

Streaming Media Overview: A look at the current technology and what CIT is doing with it

In July/August 1998 I wrote an article for the *CIT Information* newsletter describing our use of streaming audio and video. At that point we had been using some form of streaming media for about two years. Since 1998 the technology and its applications at CIT have changed and matured, and our use of the technology has diversified. In the following paragraphs I will try to describe some of the ways CIT is using streaming media and highlight some of the technological advances made during this time period.

An overview of the technology

Streaming, in simplest terms, is a process allowing a file to be opened before the entire file has been transferred or copied from the media server to the local hard drive. Typically what happens is that a request for an audio or video file is made from a client's browser via a Web page. After the client's browser receives the file information, it launches the streaming application or plug-in to receive and play the audio or video stream.

This definition has not changed. What has changed is the number of companies offering streaming product solutions, the number of formats that offer streaming solutions, the amount of content available online and, perhaps more importantly, the number of potential users of streaming media. Of these factors the number of potential users who have some form of broadband connection is, in my opinion, the driving force behind the growth of this industry, along with the fact that the average desktop computer today has more than enough processing power and high enough quality video hardware to handle receiving audio and video streams. In 1998 this was not always the case.

In 1998 the number of companies offering streaming media solutions could be counted on one hand. Today I could not even begin to list the companies offering some sort of streaming media solution. Nearly every major news corporation offers news, entertainment clips, and live feeds in one or more streaming format and almost always at a low and high bit-rate.

A good example of what has happened in the industry in the past five years is the growth that RealNetworks has reported.

In 1998 I reported that "The current market leader (Real Media) announced their streaming video product in March of 1997. Within a month 8 million users had downloaded the Real Media browser/plug-in. Roughly one year later 44 million users had downloaded this product."

Looking at their website today, RealNetworks reports that:

- ▶ "RealNetworks technology is used by hundreds of millions of unique, registered individuals throughout the world.

- ▶ RealOne Player user base grows over a hundred thousand new users per day.
- ▶ RealPlayer/RealOne Player is the second most widely-used Internet-based software application in the world.
- ▶ RealNetworks system software delivers content on more than 85% of all streaming media-enabled Web pages.
- ▶ RealNetworks system architecture is used to broadcast more than 350,000 hours of live sports, music, news, and entertainment over the Internet every week. Hundreds of thousands of hours of on-demand content are also available."

(RealNetworks Website, Company information: Just the Facts. October 27, 2003. www.realnetworks.com/company/index.html)

As you can see, streaming technology has become a mainstream Internet application, and continues to grow.

IANR's use of streaming media

In 1998, I described IANR's use of streaming media. We had some successes and failures and determined that part of the success equation depended on how an instructor was implementing the technology. Some instructors were very capable of working in the convergence of live television and online technologies and some found this difficult. The same could have been said about the individuals producing the content.

As the technology matured, and as faculty, staff, and students were exposed to the technology, some of these barriers have been lowered. Currently, CIT does not stream classes "live," but does encode a lot of supplemental and prerecorded content for use in many classes. A lot of content is reused from previous classes in this manner.

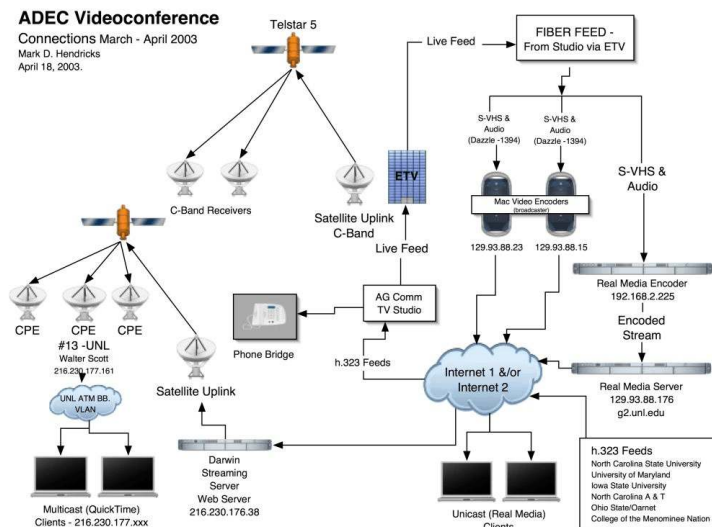
CIT does however encode live programs. Currently Backyard Farmer, Market Journal and several video conferences annually are "broadcast" live on the internet. Backyard Farmer (byf.unl.edu) is a good example of how CIT uses the streaming technology. You can watch the program live, watch a previous program from the archives, or search the program archives by keywords. This last feature is what I find most exciting. For example if I search for "pruning," I get a list of links to video segments of Backyard Farmer where the topic was pruning. These links take me to the portion of the program(s) where the topic is discussed, so I don't have to watch or fast forward through a program or programs to find my answer, which is a great time-saver. The Backyard Farmer site also lists the top twenty most viewed clips, which is helpful when there are global gardening issues.

The technologies behind the site primarily integrate an SQL database, Apache Webserver, and RealNetwork technologies. The Backyard Farmer site demonstrates some of the advantages to using online audio and video content over the traditional linear distribution of these programs. (As I wrote the article in 1998, these technologies were just coming online and we were not sure how we were going to implement and integrate these technologies into our application development. We have barely scratched the surface, and the Backyard Farmer site is one of the best examples of our development.)

IANR and CIT have also been involved with the American Distance Education Consortium (ADEC), working with using streaming media over a satellite based network. While working with the multicast protocol, this project uses Apple's Darwin Streaming Server technologies, the h.323 protocol, and MPEG-4. ADEC is partnering with Tachyon.net (IP-over-satellite service provider) on this project.

Some of the barriers in a satellite network include the fact that bandwidth is limited, net traffic is asymmetric, and atmospheric conditions can come into play. Advantages of working with the ADEC satellite network include

- ▶ the fact that it is a multicast-enabled network,
- ▶ that we can get broadband services to locations where even cell phone connectivity is a problem, and
- ▶ that it is a network where ADEC is able to control network hardware to a degree to do testing.



The multicast protocol in simplest terms is a protocol which allows many network devices to listen to a single stream of data (and/or audio and video) as opposed to unicast, where each device receives its own individual stream. This is very significant in limited bandwidth networks, and all networks ultimately are limited. Many routers are not configured to allow multicast traffic to pass and the stream fails.

One example of this work was the April 2, 2003 ADEC video-conference. This program, and several that we have hosted since April 2, was an example of successful use of the multicast protocol, the MPEG-4 audio/video format, and Apple's Darwin Streaming Server technology. (See schematic drawing above.)

This program had several pieces which all had to work together. One part was getting h.323 feeds into CIT's television studio from six colleges and universities. Another part was encoding the video from the studio into the MPEG-4 format and the Real Media format. Another piece was sending a unicast stream via Internet2 (I2) to a Darwin Streaming Server in San Diego, (The server was on both I2 and on the ADEC satellite network). The unicast stream was then relayed as a multicast stream to the ADEC satellite network. ADEC also broadcast this conference via traditional C-band satellite, a unicast Real Media stream (for ADEC personnel not on the satellite network), and an audio phone bridge.

Implications and conclusion

Streaming media technologies open many doors and solve a lot of problems facing distance learning instructors, content providers, instructional designers, and students. Users can time-shift programs and classes to fit their schedule in their location, and can review materials and presentations several times.

Providers can overcome cost factors, satellite footprints, and political and geographical borders, delivering their classes and programs to new student bodies and clientele. And, instructors and designers can develop robust presentations that they may not be able to present in the traditional classroom.

Distance learning environments can and will become better learning tools as the

- ▶ convergence between print, data, audio, and video continues;
- ▶ CPU's become more powerful; and
- ▶ bandwidth increases.

Seven years ago I used the analogy that streaming technologies were in the "Kitty Hawk" phase of development, and five years ago I rephrased and stated that perhaps the technology had reached the "Spirit of St. Louis" phase — now I'd say we have entered the DC-3 phase where we have a reliable and affordable set of technologies to use.

~ Mark Hendrichs

IT Update and Digital Assets Broadcasts Available Online

CIT's 2003 Information Technology Update (broadcast Oct. 29) and the "Digital Assets" broadcast (Nov. 14) are available on the EXCITE website (www.ianr.unl.edu/excite/).

Update topics included Statewide Networking Update, UNL Networking and Issues, Satellite Internet Connection with the Tachyon Quick Deploy Unit, CIT Computer Support Policy Update, and County Extension Website Upkeep.

The "Digital Assets for Extension Clientele" broadcast showed three presentations from the "CIT Technology Highlights" program: Grazing Livestock in the Nebraska Sandhills, Water & Nitrogen Management, and goCybercamp.

**Check out CIT Computing's new website:
citcomputing.unl.edu**