Drag and Drop Streaming: an Inexpensive Method for Recording and Delivering Lectures is Becoming the Next Revolution in E-Learning

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Abstract: We have developed new opportunities for faculty to deliver recorded classroom lectures via the Web. These have proven to be a revolutionary and affordable means to improve the quantity and quality of course materials used for E-learning. In addition to E-learning, VNet is also enhancing learning in the classroom. When students miss a lecture, they typically beg a classmate to borrow the notes, or pray there is no quiz the next day. But at institutions like the University of Houston (UH), begging and prayers are no longer necessary: Students simply log onto a web base system. There, digitally captured lectures in over 100 courses are streamed within moments of a class meeting)...

Introduction

VClass is a web-based course management environment for students and professors that among other things completely automates the process of publishing lectures in a streaming format. VClass was designed to be user friendly to even users with the most minimal computer experience. Educators use this powerful streaming automation tool to provide students with almost instant video versions of their class lectures through the web without requiring the intervention of technical staff. Students have 24/7 access to course content, information, and materials at any time, from any location where they have access to the Internet. They can also upload their finished assignments for instructors to view and grade. Streaming lectures can be accessed even through dial-up Internet connections (see Apple 2005).

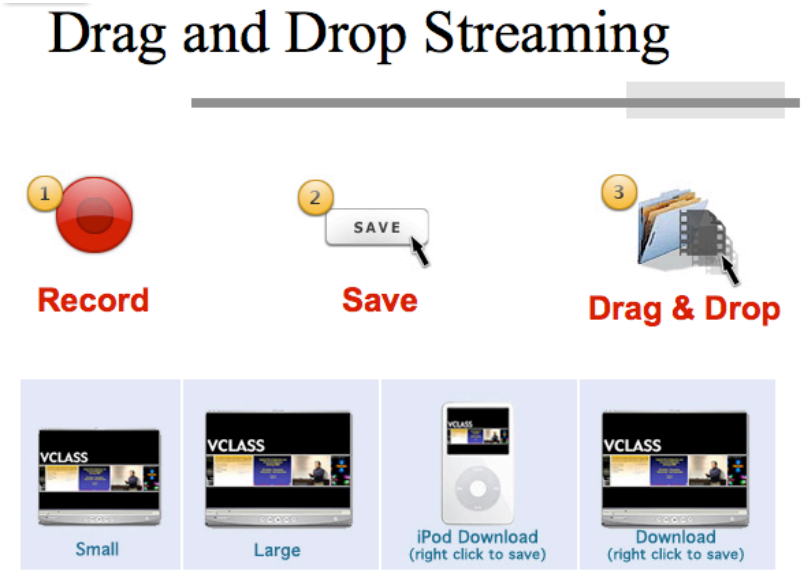

Figure 1: Drag and Drop Streaming Steps and File Formats

The streaming compression and everything else is done by VClass — you don't need staff to publish it! It's completely automated; so all the professors on the campus can stream their classes every day without any problem, if they wish. Plus they can post any course-related materials, such as handouts, practice problems, PDFs, and more. VClass helps overcome the spatial and time limitations of the classroom environment, adding a new channel of communication between student and teacher, and greatly enhancing the learning experience (see vnet.uh.edu 2006).

Our objectives for this presentation are: present a new approach to deliver recorded streaming lectures that does not require extensive technical support personnel or expensive equipment which are usually required for traditional streaming methods; show how Drag and Drop streaming has been key in getting professors to use emerging technologies like tablet PCs to record and publish their lectures daily for their students; demonstrate how daily lecture's recording improved the educational environment at numerous US universities using VClass; discuss how daily recording of real classes can be an instrumental tool to help increase not only the number of long distance education courses but also their quality and effectiveness (see Báez-Franceschi & Le &Velez 2004).

Teaching Experience

The two faculty authors associated with this paper use digital streaming in 5 courses. Some of these courses were converted from existing courses that had been taught in the more traditional fashion for many years, and Power Point presentations were developed from existing course notes. At least one course was developed from scratch for digital streaming.

Initial Issues

In the initial semester of use, several problems were encountered. Some were related to the unfamiliarity with the system, compounded by students interrupting during the start-up process. These problems have largely disappeared as instructors became more familiar and comfortable with the system. Outside of the classroom two initial problems were encountered. Poor audio quality was an initial problem, now resolved. A more significant problem was associated with uploading lectures to the server. Initially this took a long time (up to 20 minutes or so) and commonly required the assistance of an IT person. Currently this process takes only a few minutes and can be completed without IT assistance.

Faculty Reaction

Ease of use is an important factor when attempting to incorporate technology into any system. VClass digital streaming has evolved and improved over the semesters that it has been used at the University of Houston. At this point there is minimal contact with IT personnel as the system is very user-friendly. Using tablet PC's and associated electronic pen have allowed the instructors to teach facing the class with the benefits of maintaining eye contact with students (see Microsoft Corporation 2005). In addition, having access to recorded lectures allows instructors the opportunity to review and improve their presentation techniques. In courses taught thus far, there does not appear to be any obvious erosion of attendance. Faculty, who initially expressed skepticism when first asked to use the system, have largely embraced VClass despite the initial problems experienced during the early semesters of development of the system. At this point, operational problems are minimal, and faculty who are open to trying new teaching experiences will quickly adapt to this teaching innovation (see McNamee 2006)

Student Reaction

Discussions with students have revealed that they like the availability of the lectures in the digitally streamed VClass format and they use this resource in three basic ways.

1. Students spot-check certain segments of the class when they have a specific query or problem understanding the material.
2. Students view the entire lecture. This typically occurs if a student misses a class. In one case a student missed three classes when she traveled to China in the middle of the semester. She was able to access her classes in China. In a second example, a junior college student using VClass was able to continue and complete classes after his unit was posted to Iraq.
3. A few students have indicated that they viewed up to as many as 14 lectures prior to a major exam. Students commonly performed screen captures to generate a hard copy of slides used in the classroom presentation and incorporated these documents into their class notes.

VClass Technical Overview

This section covers information about the technical aspects of VClass.

Original limitations

The problem of recording lectures and publishing them on the www in an efficient and sophisticated manner had to be solved. We needed to minimize human intervention and effort in this process.

To summarize, in order to publish a recording on the www the following steps are involved:

1. Audio/Video Capture: The task is to identify what is the most important part of the lecture. Is it a visual of the professor, his/her writing on the board, a view of the class, or is it a view of everything combined? Many classes today are conducted with the aid of some kind of presentation software tool like Microsoft PowerPoint combined with a projector. In that case what should be recorded? A view of the screen showing the projected slides.
2. Recording hardware and manpower: The hardware needed to record the lecture could be very expensive. Also if we wish to follow the professor and keep changing focus from him to the lecture (slides, black board) we would probably need someone to operate the camera and do the recording. So for the case of a university, school or college with several courses being taught simultaneously this would mean having high quality recording equipment and at least one person for each class. This could be very costly and non-practical. There would also be other things needed, such a mount for the camera and a studio for the recording. This should give the reader some idea of the issues faced in capturing a class lecture.
3. Video editing: In order for the video to be ready for streaming over the Internet it has to be processed and hinted. Processing: The original video would probably be recorded with extremely high quality. It would need to be processed to make the size smaller with minimum quality reduction so that it can still be sent out over the Internet. This would include compression of the video. Hinting: Even when the size of the video has been reduced, it still cannot be made available the way it is for download since a 100MB or even 10, 15 or 25 Mb file would take long periods of time to download depending on a person's Internet connection speed. Therefore, the most desirable option is to stream the file over the web. Streaming technology has become very sophisticated and our solution makes full use of it. Hinting is the process of changing the format of a file to make it ready for streaming. To do both hinting and processing would require a skilled technician with the right software and editing tools. To perform this process for each course lecture would be very time consuming.
4. Publishing on the web: As soon as the file is ready for streaming it should be available on a website. Traditionally this would mean hiring a web-site developer to perform this function and link the appropriate files to a web page.

All the above limitations hinder educational institutions from recording their classes and publishing them on the Internet.

We propose a model and a solution to these problems, which revolutionizes distance education. Our solution is cost effective, requires little human intervention and is completely automated (see Geanangel & Báez-Franceschi & Hazelrigg & Doan 2003).

1. Sound/Video Capture: Instead of using a camera why not use a Tablet PC or Wacom tablet. The following is a brief introduction about Tablet PCs quoted from Microsoft.com:

   "Computers powered by the Windows XP Tablet PC Edition operating system, and equipped with a sensitive screen designed to interact with a complementary pen, are called Tablet PCs. Tablet PCs are fully-functional laptop PCs and more. You can use the pen directly on the screen just as you would a mouse to do things like select, drag, and open files; or in place of a keyboard to handwrite notes and communication. Unlike a touch screen, the Tablet PC screen only receives information from a special pen. It will not take information from your finger or your shirtsleeve—so you can rest your wrist on the screen and write naturally. By interacting directly with the screen, rather than with a mouse and keyboard, the PC becomes more comfortable and easy to use. There is no need to find a flat space on which to use your PC, nor does a vertical screen become a dividing wall between you and the person with you whom you are meeting.

What's more, a Tablet PC can even be used while standing up, which is perfect for professionals on the move such as doctors, foremen, and sales managers."

A Tablet PC connected to a projector makes it the ideal tool for presentation of a class lecture. A screen capture software such as Camtasia, is used to record the entire lecture (every activity with the computer) including the audio. A wireless transmitter/receiver microphone allows freedom of movement of the instructor (see Camtasia Studio 2006). This is recorded as a movie file.

2. Video Editing: Once this part is complete the professor logs into his course on VClass and simply drags the file from his computer desktop (or whichever folder) onto the browser window and that completes the process of uploading the video file into VClass.
3. From there, using scripting technology we have automated the process of compressing and hinting the movie using software such as Quicktime. As soon as the file is uploaded to the server the server processes and hints it to make it ready for streaming. The script simply launches Quicktime, processes and hints it and makes two versions. One optimized for dial-up Internet connection and the other for Broadband. All this is done on the server and the movie is ready within a very short time depending on how many movies are in the queue.
4. Web Publishing: Once the movie is ready, the link in VClass pointing to that movie becomes available and ready for streaming.

Bandwidth Issue

Campuses may have high-speed Internet access. However off campus locations still suffer from lack of bandwidth. Our solution caters to people with all kinds of Internet connection speeds as low as dialup.

Architecture

We have discussed the process of most of the model above. Now let us focus on VClass. Course management is made very simple using VClass. The part we would like to mention about VClass is its file management system. It is just like using your personal computer with a secure way to access and arrange your files and folders however you may want. You can create, delete, rename and update files and folders just like you would on your computer. The files in this case are resources you have uploaded. Uploading in VClass is as easy as dragging a file from your desktop and dropping it into VClass. What we have is an adaptable system for any environment from educational to commercial.

User-friendly web interface

The key goal in our web interface was to keep it simple, so that it can be used instantly without any prior training. Every function provided is made obvious in the interface.

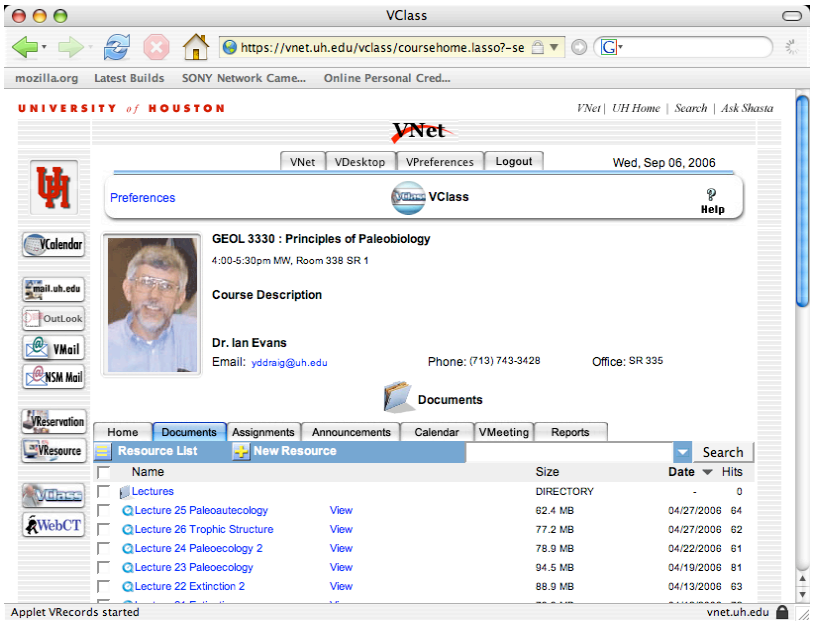

Figure 2: VClass Course View

Web Engine: We are currently using an affordable, reliable and scalable web engine. However our future plan is to use a completely open source Web Engine such as one using Java.

Database Server: Using an open source database server makes it more cost effective.
VClass is very flexible and scalable. An abundance of other features besides streaming includes:

- A complete course management system from streaming lectures to downloadable files
- Drag and drop file upload
- Assignments
- Calendar
- Reports
- Class statistics
- Sophisticated search technology

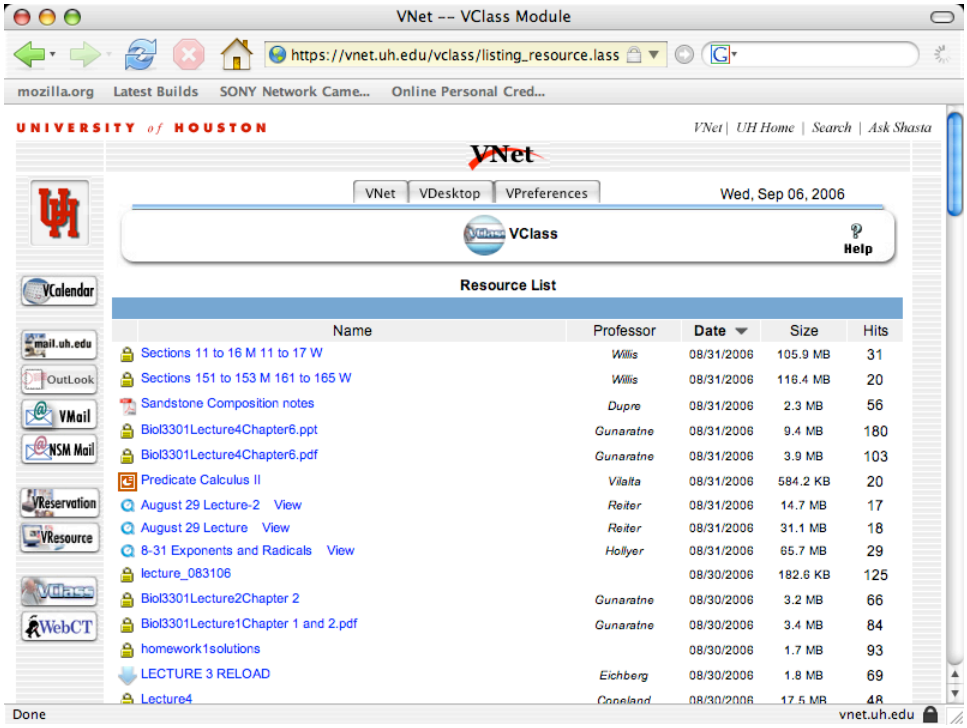

Figure 3: VClass Search Results View

Future Aims and goal

- **Providing subtitles and captioning** in different languages for recorded lectures using sophisticated speech recognition technology. The goal of VClass is to reach across cultural barriers such as language. We are working towards a solution that will enable a lecture recorded in one language to be available in several different languages using captioning. The key issue is speech recognition and overlapping the captions with the corresponding video frames.
- **Advanced Search:** The captioning will allow users to also search on the audible content of the video. Also we aim to be able to search on content of uploaded files besides video like PDF, Word and Excel amongst others.

Conclusion

The new opportunities that VClass brings to faculty to deliver recorded live lectures via Web has proven to be a revolutionary and affordable means to improve the quantity and the quality of course materials used for E-learning. Despite its powerful capabilities, VClass greatly reduces the cost and complexity of bringing advanced, Internet-based services to students, faculty, and staff. VClass helps overcome the spatial and time limitations of the classroom environment, adding a new channel of communication between student and teacher, and greatly enhancing the learning experience. This ease of use has converted many faculty skeptics who initially resisted the implementation of this system.

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Acknowledgements

Our thanks to the VNet team, UHIT staff, NSM Dean's Office staff, professors and all students who have made this project a success and therefore this paper possible.