Compressed Video for the Global Village

Al P. Mizell
Nova Southeastern University, USA

USING COMPRESSED VIDEO TO CONNECT STUDENTS WITH THE REST OF THE WORLD

Marshall McLuhan (1964) introduced the concept of the global village that helped us see what was happening with worldwide, inexpensive communication through technology. However, at the time we did not envision that it would result during our lifetimes with our students being able to see and talk with students across the ocean and around the globe. From Nebraska's statewide video network (Robinson, 2004) to the Florida Virtual School (Johnston, 2000), the use of technology to connect students at distant locations with a central site has become almost commonplace. When students find that a course they need to take is not available at their school site, they can electronically register to complete that course online with students from many other locations—all connected together. If a teacher is presenting a lesson on exotic animals, but lacks in-depth expertise in that topic, he or she can go online and bring in an expert from one of the several online zoos or connect the students to a Webcam set up in the wild where the animals can be viewed in real time around the world. To get even more structured interactions with students in other parts of the nation or the world, and to have high-quality picture and voice exchanges, compressed video systems connected via broad bandwidth ISDN phone lines are being used.

Compressed video, usually referred to as "videoconferencing," connects two or more locations so they can see and hear each other. The basic equipment involved includes one or more monitors, cameras, microphones, and speakers. A compressed video system transmits its signals over an ISDN phone line or over the Internet in an Internet Protocol (IP) after the signals have been compressed (Branzburg, 2001).

There are basically two choices today to connect multiple sites where pictures and voice can be used and everyone can fully participate: 1) use of a Web camera on a computer (desktop, laptop, notebook, personal, PDA, etc.) transmitted over the Internet (IP); and 2) compressed video over ISDN or T1 phone lines. While IP is the least expensive approach by far, it is also the lowest quality. Each year, the quality of IP video improves, and with the proliferation of broadband connections and improved compression techniques, the quality will continue to improve. Compressed video over ISDN phone lines is the higher quality approach, but it is also the most expensive way to go. While it is the most expensive approach, compressed video systems result in images that can be expanded using a projector or large monitor and still retain their clarity. In addition, by tying multiple ISDN lines together, wide enough bandwidth is available to have full motion video that is almost comparable to television quality.

In fact, today's compressed video systems give evidence that their manufacturers already recognize the coming of this trend because almost all new systems come with built-in IP capability. We are now beginning to see high enough IP quality that IP and compressed video over ISDN signals can be mixed on the newer video bridges so both types of transmission can be meshed within the same video conference.

Unquestionably, IP will replace ISDN in the future as the quality of IP compression continues to improve and high-speed bandwidth becomes commonplace. The good news and the bad news is that we are currently in the awkward transition stage.

What is Compressed Video?

Branzburg (2001) indicates that compressed video requires a monitor, camera, microphone, and speakers. This is in addition to some technical hardware such as a codec. Of course, as he adds, you also have to have a way to connect the equipment and the people involved. This usually means having one or more ISDN telephone lines available or using the Internet Protocol (IP) instead.

Compressed video technology is explained by Lever-Duffy, McDonald, and Mizell (2003) in these words:

With a dedicated compressed video system, digitized video can be transmitted with image and sound as clear as broadcast video. The image, either live or recorded, is compressed by using a codec (compression/decompression) unit that digitizes and compresses the video and audio signals for transmission…High-speed phone lines (multiple ISDN or T1 lines), which have greater bandwidth (than traditional phone lines), are then used to send the compressed audio and video to their target location. There, another codec unit turns the signal back into traditional video and audio to present on a monitor or for recording on a VCR. With video cameras, codecs, and monitors (and microphones) at two or more locations, then, you can establish live video communication between remote sites. (p. 323)

Compressed video equipment has specific advantages over the transmission and reception of audio and video signals over the current Internet using a Webcam. Bandwidth is limited on the Internet, so transmission of video means that there is a need for greater signal compression and/or there will be longer delays in uploading and downloading the large amount of data that video and audio involve. With the arrival of video streaming, there has been improvement in the one-way, asynchronous transmission of video, but we are talking about transmitting two-way, interactive video and audio in real time. In addition, we are conferencing one to two dozen sites together at the same time. Using a video bridge and multiple ISDN or T1 phone lines, we have the bandwidth we need for full motion video and very clear audio signals for multiple sites to be connected in real time.

Compressed video may be classified in three categories: *desktop, set top,* and *group systems*. *Desktop systems* consist of a compressed video card that also contains the codec. It is inserted into the desktop computer and usually comes with a speaker-phone (or headset and mike), and is then viewed on the computer monitor (or it may be projected for a small group). This system is normally used by one to three individuals unless it is enlarged in some way. The image is usually small and loses sharpness if enlarged. *Set top systems* consist of a box with everything in it plus a video camera built into the box. It sits on top of, and is connected to, a TV with the ISDN line(s) plugged into it. It is best for small groups, but can be used in groups up to classroom size. The most desirable system is a *group system*. Here there is a separate codec, camera, modem, microphone, and one or two large monitors. These systems can be used with almost any size group as long as there are enough microphones and monitors or projected images.

In addition to the compressed video system, when trying to connect groups in various locations, a video bridge (which is very expensive) must be available or leased for the session. Some private companies are equipped with the needed lines and equipment to rent out use of their systems for those who do not have their own systems.

Equipment prices are generally lowest for desktop units (around $2,000), somewhere in the middle for set-top units (up to about $12,000), while group systems are the most expensive and most desirable (in the $15,000 and greater range). However, reconditioned group systems are available for much less and may even come with new unit warranties.

It must be noted that in addition to the cost of the compressed video equipment, each ISDN phone line (128 KB) involves an installation charge, plus a monthly maintenance fee in the neighborhood of $50 to $80. When long distance calls are made, each ISDN line costs the equivalent of two regular long distance calls. The quality of the ISDN approach has been sufficiently attractive to a number of schools and businesses that it is fairly easy to find schools almost anywhere in the world willing to connect with other schools so their students can work together and learn about other cultures and societies.

USE OF COMPRESSED VIDEO IN DISTANCE LEARNING

Two well-known compressed video projects are the Global Nomads Group (http://www.gng.org) and the SAXophone project (www.fgse.nova.edu/saxophone). The SAXophone project will be described as one example of the use of compressed video to help shrink the globe. In both of these projects, students and teachers have to learn how to use the basic equip-