Bringing Your Distance Class to Your Student's Desktop

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Abstract

This paper deals with the distance delivery and allowing your remote students to be able to view and even possibly participate as the class is happening from their desktop. The paper details the strategies, hardware, software and student computing requirements to be able to participate in either the live Internet delivery of a class or an encoded (archived) version.
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1. In the Beginning

In the beginning we started teaching classes face to face with our students.   Then came the advent of the correspondence course that provided students the opportunity at a distance to be able to complete course work without attending a local campus center. Enter the era of the Internet and the correspondence class goes electronic with assignments posted on a Website and assignments received via electronic mail. Students of this method of distance delivery then felt a desire to be able to participate in a fuller and richer experience. At Dakota State University this concept of being able to watch and listen to what was happening in a classroom was spurred by a student enrolled in a totally text based distance course.

2. Encoded Video – The First Method

Based upon a campus visit by a distance student who was taking a CSC 150 Principles of Programming course utilizing only a Website asked if he could visit the campus and actually attend a class session. In a follow up conversation the underlying theme revolved around the student's positive impression of the synchronous interaction that was happening in the classroom. He felt so strongly that he was not gaining the full benefit of the course without this synchronous

opportunity. He returned to campus a second time and it was following his second-class visit that a concept was born.

Fortunately this student was currently employed with South Dakota Public Broadcasting and that agency was just beginning to utilize some of the early techniques of using the World Wide Web for the delivery of both audio and video transmissions. The student indicated his organizations willingness to assist with the encoding of class sessions for later utilization on the World Wide Web using the Real Player technologies. While this still presented materials in an asynchronous format it was great improvement over a static web page.

The initial plan was developed where the class would be taught not in a regular classroom, but rather taught in a studio that was designed for the purpose of delivering courses via a statewide system for two way video and two way audio. The original studio was primitive by today's studio standards, but did allow for the most important element which was the capture to video tape the presentation by the professor, but more importantly the opportunity for students at a distance to be able to hear and see the synchronous interaction that was happening within the classroom. As we all know a question asked by one student is the same question that lingers in many other student minds.

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Once the class was video taped it was decided that a statewide courier service would be used to transport the tapes from the Madison campus to the video studios for South Dakota Public Broadcasting in Vermillion. It is a distance of approximately 100 miles, but with the courier schedule it was a two-day trip to get the tape to the studio. Within 24 hours of receipt of the tape it was encoded and placed on a South Dakota Public Broadcasting video server where the professor was able to create a link for current distance students to then view that class session a mere three days later. This was by no means a perfect system, but was the start of concept that has eventually led to the live delivery of the classroom to the distance student's computer desktop.

3. The Next Iteration

The next iteration of the process was to eliminate the dependency on the courier service for the delivery of the videotape to the studios of the South Dakota Public Broadcasting. This required the purchase of software by Real that would allow the encoding of the video on the Dakota State University campus. In addition a server was dedicated to the storage and dispensing of the encoded lectures. The time was greatly reduced from the previous three days to now less than 24 hours. A slightly improved studio was utilized and the tapes were then delivered on campus to a computing services office where both the encoding machines and the video server were housed.

4. The Advent of Live Video

It became a short transitional step from the video tape archive to the use of live video to the desktop of the students. There was no need for additional hardware or software on the student side. On the server side the Real Sever software was upgraded to allow for both the live video broadcast as well as the encoding.

The system that is now in place allows a class to be broadcast live on the Internet and while that is happening the lecture is being archived and shortly after the class is completed it is linked to the course website for students to view.

This enhancement has been well received by both faculty and students. It has allowed for more rapid encoding of lectures, plus truly brought real time education to the desktop of the student.

These enhancements were able to be made without having to add any additional cost to the students and were very low cost to the institution. These enhancements are now available to all distance students and faculty. Therefore it is difficult to project a total number of students who have participated in this mode of delivery.

The authors feel that the use of video to the desktop has actually reduced the amount of time necessary to prepare for a distance delivered class as the website and materials send to students does not need to be as detailed.

5. The Studio Configuration

The studio serves multiple purposes. It is used for delivery of statewide two way video and audio transmissions. It is used for the live Internet broadcast as well as the encoded video. Each studio has an approximate equipment cost of $40,000 and includes the following components:

Quantity	Description	Cost
1	PRO Galaxy Codec - Includes (DDM card, Cable, Kentrox 72651	$14,801.50
1	Camera Control System	$ 7,168.00
1	JBL Control 1 Speakers and Pair of Brackets	$ 223.00
1	Audio System Includes 24 Extra Mics, Cables and Mixers	$ 8,893.00
1	TV?PC Converter	$ 94.49
1	13" TV Podium and Instructor Stations	$ 249.00
1	Sharp Projector and Ceiling Mount	$ 4,356.00
1	Rack System	$ 814.90
2	VCR's	$ 59.99
1	Video Mixer for Picture in Picture	$ 1,079.00
1	ELMO EV-400AF	$ 1,661.81
1	Cordless Telephone	$ 59.99
1	72" Smartboard	$ 1,619.00
1	Smart Sympoodium	$ 4,029.20
1	Cables	$ 1,525.00
	Total	$46,693.87

Please take special note that this configuration is not required for doing the live Internet, but rather is used for many other purposes on the campus to support other state of South Dakota video initiatives.

The outbound transmission from the studio is handled by a V-tel system4 that connects to the State of South Dakota bridge system. It can broadcast at either H320 or H323. The V-tel software is housed on a Pentium III 350 computer and uses AMX technology for controlling the broadcast image.

The studio provides microphones on each of the tables. They are positioned so there is one microphone per two students. The microphones in the Dakota State University studio are on all of the time. This provides more of a challenge and need for stronger classroom management. Most of the statewide studios are equipped with push to talk microphones.

The following enhancements have been added to the State Wide based V-tel system at Dakota State University:

A designated computer used as an instructor station that allows for the installation of specialized instructional software. This frees resources on the minimal V-tel computer. This system is currently another Pentium III 500 computer that has 128 mb of Ram and a 13 gb hard drive. It is connected to a Sony VPL-PS10 Superbright LCD projector[5]. The Sony serves to project the image from the computer and is the image that is used to provide navigation assistance for the Smart Board. The connection from the computer and the television is S-video and connects into the V-tel system via a videonics connection.

The SMART Board is an interactive whiteboard that turns your computer and projector into a powerful tool for teaching, collaborating and presenting. With a computer image projected onto the board, you can simply press on its large, touch-sensitive surface to access and control any application. Using a pen from the SMART Pen Tray, you can work naturally at the board to take notes and highlight important information[3].

Other additional items include a video mixer that will allow for the use of picture in picture technology. Thus if a PowerPoint presentation or programming code demonstration is being done there is the potential for the student to still see the instructors picture with a picture in picture option on the screen. A wireless microphone that does not tie the instructor to a specific location in the room is utilized. The studio room also has added cameras and software that will allow the camera to follow instructor.

The studio additionally contains three smaller monitors that are panels. They are mounted in a cabinet and enable the instructor to easily see what the students at the remote site are able to see, and what is being transmitted to the remote sites as well is being displayed on the instructor station.

6. The Physical Layout of the Studios

On the Dakota State University campus there are currently three dedicated studios that are used for recording, live broadcasting and other teaching. In addition we have purchased a portable studio configuration capable of doing live broadcasting as well as encoding. That configuration will be described in full detail later in the paper.

One of the studios is named the Dakota Digital Network (DDN) studio. It is configured like multiple other studios across the state in both higher education institutions as well as all of the K – 12 schools across the state of South Dakota. The DDN studio has seating for 32 students.

Another studio is named the Governor's Electronic Classroom and it is configured similar to a studio that has been provided on each of the other five state campuses. This particular studio has the feature of having computers installed and there is one computer for every three students. This configuration houses 27 students.

The third and newest studio is called the Star School studio. This studio has been provided as a part of grant and is similar to what other College of Educations across the state had received. This studio will have seating for 32 students.

All of the above studio configurations are cable of doing live Internet broadcasts as well as encoding of the video for later posting to the website.

7. The Encoding Machine

The encoding and the live broadcast is handled by the same system. The system is a Pentium III 1000 and has 256 mb of RAM and an 18 gig hard drive. The computer uses an Osprey 101 Capture card[6] that is connected directly to a VCR which becomes the mechanism for recording to tape, digitizing the signal for live broadcasting, and storage on a hard drive on the video server. The software that is used on this system is the product by Real and is called the Real Producer Plus[7]. The cost of the Real Producer Plus is $1,999.95.

The Real Producer Plus handles the live Internet broadcast, the Digitized files that are stored and linked for later viewing. The same software can be used to edit the digitized files.

On the student end to view the classes they need a computer that has Internet connectivity. Optimal viewing is possible using some type of a broadband connection such as a cable modem. Students have been able to view either the digitized lectures or the live lectures using a minimal 56 K modem for a dial up connection. The power of the computer is less important than the speed of the connection. At a minimum students have reported having success with a lower end Pentium II computer. In addition students who want to participate while the class is being live broadcast will need to have some type of other phone connection which may well be in the form of an additional land line based phone or even a cell phone if they are using their phone line for connection to their Internet Service Provider.

8. More on The Real Products

The minimum systems requirements:[8]
> 233MHz Intel Pentium II processor
> 64MB of RAM

28.8Kpbs modem (audio only)
16-bit sound card and speakers
65,000-color video display card set to display at 800x600 (video)
Windows 98, Windows 2000, Windows ME, Windows NT 4.0 with Service Pack 4 or later, Windows XP
IE 5.0 or later

The recommended system requirements: [8]
300 MHz Intel Pentium III processor or greater
128MB of RAM
56Kpbs modem
Full Duplex sound card and speakers
65,000-color video display card set to display at 800x600 (video)
Windows 98, Windows 2000, Windows ME, Windows NT 4.0 with Service Pack 4 or later, Windows XP
IE 5.0 or later
Windows NT 4.0, Windows 2000 (Workstation or Server), Windows XP Workstation are the operating systems recommended on the Intel Pentium Platform.[7] In addition the Sun Sparc, the IBM RS/6000 Power PC, the HP PA RISC 2.o and the Alpha at all supported. [7]

The system server memory requirements for the RealSysterm server are a minimum of 256 MB of Ram to run optimally. The addition of more RAM to a RealSystem server may increase the number of client machines that can be served simultaneously. Adding memory enables RealSystem Server to handle more information at any given time, whereas adding processors enables RealSystem Server to process information faster. Thus, if you add processing power to a system, additional memory will help the processors perform at their optimal level.[7]

On Bandwidth requirements you will need a stream data rate of 20 kbps for a maximum audience size of 60. Therefore you require total bandwidth for those 60 connections of 1.2Mbps or the equivalent of a T-1 connection.[9]

9.   Mobile Studio Configuration

Another step has been to advance this technology and make it mobile. The mobile studio has been used approximately 20 times in its first semester and is used for telecasting live and digitized athletic events, symposiums, as well as graduation.

The mobile studio was able to be purchased for an approximate cost of $20,000. The mobile studio requires three people to operate it for an event. Two people act as camera people while one person assumes the role of the producer and controls what is being sent

out from the cameras and the audio signal. It has been through a partnership with local radio station that the athletic events have been able to be broadcast using the radio announcer and the picture provided by the mobile studio.

The mobile studio consists of three portable cabinets that contain various components for the studio. Those cabinets are listed below:

Cabinet 1   The Production Cabinet
A drawer that is used to store the wireless microphones
A drawer that contains a 7 port switcher that is used to control video inputs
Four 8 inch monitors that are used to display the final output, the input from camera 1, the input from camera 2, and a fourth monitor that is used to check input from a play VCR
A video mixer board that is used to control what signal is being sent out

Cabinet 2   The Record Cabinet
A 1 X 10 Distribution Amp for output
A Gateway 9500 1.066 GHZ laptop system with 512 mb of RAM a 40 GB hard drive
3 VCR's
Drawer space for cables

Cabinet 3   The Audio Cabinet
A play VCR for the addition of input from tape
Audio Mixer that will accommodate 6 microphones and has 6 additional line inputs
A radio for monitoring purposes when doing a dual broadcast with the local radio station
Drawer space for the cameras

10.   Student Comments

The following is a portion of the comments made by one of the first students to take advantage of the option of the class to desktop:

A new experience to say the least... Taking a class via Distance Education definitely takes some adjustments in a person's perception of education. Unfortunately OR Fortunately it is the only way I am able to further my education. I was very fortunate the other night. I had the opportunity to take part in the first Live Internet Broadcast for DSU's Visual Basic CIS 595 course. While it was not as good as being at the class site being able to visit with the other students and the instructor it was the next best thing. Link that statement with the fact that it was blizzarding and I was not even able to venture 7 miles from home to view the class over the V-Tel system, I was very fortunate. I was able to, in the comfort of my own home, view and interact with the class. Since the instructor had

taken the time to put the PowerPoint notes on the Internet I was able to download them and use them as a note-taking guide.

I was able to have several applications running on my personal computer at one time: PowerPoint, Visual Basic 6.0, Word, Internet and of course Real Video. By having these applications handy, I was able to follow along with all aspects of the class. This was not even an option for me with V-Tel. I found this aspect to be extremely beneficial as I could go to the CIS 595 web site and obtain needed code for assignments as the class progressed. With this code I was able to see almost everything on my screen that the students were seeing in the actual class.

I was even able to phone in to class to help out during one situation (although there was a 14 second delay in feed…the class had already figured out the situation).

Another student commented about using the videos as a part of one of the classes he was teaching:

We watched some of the live streaming video in class yesterday - it came through very well at SDSM&T - only 7 hops away

Another comment regarding the video being delivered to their desktop:

Good Morning! I wanted to let you know that I enjoyed last night's class. It was hard to sit for 4 hours but well worth it.

A nontraditional remote student commented about the use of the encoded videos:

I like taking the class. I like being able to go back to the videos on real player for review. I do think the classes give good instruction.

One final student comment:

I like being able to do this from either at the school or at home and also the fact that it is available even after class, via the video archive.

11. Conclusion

Students who have been enrolled in the classes have been most appreciative of the added dimension that both the digitized lectures and live Internet broadcasts have provided. They find that not having to travel to a site is where they can receive the class using the more traditional two way video and two way audio far outweighs the disadvantages of the broadcast or digitized lectures. Historically students who have participated in the live Internet option will phone in at

least twice during a class session to ask a question or to provide input into the class. They certainly are able to feel more a part of the class environment.

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