the recording.

Section 4 to section 7 describes different content distribution channels and platforms.

2   Podcasts

2.1   Introducing Podcasts

A distribution approach is utilized with the adoption of the podcast technology. The term podcasting describes the production and the automatic download of audio data from a publisher to a subscriber over the Internet.

The word *podcast* is a combination of the word *broadcast* and the name of the popular audio player from Apple Computer called *iPod*. It is a bit of a misnomer in that it implies that an iPod-player is required to listen to a podcast. In fact, a podcast can be used with a variety of digital audio formats and can be played on almost any audio player or computer (Meng 2005). Even on mobile phones it is possible to use podcasts. The term *podcasting* describes the production, distribution and the automatic download of audio data from a publisher to a subscriber over the Internet. The typical podcasting scenario is depicted in Figure 1.
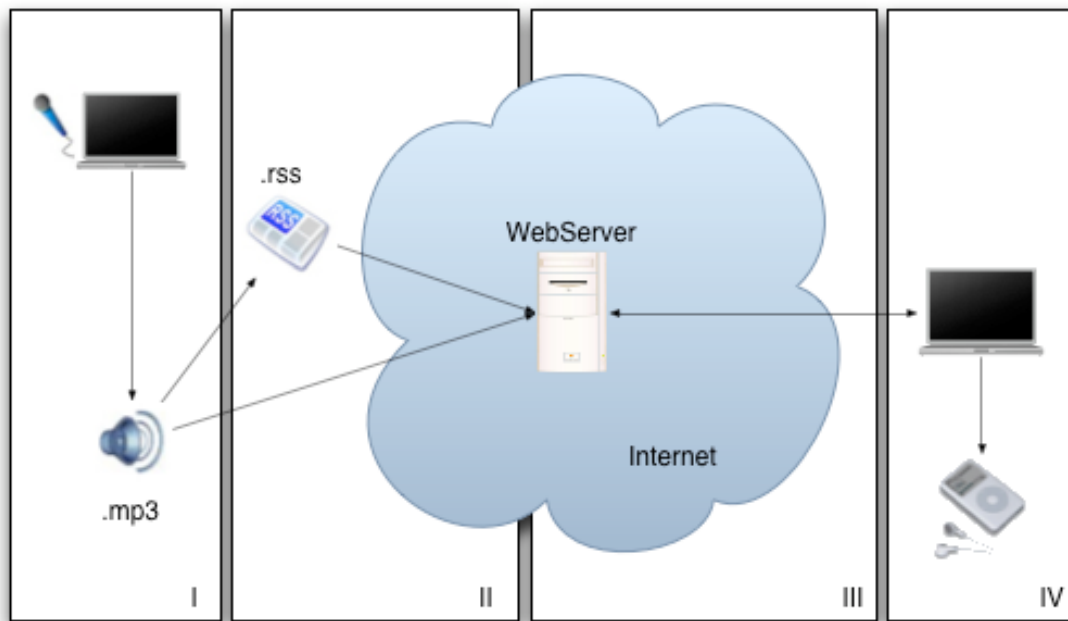

Figure 1: From the Producer to the Listener

I:	Record and edit your podcast contribution. Create an audio file with a microphone and a recording software on your computer. Convert it to space preserving and widespread MP3 or AAC format.
II:	Place your contribution on a webserver. Additionally create a RSS (XML structure) file which contains a description and the URL's (links) to the audio or video files.
III:	A podcast client software on the subscriber's computer keeps the user informed about new episodes and manages the data transmission.
IV:	Synchronize your mobile device with the podcast client software on your computer.

2.2   Podcast Client Software

Podcast client software lets users subscribe to and manage podcasts. Podcast clients or "podcatchers" exist for many platforms. Besides software for computer platforms (Windows, Linux, MacOS, Amiga) there also exist implementations for many mobile devices (Pocket PC, Palm, Smartphone, Symbian Phones memory cards and USB sticks).
Listeners don't need to buy new music player gadgets, they can use the device they already have.
Subscribing to (or unsubscribing from) a podcast is very easy. The listener only has to copy a weblink (feed URL) to the preferred podcatcher software (or simple deletes the link).
Normally the software runs as background service on a PC and reviews the feed URL after a specified interval. Users can choose to update podcasts at a specific time (for example every day or every six hours).
If the feed data has substantively changed from when it was previously checked, the program locates the new contributions and automatically downloads them to the subscriber's computer or even to the mobile device.
With podcast technology the explicit download driven by the user can be eliminated as the data is automatically handled on the receiver's end and downloaded to the playlist of the playback device as long as the receiver is subscribed to the cast. The latest updates are always readily available with no effort required by the listener.

2.3   Enhanced Podcasts

Enhanced podcasts do not only contain audio information, but also integrate new data information that can be synchronized to the audio information. E.g. an image or an URL can be shown at a certain time concurrently to the audio information in a synchronized manner. There are software tools available to support the production process as well as the consumption of enhanced podcasts. Most of them are free- or shareware. Like usual

podcasts, enhanced podcasts can be used on different platforms and devices. Players are available for Windows or Mac computers as well as for mobile devices.

Enhanced podcasts based on recorded lectures offer a very interesting approach to support the ubiquitous learning process. With the combination of a fine granulated structure of a recorded lecture (as described in section 3), an enhanced podcast allows a very precise navigation to specific content of a lecture that can be used anytime and anywhere.

2.4   Video Podcasts

The next generation podcasts are called video podcast (or vodcast, videocast). Vodcasts are the video equivalent of a podcast and contain, as the name implies, video information instead of audio. Video podcasts can contain downloadable video files but also streaming sources. Therefore it is more difficult to create a vodcast than a simple audio podcast.

The problems with the comprised multimedia contents are versatile and it is a big step from a simple audio podcast to the video content in a videocast.

Producers have to keep in mind, that there are a lot of different video codecs, formats and also resolution diversities. As a result the production and distribution depends on the capacity and features of the client device.

This seems to be one of the reasons why audio podcasts are more popular than video podcasts. Nevertheless the automatic download step of the latest episodes is certainly again a very important feature, because subscribers don't have to select items or channels on their tiny hardware displays.

The video content in a vodcast can also be split into chapters. Some podcast clients can navigate through the created chapters. An adversarial problem is presently that mobile devices (like the video iPod) cannot use this video chapter features.

3 Acceptance and Dissimination of Podcasts

Both universities, the University and the University of Applied Sciences of Osnabrueck are using an open source learn management system called Stud.IP (Stud.IP 2006).

This LMS is an inherent part in both university sceneries since 2004 (Hamborg & Knaden 2004) with about 18.000 participating students.

A survey in Stud.IP at the University has shown that 45% out of 314 participating students would use podcast technology. 47% indicate that they sometimes listen to lecture recordings. The rate of students indicating that they wouldn't use (or can't imagine to use) this technology was about 8%.

In fact american universities are still encouraging the creative use of mobile audio devices in education and campus life (Duke 2005). At the University of Duke every first year student was equipped with an iPod.

So it is possible to use podcast technology for whole classes and extensive university projects.

4 Combining Lecture Recordings with the Podcast Technology

Recordings of lectures are a cost-efficient and easy-to-use way to produce e-learning content. In a university context with tight financial constraints they can only be used if the production process is automated to a high degree and a manual intervention is not necessary. At the University of Osnabrück and at the University of Applied Sciences Osnabrück, an automation approach that uses the Stud.IP LMS (Learn Management System) for content distribution is currently under development (Mertens, Knaden, Thelen & Vornberger 2005) and being tested. It is designed to feature a fully automated production chain from starting the presentation to linking it to the corresponding course. A concept for integrating podcasts into this production chain is described in (Ketterl, Mertens, Morisse & Vornberger 2006).

Building on the production chain for the web interface, slide synchronization data and images of the slides are extracted automatically from the material that is used to generate the web interface (left in Figure 2). This way, one source is used for multiple output channels.
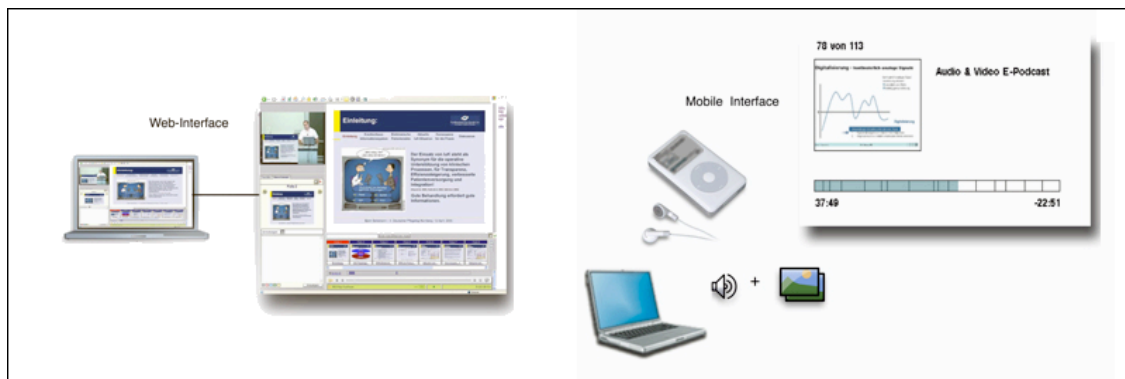

Figure 2: virtPresenter lecture recordings for different devices

The information presented in the podcast therefore closely resembles the information delivered in the web lecture. The web lecture interface offers a hypermedia navigation concepts that allows fine grained navigation in the recording (Mertens, Schneider, Müller & Vornberger 2004). It also incorporates a shared bookmark feature that can be used to externally communicate about arbitrary clippings of the recording (Mertens, Ickerott, Witte & Vornberger 2005).

This makes the podcast a lightweight version of the web lecture that adds the advantage of mobility (right in Figure 3). Students can use the mobile recording to review parts of the lecture and they can use the web interface for tasks involving search, navigation and communication. While more sophisticated navigation facilities can currently not be supported, navigation on the slide level is implemented in the mobile version.

The lightweight interface version is currently supported by Apple´s iPod & iTunes Software (described in section 6) and field-tested at the University of Osnabrueck and the University of Applied Science Osnabrueck.

5 Bluetooth

Another distribution approach is utilized with the development of a point of information (POI) for content distribution purposes (Ketterl 2004). The aim of this POI is the research and implementation of an area-restricted media service offer for mobile devices. However, first and foremost is the requirement of a content distribution service for learning purposes, which is free of charge to the user. For this reason, the POI relies on the bluetooth radio technique, as this is now readily available and capable of good performance and above all it is free of charge for the connection and transmission. Another central issue are the capabilities of our daily used equipment regarding the development and the presentation of different media contents.

The POI server is able to offer and distribute media objects of different formats. Apart from the reduced transmission range (depending on the bluetooth power class of the used bluetooth device) the only restriction is the efficiency of the mobile device. Bluetooth lets these devices talk to each other when they come in range, even if they are not in the same room.

The size of a lecture (audio) podcast is about 75 MByte and is encoded in MP3 or AAC audio format. This might be a problem for some devices, because some cell phones do not support these formats nor have enough memory to store the information. The POI-Server therefore converts the audio information to the widely supported AMR-NB mobile phone audio format. After that the POI Server sends the converted podcasts to nearby devices. This distribution approach seems to be a promising way for future mobile products, therfore the efforts in this project are going to be expanded and further developments and tests will be conducted.

6 iTunes

An easy and promising way to publish content for many devices is Apple's iTunes software. iTunes is by far the most popular podcast client (Meng 2005). The reasons for this fact are manifold. A main point certainly is the simple handling of different file types (Video & Audio: MP3, WAV, AIFF, MPEG4, Apple Lossless, M4P/AAC Protected Content, and a variety of QuickTime supported media formats as well) and several media resources (user library, streaming video/radio server).

A further point is the seamless integration of the Online Music Store. The iTunes Music Store is an online music store run by Apple Computer through its iTunes application. Apple's iTunes Music Store lets customers search within an enormous catalogue of tracks, including music from all major labels. A user can perform searches by specifying criteria such as artist, composer, title and genre. Besides the commercial music offer one can also find free of charge podcasts and video podcasts with different matters and derivations. These podcasts can be uploaded by anyone registered in the iTunes Music Store. To prevent copyright abuse etc., content uploaded is checked by Apple before it is published. This procedure usually takes around one day.

Due to this easy way of publishing, producers can use the music store to reach many listeners or viewers. The University of Osnabrück and the University of Applied Sciences Osnabrück have already integrated three lectures in the store.

To subscribe to one of these podcast lectures simply perform a search by name „Morisse" or „Osnabrück" in the iTunes Music Store.

6.1 iTunes University

Apple has launched a service called iTunes U (iTunes University) that provides free hosting for universities who want to make lectures and other audio or video content available to the public.

„Students expect a campus environment that accommodates their digital lifestyle, adapts to their individual learning needs, and encourages collaboration and teamwork. Introducing a way to simplify and meet all these needs - iTunes U.“
(iTunes University 2005)

The new service has already been piloted at a number of universities like Duke, the University of Missouri, the University of Michigan and Stanford.
For example Stanford on iTunes provides access to a wide range of Stanford-related digital audio content via the iTunes Music Store (Stanford on iTunes 2005).
All these universities are collaborating with Apple Computer to allow public access to a wide range of lectures, speeches, debates and other university content through iTunes.
The iTunes U looks like a customized iTunes music store. University colors, photos and logos can be integrated to make iTunes U look familiar to staff, students, and alumni.
Students can access the special music store using their university ID with a password and subscribe to the classes that they want to. There is no possibility to reach the non public university content throughout the regular music store or through other tools.
Because of this features iTunes U can become a very interesting platform for universities to share content in an easy to use, closed and secure environment.

7 PmWiki

A wiki is a web application that enables any user to easily add and modify content of a collection of interlinked snippets of information. (Langreiter & Bolka, 2005)
This functionality makes wikis excellent tools for collaboration in an online environment. There are many different wikis, called wiki clones. Wikis have a variety of features, such as user authentication, which are useful in an e-learning setting.
However, not all wiki features are enabled by default upon installation. Implementing advanced features sometimes requires the location and manipulation of individual lines of program code in the wiki source files. (Augar, Raitman, & Zhou, 2004)
User authentication is a very important feature for e-learning scenarios in a university context (e.g. to associate content to a specific person). Choosing the right wiki depends on the required features. (Tonkin, 2005) PmWiki is a wiki-clone written in PHP and a system for collaborative creation and maintenance of websites. It is easy to setup and to maintain and fits well in the existing LMS Stud.IP environment of the universities in Osnabrueck. An important feature of PMWiki is that it can be configured in a way that authors can easily upload and attach many different file types to pages. Thus it becomes possible to use even podcasts in a collaborative way.
There are two projects at the University of Osnabrück and at the University of Applied Sciences Osnabrück which are investigating this new collaboration approach. One is a seminar in which members of a group of students create podcasts together in a wiki-like way of collaboration. The second project is using podcasts in preparation for course

meetings. These didactic models can be applied to fields of studies where students exhibit a natural interest in creating media, music, fiction or art. Transferring this approach to other fields of study like natural sciences will not be feasible without crucial changes to the didactic design. Alongside to the mentioned projects many other pedagogical implications are conceivable (Meng, 2005).

8 Final Conclusion

This paper has presented new ways for using mobile devices in an educational context.
The combination of new technologies like podcasts, bluetooth and PmWiki can lead to new application models for e-learning scenarios.
Based on an existing workflow for lecture recordings, which are offered to the students over the internet, the production chain has been extended to support mobile devices as new platforms for the playback of lecture recordings. Podcasts are gaining more and more attraction. They offer an attractive possibility for students to listen to recorded lectures e.g. while traveling. The paper has described how the production and content distribution of podcasts could be realized in a convenient way. Moreover some requirements for didactic scenarios have been presented.

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