

Application Note:

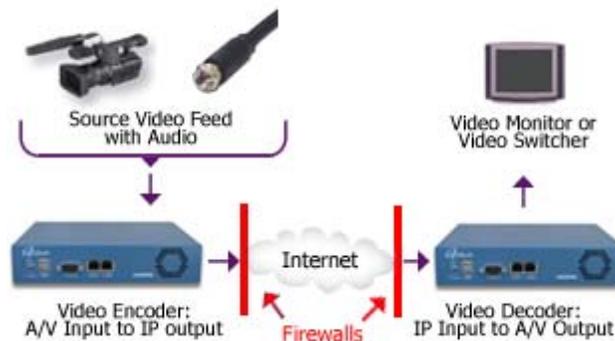
Video Transport over Internet Connections

Abstract

This application note describes how to set up a robust point-to-point live audio-video link over the Internet or other network connections having firewalls at each end, and having the potential for packet loss and other network impairments. In particular, we describe how to configure QVidium codecs in conjunction with QVidium's patented ARQ error correction to correct for packet loss and other network impairments. We further describe the basic configuration requirements for the firewalls and network links.

Overview

This application note describes a point-to-point deployment where the source of a live audio-video stream feeds into an Internet connection at a QVidium codec configured as a video and audio encoder at a source node. The stream then travels through the Internet network cloud, through various routers and switches, until arriving at a QVidium codec enabled as a decoder or some other hardware or software implementing QVidium's patented error correction technology at a destination node, as shown in the figure below.



Sending a live audio-video MPEG Transport Stream encapsulated as a stream of IP packets over the Internet requires the coordination of the QVidium encoder and decoder along with the configuration of firewalls that may be deployed at the source or destination, or most commonly, at both the source and destination. One must expect that the Internet will randomly drop packets, will introduce random delays for some or all of the packets within the stream, and may dynamically re-route the stream, causing packet re-ordering.

There are two ways to send video from the encoder to the decoder, which we will call **Push Mode** and **Pull Mode**. In Push Mode, we enter the IP address and UDP port for the destination at the encoder. At the decoder, we leave the IP address blank and only enter



QVidium Technologies, Inc.
Web: <http://www.qvidium.com>
E-mail: Sales@qvidium.com
Phone: +1 858-792-6407

the UDP port for the decoder to listen on. We then start the encoder and decoder, in any order. The encoder then pushes packets over the Internet, while the decoder passively listens for any incoming packets arriving at the designated UDP port. The next section will go into the details on how to set up error correction and dealing with the firewalls when using the Push Mode.

In Pull Mode we leave the Destination IP address blank, and place the decoder in “Server Mode.” Also at the decoder, we must enter the IP address of the video “server,” which usually would be the IP address of the PC running the QVidium QoS Proxy Sender (QVAVC-TX), although for certain QVidium encoders that support it, the server can be a QVidium encoder. When we start the decoder, the decoder sends a packet upstream to tell the Proxy Sender or other QVidium video server to start sending video in answer to the decoders start request. QVidium currently only supports Pull Mode when using a QVidium ARQ Proxy Sender (model #QVARQ-TX).

The rest of this application note will only consider the case of Push Mode. If you wish to set up a Pull Mode of operation, please contact QVidium for details.

Destination IP addresses and Firewalls

The Public Internet makes a distinction between “**public**” IP addresses and “**private**” IP addresses. Without going into too much detail, if your IP address starts with “10.X.Y.Z” or “192.X.Y.Z,” then your IP address is a **private** IP address. (Here, X, and Y may be any number from 0 through 255, inclusive, and Z is usually, though not always, limited to a number from 2 through 254. Without any firewalls, the encoder and decoder would have **public** IP addresses, and we would be able to simply enter the public IP address for the decoder as the destination IP address.

A good way to check whether there is a firewall between your encoder or decoder and the Internet is whether the IP address of your device is set to the same IP address as the public IP address. If you have a QVPRO or QVSD codec, and have installed version 51 or newer of the codec firmware, then you can click on IP Address under the Network menu and click on “Contact Server.” If you have connectivity to the public Internet from the codec, then it will tell you its external, or **public**, IP address. Another way to find the public IP address is from going to certain web sites from a PC connected to the same local-area network (LAN) as the codec. Certain web sites, such as <http://www.ipchicken.com>, will tell you your **public** IP address. If you have a PC running Microsoft Windows® then you can click Start/Run and type “cmd” to bring up a DOS command prompt. From there, type “ipconfig.” It will then tell you your local IP address. If this address is different than the address printed out from IP Chicken, then this is a “**private**” IP address.

Note: You **cannot** use a **private** IP address as the Destination address in the encoder for Push Mode, or as the Server address in the decoder for Pull Mode. Instead, you must use the **public** IP address and add a **port-forwarding** or **network address translation** rule in the associated firewall leading from the private address to the Internet.



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Push Mode Configuration with ARQ Error Correction

For Push Mode of operation, in order for the IP video packet stream to pass through the firewall at the destination to the decoder, you must enter the **public** IP address for the destination address in the encoder profile, and you then must **also** create a **port-forwarding** or **network address translation (NAT)** rule in the firewall to forward the incoming packets to the private address of the decoder. Because of the wide variety of firewalls in existence, we are not able here to explain how to configure port-forwarding or NAT rules for every make or model of firewall. Please consult your firewall manual, or ask your network consultant or IT department's firewall specialist for help setting this up.

In general, we have to be prepared for firewalls at both the source and destination sides of a point-to-point video link. At the destination, we must add a rule to the firewall to "port forward" any incoming audio-video packets on the designated UDP port to the internal IP address of the decoder.

QVidium's ARQ error correction uses a patented feedback-based mechanism to let the encoder know that a packet was lost during transit to the decoder, and to send a replacement (or retransmission) packet back to the decoder. Thus, when using QVidium's ARQ error correction, the encoder-side firewall will need to pass ARQ retransmission request packets back upstream from the decoder to the encoder. When the ARQ port and UDP port are set to different values, then you will have to add a port-forwarding rule to the encoder-side firewall to forward upstream packets on the ARQ's UDP port into the encoder. In older QVidium codecs and software, the ARQ port was set by default to UDP port 7020.

In all newer versions of QVidium codec firmware, you are allowed to use the same UDP port number for both the video UDP port and for the ARQ retransmission request UDP port (simply called "ARQ Port" in the user interface). The advantage of setting the UDP port to the same value as the ARQ port is that by making them equal, you can generally avoid having to create any special port forwarding rules at the encoder-side firewall. This technique exploits a feature present in most firewalls that are configured to allow outbound packets on arbitrary UDP ports. If your firewall allows packets to exit your location into the Internet without special configuration, then it usually will create a path for any return packets. QVidium takes advantage of this feature of most firewalls in how the ARQ mechanism is implemented. In summary, if you set up the ARQ Port to be equal to the value of the UDP port, then you should not need to configure the encoder-side firewall to facilitate ARQ.

In order to determine with certainty whether the firewalls are properly configured for ARQ to function, you can look at the decoder stats when the decoder is running. In particular, please check that you are seeing a non-zero value for Recovered Packets when you are seeing non-zero Packet Loss (or Network Loss). If you are seeing no Recovered Packets in the presence of packet loss, then the likely cause may be that the encoder-side firewall is not allowing the upstream retransmission request packets to enter from the network into the encoder. (However, if you happen to have a QVidium model #QVMP2C-1011 MPEG2+4 IP Codec, you should check that you have the Error Correction license



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E-mail: Sales@qvidium.com
Phone: +1 858-792-6407

installed in your encoder and decoder. The QVMP2C-1011 codec could be purchased without the error correction enabled, which would cause the same behavior.)