Java Video: Install Once, Play Everywhere

We live in an age where the availability of any kind of digital material – video and audio in particular – is expected to be accessible at all times, and yet, despite all of our technological innovations, server setup and port forwarding are still mandatory and cumbersome steps in the streaming process. This project attempts to solve the problems of server cost, setup, and maintenance through the use of a Java-based video streaming program. By connecting two personal machines across the Internet – even those behind a private network – and streaming video and audio found in almost any format container, server setup (and its cost) is no longer necessary. This is all achievable in a single free software installation.

The connection between server and client machines is a peer-to-peer connection. The method used to establish the P2P users across private networks is known as “hole-punching”. “Hole-punching” is a technique that makes use of a central server carrying a public IP address. This central server establishes the connection between the two personal machines by passing the public routing address of the personal server machine to the personal client machine. The client then requests a socket connection with the server. Data objects are then serialized passed via this I/O socket. Many other popular services also use this technique for fast and efficient communication between personal computers. One such company that utilizes “hole-punching” is Skype.

This software utilizes three techniques in order to achieve data transfer after a connection is made. They are 1.) The ability to read multiple video containers, 2.) Transforming the content in those containers into a serializable class, and finally 3.) Performing audio and video playback in sync. The first is inherent by the third party library, Xuggler. Xuggler makes use of FFmpeg to read different video formats. Transferring pieces of the audio and video streams are only possible by decoding the information to a byte array. This byte array allows the object to be serialized, transferred across a network, and then rebuilt on the client side. Finally the client must reassemble the sound bytes or images and play/display them according to their timestamps.

By making use of Java for this project, the challenge of creating connections across multiple operating systems is easily bridged. In this way a Macintosh running OS X Lion may transfer data to another machine running Windows XP. Only through a central public IP server, data can be shared between personal machines on http port 80. No localhost setup via apache or port forwarding is necessary for these connections to occur.

The main advantage to these techniques is not only easy sharing of information, but also overhead cost. By applying these networking techniques no expensive or specific machines are necessary. Logging into a router a setting up port forwarding is not a requirement. Only an Internet connection and http port 80 make up the basic needs for this system to work.

In short, through the use of the Xuggler library and FFmpeg, multiple video formats may be opened in a directory and broken down into individual packets. These packets can then be converted to one standard format on the fly, wrapped in a serializable class and sent to a client across the web via a socket connection. The client then plays these audio and video bytes by using one thread to download and store content, another to display a series of images, and finally one more for audio playback. Video data can be sent from one private IP to another over the Internet using similar methods as other peer-to-peer programs (i.e. Skype) that use a central public server. This technique is known as “hole punching.” This software demonstration shows solutions for individuals to easily host their own content without converting each file to a standard format or engage in server setup. During the demonstration, participants will have the ability to download and install this software to begin hosting their own content. The ability to share information quickly and effectively is of prime importance to our society today, and this project furthers that goal.