

PIONEERING THE POTENTIAL OF IP VIDEO: INTEGRATING MACROMEDIA BREEZE LIVE AND BREEZE PRESENTATION SOFTWARE INTO A LEARNING ENVIRONMENT

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Abstract

The intent of Southern Utah University is to offer courses via Breeze, to potential students living in and out of the state of Utah. The technology of Breeze will increase student enrollment by offering courses synchronously and asynchronously.

KEYWORDS: Breeze, H323, Voice-over IP, Online Learning Environment Application, Liquidity, Bandwidth.

INTRODUCTION

In 2007, universities and colleges in the United States will begin to see an increasing number of college applicants. It is anticipated that a high percentage of these college applicants will be turned away as a result of enrollment capping practices. At some campuses across the country the capping has already begun. In Utah alone, the influx will be over 150,000 students beyond the current system enrollment.

These displaced students will be forced into a “*no man’s land*” of declined applications. Here at Southern Utah University, the School of Continuing and Professional Studies, realizes the potential market revenue increase as well as the potential student need. Due to the very rural location of SUU, students have limited access to the main

campus. The only way for SUU to greatly increase in students attending, is to provide access to these large numbers of students in urban Utah through the virtual campus.

Expansion into a global vision forces campuses to embrace the need for diversity which, in turn prepares the student through a rich curriculum for global work. At Southern Utah University, the effort takes two basic approaches; the first being the aggressive recruitment of a diverse student body coupled with study abroad opportunities student and faculty exchanges. The second is to position the campus through visionary approaches that use technology to reach rural and urban in state areas, out of state students, and international students.

For the past three years, teams of students have visited many European countries. There are efforts underway to expand such opportunities to other continents. Through partnerships with universities across the nation and abroad, SUU has indeed broadened the global and cultural perspectives of its students and faculty. In order to reach these constituencies we are training our international partners in the use of the technology options and adding IP video to all of our online courses. By putting the Breeze in all of our online courses, we have elevated the quality of our synchronous moment.

HISTORY

In 2004, the School of Continuing and Professional Studies (SCPS) at Southern Utah University through its Instructional Media Integration Centre (IMIC) emerged as a leading innovator in distance learning in the western U.S. This was possible through the use of Macromedia’s Breeze software application of H.323 compliant IP/Video. Breeze was originally created for the corporate market, but it has been creatively integrated by the SCPS into the existing telecommunications networks, and online operations. The intent of using Breeze was to eliminate the dependence on Utah’s interactive TV system (Utah EdNet). The high cost of using EdNet all but eliminated the capability to offer courses to small numbers of location-bound students. Dramatic increases in **student enrollment**, an appeal to a wider range of learning types, dynamic interactive course content, and accessibility via the internet, were all outcomes that Breeze software made possible. With Breeze, courses and programs are no longer limited by borders or the methods of traditional delivery. The Macromedia partnership with SUU has changed educational concepts of the future into a reality.

All technologies are transitory, and the need to create open architectures is essential for success. The technology of compressed video is clearly evolving into the IP computer based (H.323) medium. When we review this evolution, the thinking revolved around fixed classrooms within institutions such as K-12 schools, universities, and business. The limitations are obvious; however, the IP desktop computer (H.323) variation is beginning to address these limitations for broadened use in higher education. One of the authors of this paper (Ellis) worked with one of the early H.323 IP desktop products known as Avaya iCOSM. This product evolved from a variation of Microsoft Net Meeting. During a two year series of beta tests for Avaya (2000 to 2002) that were conducted by Peru State College and Oregon State University; a large amount of information was gathered to determine the utility of the product. In 2003, the authors (Harker and Ellis) became aware of the Macromedia “Breeze” product. Yes, there were approximately a half-dozen products that used the H.323 protocol that were entering the market place in the early 2000 time frame. In looking at these products, pricing and scalability for higher education use was the paramount issue. After reviewing the various choices, the Macromedia product was chosen as the best fit.

Choosing a product is one thing but, the old adage of the telecommunications game is that everything is all about “bandwidth” and bandwidth translates into quality, especially in video. In general, we have found that higher education administrators are ill prepared to deal with most issues in telecommunications. If administrators in higher education understand that we are going to have a higher capability within a narrower bandwidth, the learning curve will be shorter, and they will be able to foresee "future" telecommunications issues (Ellis & Bartlet).

The image right, Chart A, describes the quality of the video signal that the various IP protocols provide (H.32x Quality Coverage) and following image, Chart B, describe the layers of the protocol (The H.323 Protocol):

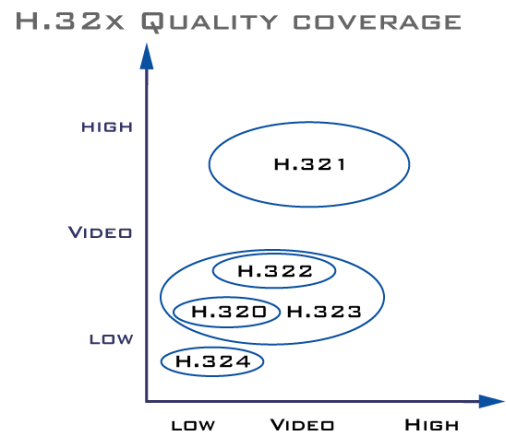
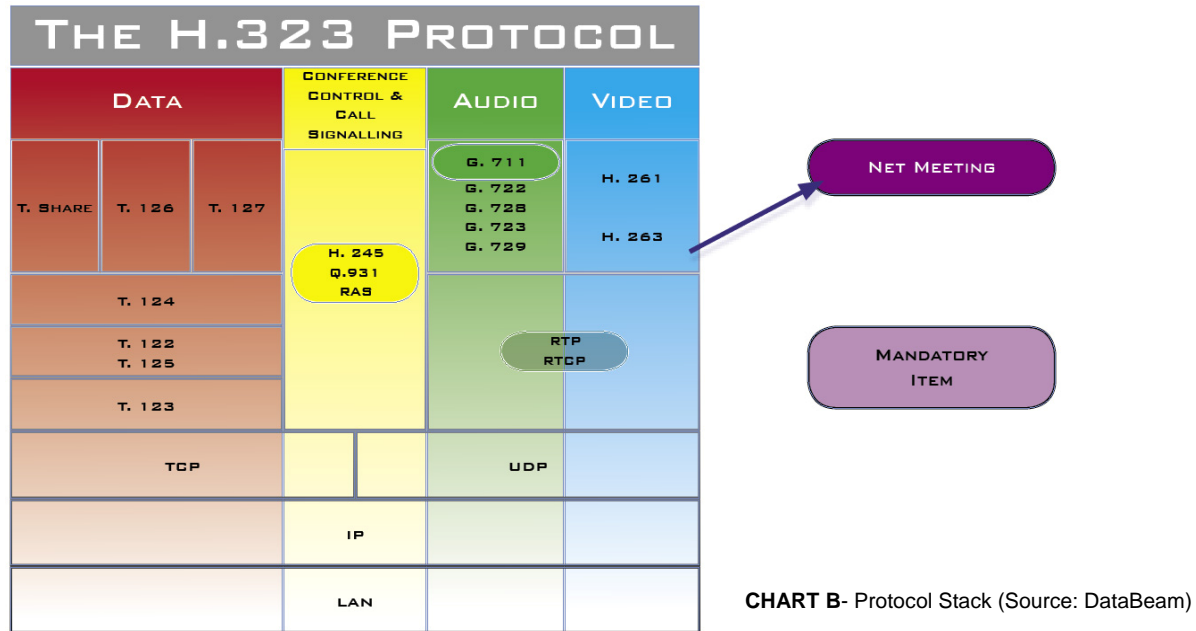


CHART A- Quality Coverage (Source: Qwest)



In order for institutions to make a commitment to distance learning, it is essential that long-term economic viability can be ensured. To do this, institutions must have a fixed and affordable utility contract. University and college administrators have had mixed results in dealing with utility companies. In many instances, distance education initiatives were financially doomed from the start (Ellis & Bartlet).

At SUU, courses are taught using an instructional television system called EdNet. This system sends closed circuit video to virtually every school district and postsecondary campus in Utah. EdNet uses analog delivery, and recently, some sites have been upgraded to IP video, using Polycom systems. The Polycom system will only manage four sites. An expensive video bridge is being added by EdNet to switch to more Polycom sites. Investigators feel that given system limitations, EdNet is investing in an inadequate platform, with high costs to follow.

The School of Continuing and Professional Studies at SUU oversees the EdNet Hub for the Southern Utah. It has two EdNet studios and one receiving site classroom. Based on enrollment, up to nineteen EdNet sites have received SUU courses through this system. It costs \$607 per course to broadcast to these sites. Several universities that use the EdNet system now require a minimum enrollment to justify site operation. For spring 2005, several EdNet courses were required to have up to a minimum of fifteen students enrolled just to activate the receiving site.

Recognizing cost and delivery problems, SCPS formed the Instructional Media Integration Centre (IMIC) to find a solution to benefit students and cut costs through IP video. The Utah Education Network (UEN), a division of the State's Board of Regents, is in the process of upgrading all EdNet classroom sites. These upgrades use Polycom systems to convert the existing analog video signal into the digital IP video signal.

The most common technical issues of IP video system are the need to create bridge codices and the use of traffic/bandwidth shaping software. These are used to ensure a consistent signal flow. Without a dedicated T1 pipeline, the H.323 signal can become compressed and buffered to the point that either both the receiving or sending units could crash the system (Ellis & Bartlet). (I.e. Only four sites can be seen at one time by students and instructors without bridge)

A majority of high schools around Utah are equipped with only one EdNet classroom. School administrators are forced to book classrooms for courses with the highest enrollment. This excludes many students from taking other courses offered at the same time. Adult learners are also faced with not having access to the EdNet courses that are offered during public school hours. Hence, the support services, access, and revenues are lost. To tap into this potential market meant that SCPS needed to find alternative IP video applications that can exist and operate independent of the EdNet system.

When searching for an alternative system, the IMIC (Harker) explored various computer applications. Many products had been developed specifically for the corporate market. Few products had been created to use in an educational setting. Fewer still can work in cross-platform situations. Another limitation of some of these products is the expensive hardware or the need to install software at both ends of the IP circuit. With other products' video broadcasting was either non-existent or poor in quality. All of the products reviewed differed within system

requirements, notably in bandwidth or internet connection requirements. Software applications varied in the complexity of setup and user settings. Product costs and support fees varied. Many of these applications are not comparable to EdNet's video signal quality and functional standards. One would think that Utah EdNet, which costs approximately \$20,000,000 per year, would meet the needs of the State, yet it falls short of its purpose, and that led to the search for a solution (Harker & Ellis).

SOFTWARE SOLUTION

When Breeze was examined by the IMIC staff, it appeared to solve several of these issues. Through Breeze, student access is not limited to location or conflicting course offerings. Signal management is not needed at the receiving end because it is automatically performed by the Breeze server. Participants do not need to download or purchase software because it uses the Flash plug-ins prepackaged with major web browsers. Marcomedia estimates 98 percent of computer users are Flash enabled. The user interface is easy to use.

Benefits for Faculty

- Different interface layouts can be used to customize each instructor's learning environment preferences.
- Instructors can teach using methods that they feel most comfortable with and which will best serve students.
- Interfaces are easy-to-learn.
- Online learning and communication elevate student learning environment by replacing WebCT whiteboard and text chat features with media rich interfaces.

Benefits for Students

- Different layout, such as slide show, allows students to show their own presentations and interact with both the instructor and the whole class.
- Tech support is simplified in Breeze classrooms because of the accessibility of Flash plug-in.
- The physical classroom is readily transferred into an easy-to-use online learning environment.
- Student learning is interactive. (They become part of the lectures and can lead discussions and showcase results)
- Instant feedback is provided to students.

Additional Benefits

- Breeze brings the entire classroom to the student's computer without the overhead costs related with the EdNet system.
- Breeze is not limited to closed circuit television system classrooms.
- SUU can better prepare for and facilitate a projected boom in college students without having to impose an enrollment cap.
- Breeze has the capability to send and receive synchronous ("real-time") audio and video.
- Breeze is cross-platform capable between Macs and PCs, and it is more compatible with different modem speeds (128kpbs or higher).
- WebCT and Breeze integrate easily. SCORM compliant. Breeze Presentation quizzes and surveys can be imported into the WebCT grade book.
- SUU can provide valuable quality education to a wider, potentially worldwide market (including previously unreachable rural areas).
- Breeze allows the recording and archiving of synchronous classes and events.

REQUIREMENTS FOR THE PRESENTER AND PARTICIPANT

IMIC staff members tested the limits of Breeze (version 3) during an initial application beta-test. They have been surprised to find that it will work on older and slower computers. However, they have compiled a list of minimum requirements for the receiving end users. This allows students to minimize the need for technical support while ensuring a higher level of IP video.

Users are required to have the following computer hardware, internet connection and system requirements:

1. DSL/Cable/T1/LAN or any other Broadband Connection (128 Kbps minimum). *With the availability of satellite dish DSL services, rural locations can easily receive the Breeze Broadcast. Uploads from these sites do consist of using a dialup connection, thus limiting upload. Student broadcast of video and/ or audio may not be requested from the instructor.*
2. One of the supported operating systems-
 - Macintosh 9.2, OS X 10.1 or later [Breeze 5.1- use MacOS X 10.4 (Tiger)]
 - Windows (98se, ME, XP, NT 4.0, 2000) or later [for Breeze 5.1 it is recommended to have 2000 or XP]

It is suggested that computers using these operating systems have a 450 MHz CPU to reduce latency.
3. One of the supported browsers listed below:
 - Safari 1.1, 1.2 (MacOS only)
 - Netscape® 6.2, 7.1-7.2
 - Microsoft® Internet Explorer 6.0 (or later)
 - CompuServe 7 (Windows 2000 & XP only)
 - Mozilla Firefox +1.2
 - Opera 7 (Windows only)
4. Macromedia Flash Player 6.0.65 or later as a browser plug-in.
5. A sound card and, headphones or headset with microphone to hear audio broadcasts from other meeting participants.*
6. A microphone to broadcast audio to other meeting participants*. *May be included with a WebCam or teleconference headset. Most Macintosh models cannot use a microphone with a 3.5mm plug. (Optional to Participants) †*
7. A Web camera to broadcast video to other meeting participants. *Some cameras have a built in microphone. I.E. iSight™ [Apple], Logitech® QuickCam® Zoom™ [Mac&PC] (Optional to Participants). (IMIC[Harker])*

THE SERVERS

Once SUU officially decided to go with the Breeze product SCPS needed to invest in top of the line hardware. The purpose for this was to guarantee that the Breeze signal is sent at the highest IP broadcast level to faculty and students. With Breeze there are two main components: Breeze Live (Meeting [Breeze v. 5.1]) and Breeze Presentation. For each license SUU has purchased a server. This is what SUU uses:

- Breeze Live (Meeting) and Presentation license version 5.1
- Operating System:
 - 2 Windows XP 2003 servers (w/ a backup Raid- 1 Mirrored)
- Hardware per server:
 - 3.261 GB Xeon processor
 - 1 GB RAM
 - 72.8 GB hard drive
- Breeze deployment with SSL
 - Enabled SSL Hardware Accelerator

SUU's Breeze servers were previously clustered so that during a Breeze Live meeting, the uploaded Power Point Presentation could be accessed and shared. SUU has a (Raid array) backup hard drive for a Presentation server. Recorded meetings from the Breeze Live server is moved to the Presentation server for backup. Update- with Breeze 5.1, both applications can only be served off of a single server. The loss of separation is replaced with the ability to convert PPT's on a local PC, where as it was previously done on the server. (Harker)

* To avoid audio feedback during live presentations headphones are required. Microphones can be used on headsets or as a built-in webcam or computer component. Speakers used instead of headphones will create a feedback loop and are not to be used.

† SCORM: Sharable Courseware Object Reference Model – See <http://www.rhassociates.com/scorm.htm> for details.

EDNET INTEGRATION WITH BREEZE LIVE

The IMIC has created two scenarios in transmitting the EdNet broadcast through Breeze Live. Since the EdNet system based at SUU, broadcasts an analog NTSC signal, SCPS uses a “vanilla” PC with an audio/video card to capture and digitize the signal to IP video.

The beta PC for video capturing used an Osprey 210 A/V card in a Window XP, Pentium 4. The test was successful in using NTSC signals from DVD players, VCR’s, and ELMO projectors. (Osprey drivers also can convert PAL video formats as well.) This proved that SUU could use these devices to broadcast video to students attending a Breeze Live course.

Both EdNet studio computers use the Osprey-500 DV digital streaming capture card. The PC’s configuration is a Pentium 4, 2.8 GHz CPU; 512MB RAM; and 40GB Hard Drive. Audio breakout to the EdNet system uses an unbalanced stereo connection. Video uses the analog composite breakout. (Harker)

TWO VISUAL CONCEPTS FOR THE BREEZE LIVE/EDNET SET UP

Set-Up 1

This does not disturb existing EdNet system. Video and audio is piped into the origination PC's A/V card. Breeze will accept the captured NTSC signal from the A/V drivers and broadcast via the camera and sound pod. End users will be able to see and hear the Instructor.

End users can send their web cam video and audio, in which the origination PC will see in Breeze. What is displayed on the origination PC monitor can be piped into the pre-existing EdNet system. Audio out from the computer can be directly piped, as well. Thus the origination PC can act as EdNet site 5.

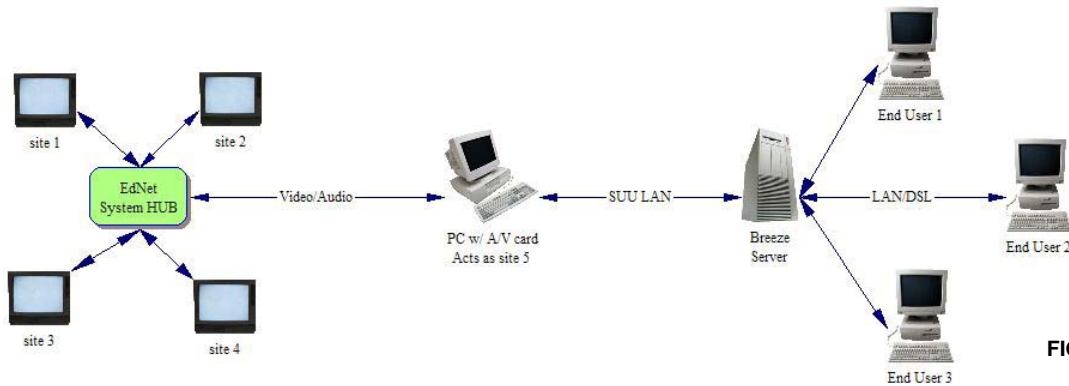


FIGURE 1- Set-up1 (Source: Harker)

Set-up 2

In this setting, video can be switched in the studio, piped into the originating PC through Breeze. Then it is sent via the Breeze System and transmitted to the EdNet classrooms. Returning signals from the EdNet classrooms are sent to the “Pre-Breeze switchboard.” Although this is more complex for the switchboard manager, EdNet classrooms will be able to see and hear Breeze students chat questions and audio.

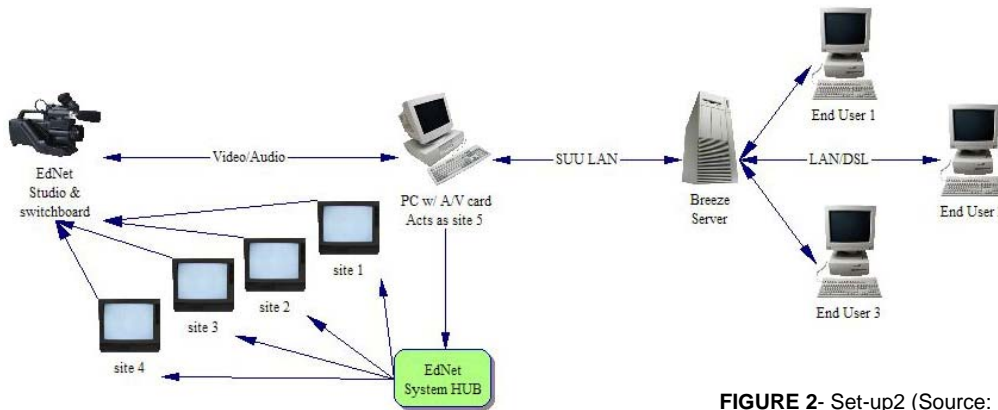


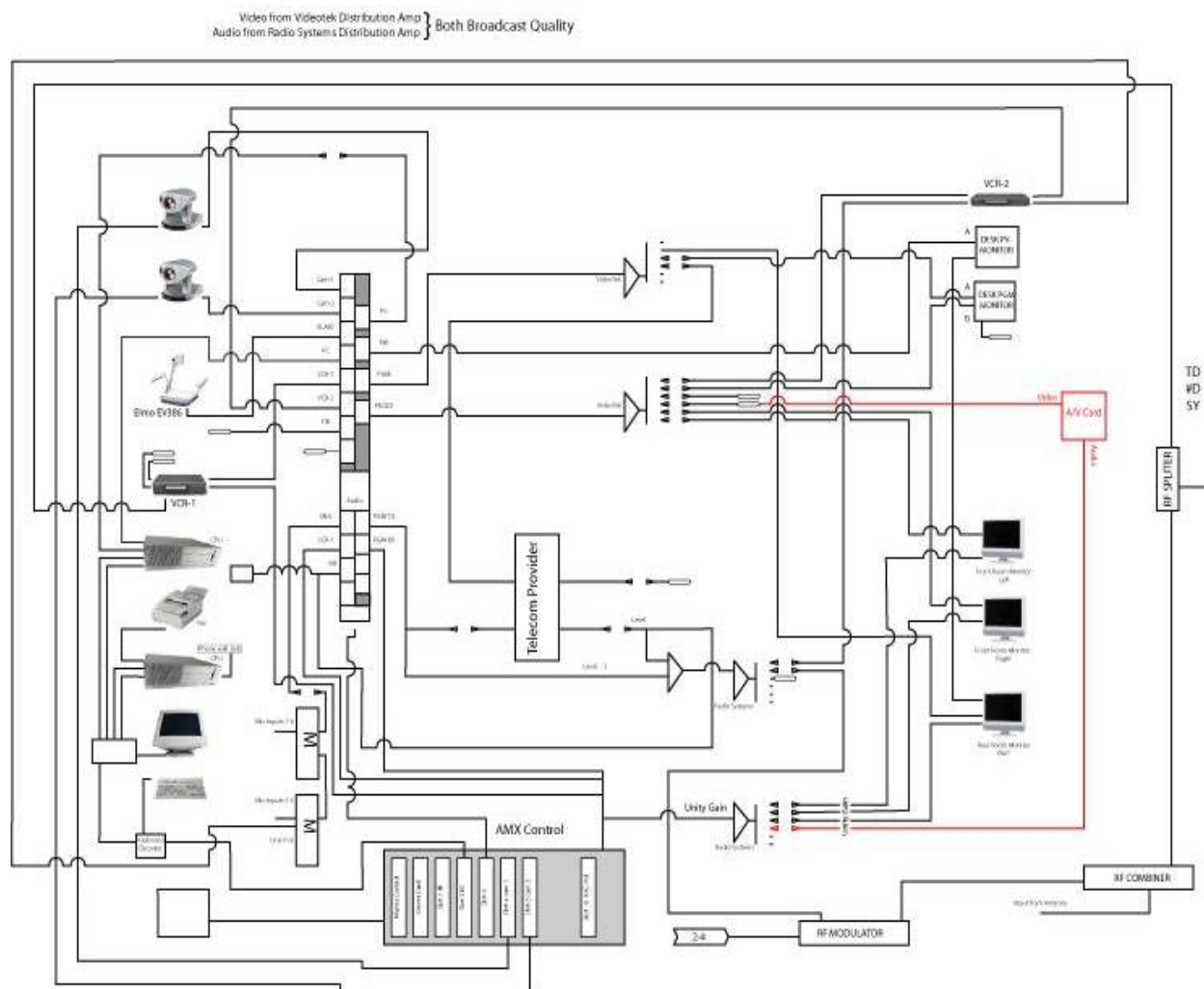
FIGURE 2- Set-up2 (Source: Harker)

APPLICATION ISSUES

With the EdNet system connection to the Breeze Server, SUU is able to broadcast SCPS ITV courses over the Internet. Principal investigators discovered that many K-12 school districts have followed the advice to install shaping software to accommodate the signal packet demands. Since bandwidth intensely varies during school hours, the signal quality is automatically reduced and can add latency to Breeze Live courses.

Students attending from other locations, such as the home or office, may see latency occur during peak internet usage times through their ISP. SCPS has made use of the EdNet phone bridge system to assist in the elimination of audio latency from remote or rural students. The following is the technical schematic showing the EdNet signal connection to the Breeze Live Server.

TECHNICAL SCHEMATIC (by Harker)



At SUU, there have been numerous problems that the availability of Breeze has solved. In the opinion of principal investigators (Harker, Ellis), a slow implementation of Breeze into the institutional fabric has accounted for much success and acceptance. Here are a few of the applications where this product has been useful:

1. During summer 2004, the College of Education needed to deliver content for two courses into one site. One of the courses served six students; the other served one. Local administrators decided to deliver the course which served more students. One student, who wanted to take the other course, contacted the distance education staff to see if there was another option. Macromedia's Breeze offered the option. As the instructor taught his regular EdNet class, he operated his laptop and webcam at the podium. The student was then able to obtain the

course which he needed via Breeze. The instructor was able to manage the EdNet course and the Breeze product at the same time. (Harker)

2. Another way that the staff has been successful with asynchronous Breeze is through creating Frequently Asked Content Question Responses in online classes. Presently, the university uses WebCT as the learning management system. During summer session, an instructor was teaching an online course about school finance, he found there were several content questions from students. He realized that as one student had a question, many of the other students would have other variations to the original question. As each question came up, he created a response using PowerPoint and the Breeze asynchronous audio function to answer the question. He posted it on a Frequently Asked Question web page. After the initial question on a topic he did not have to waste time repeatedly answering the same question. (Harker)
3. During the fall of 2004, a professor from the SUU College of Education realized that the Breeze Live component could be used to observe student teachers conducting lessons and activities in actual classrooms, all from his office. This eliminated travel time and expenses. (Harker)
4. In an article in the Chronicle of Higher Education, entitled, *When Good Technology Means Bad Teaching*, by Jeffery Young (November 12, 2004), broadly suggests an over reliance on the use of PowerPoint to deliver content. Many online presentations contain excessive reading material that could usually be delivered in a standard HTML or document format. A remedy to a text heavy or static presentation is the use of Breeze Presentation which creates dynamic interaction. This incorporates Flash objects, such as movies and surveys. At SUU, an uploaded Power Point is usually enhanced with audio integration. The appeal of hearing the voice of the instructor, even if it is an asynchronous moment, heightens the traditional online correspondence. It is desired through the use of various enhancements, that the student's retention of content and learning will be improved. The integration of these dynamic elements provides an appeal to the visual and the auditory learner. (Harker)
5. The Masters of Education program has experienced a phenomenal increase in graduate student enrollment for the spring 2005 semester. Breeze met the demand for this increase, as well as the requirements of real-time communications for teaching endorsements in Utah. Several courses are fully taught through Breeze Live system, thus bypassing the limited availability issues of the EdNet system. (Harker)
6. For some instructors at SUU, Breeze live has been used as a virtual office for internet/LMS course students needing synchronous communication.
7. Instructors who have used Breeze Presentation for their online courses have quickly discovered that they can pre-create presentations for their traditional/ face to face courses. This gives them the ability to 1) work on homework grading during the scheduled lecture, 2) give a means for students to preview a lecture so that class time becomes a Q & A session, 3) a means for students to refresh and review the lecture again for study/memory retention.

POTENTIAL EDUCATION ENVIRONMENT MODELS

Since the implementation, there have been a number of inventive applications of Breeze. With the current learning models and uses of existing technology, the IMIC has envisioned several applications for and the integration of Breeze into a variety of instructional approaches. From this work, the principal investigators have proposed three concepts for the use of Breeze in the technologically mediated classroom.

The first model suggests replacement of the EdNet system as currently used at SUU. Limitations of the system "reach" and conflicting time schedules are eliminated. With one Breeze Live (Meeting) license and server, 200 students are able to use the system at one time in an equal number of locations. Educators are now able to teach from their office computer and students can attend a class from home, work, or at the campus.

The second conceptual model is the elevation of the current online asynchronous correspondence course to include dynamic video interaction instead of just text. Students watch and hear an asynchronous or synchronous Breeze Presentation. With Breeze Live it is possible for an instructor to hold virtual office hours or even a pre-scheduled Question and Answer session with the entire class.

The third model is a hybrid or blended course. The base content and function of an internet course uses the static LMS application- handouts, tests, syllabi, etc. The course assignments are done asynchronously. Lectures are watched. Textbook assignments and readings are performed prior to a virtual 20 minute class lecture, demonstration, or Question and Answer session. In this scenario, courses would have to be scheduled for the twenty minute synchronous block, limited to the amount of Breeze Live users (thirty-five students per course and seven courses). From 8 am to 8 pm, thirty-six courses can be scheduled using this scenario. This would appeal to companies encouraging their employees to obtain certificates or work on college degrees during the lunch hour. "Twenty minutes of training" during a work break creates a symbiotic benefit between companies and their employees. (IMIC [Harker])

PROJECT UPDATES

A step towards the future mentality of "why go to college when it can come to you" is now here at SUU. Students and faculty can now meet in virtual classrooms served from a rural university to a global market. In October 2005, faculty members from our European partner schools will commence training on the Breeze software to implement joint broadcasting relationships. Through these joint efforts, SUU can increase its exposure to diverse cultures and people.

SUU has received a full product upgrade to Breeze 5.1 in the summer of '05. The transition to this new product for fall '05 was easily preformed and installed. "With the kinder interface and the new features that Breeze 5 brings, faculty training and support just got easier." (Harker). Since the initial draft of this publication started in 2004 by Harker, SUU has updated from what was at that time Breeze 3.0 to 5.1. This document has been adjusted according to those application updates.

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