

Video Broadcasting Over IP Networks

Written by:

Henry Sariowan, Ph.D.
Vice President, Systems
Path 1 Network Technologies, Inc.



www.PacketStorm.com

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Introduction

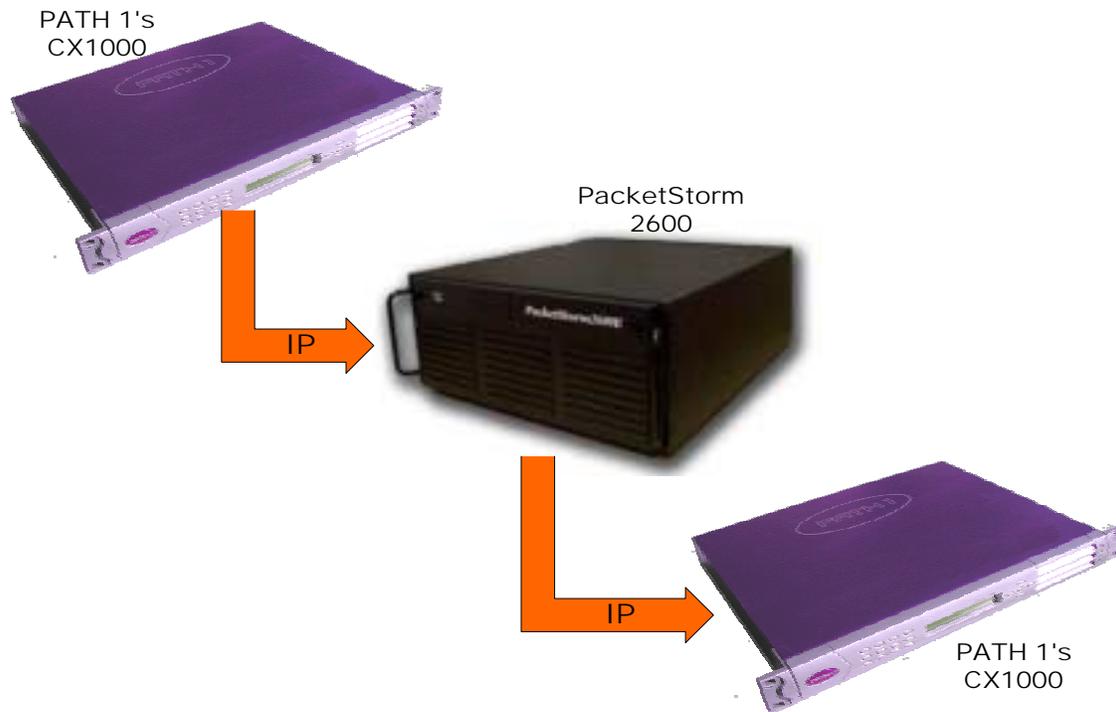
Founded in 1998, Path 1 Network Technologies Inc. (<http://www.path1.net>) has been heavily-focused in R&D, working to develop a transport solution that would provide for true convergence of voice, video and data over a single Internet Protocol (IP) network. Based on its belief that IP will be the transport medium of choice in the future, Path 1 made a strategic decision to focus developmental efforts on the problem of video and establishing a Quality of Service (QoS) transport solution of video-over-IP based upon its TrueCircuit® technology. This enables IP Ethernet networks to perform with the guaranteed security and scalability as ATM, as well as eliminating jitter, excessive latency and packet-loss which is common in packet-switched architectures. With its patented QoS technology platforms, Path 1 is proving that broadcasters can use IP as a flexible and cost-effective transport for such real-time applications as broadcast and entertainment content exchanges.

Path 1 currently designs and manufactures two professional video gateways: the Path 1 Cx1000 IP Video Gateway and the Path 1 Cx1400 IP Video Multiplexer. The Cx1000 is designed to be a carrier-class transport gateway, providing broadcasters and content owners a flexible and cost-effective means for exchanging video content over IP wide-area networks and local area networks (WANs and LANs). The Cx1000 preserves the high quality of both uncompressed and MPEG-2 compressed video by handling delay, jitter, packet losses and packet out-of-order, which are commonly observed in IP networks. In 2001, CNN recently used Path 1's Cx1000 for live broadcast when a major event required additional bandwidth that was not available to the company.

Path 1's Cx1400 IP Video Multiplexer is a carrier class Video-On-Demand (VOD) gateway and is designed to provide VOD transport solution by multiplexing MPEG-2 video streams encapsulated in IP packets into the ASI format suitable for final transmission in the cable television's Hybrid Fiber Coaxial (HFC) networks. Path 1 joint-developed a version of the Cx1400 under the name "iMux" with a European cable equipment vendor, BarcoNet (now part of Scientific Atlanta), and started shipping the gateways in July 2001 for extensive customer trials.

PacketStorm in Development Environment

Path 1's gateways are designed to handle imperfect IP network environments and still meet the stringent video quality requirement from broadcasters. Path 1 has been able to achieve this objective in relatively short time due to a combination of its technical expertise and world-class development tools. Critical among these development tools is the PacketStorm 2600E, an IP Network Emulator which recreates the dynamic behavior of the Internet.



The PacketStorm 2600E has been extensively used both during the development and testing stages of Path 1's video gateway projects. A typical laboratory set-up is shown in the diagram above. Using the PacketStorm's user-friendly graphical user-interface (GUI), a variety of network impairments can be easily created, stored and executed. Path 1's gateways are then extensively subjected to these impairments to ensure that the gateways can withstand the harsh network environment when they are deployed in real networks.

Several PacketStorm-emulated network impairments that have been used in Path 1's gateway developments include:

- Latency
- Jitter
- Packet Loss
- Packet Reordering
- Temporary out-of-service

PacketStorm provides high throughput processing not offered by competing products. This allows for impairment of high bit-rate traffic such as that generated by uncompressed SDI (Serial Digital Interface) video at 270 Mbps and MPEG-2 streams at a full Asynchronous Serial Interface (ASI) rate of 216 Mbps. In addition, PacketStorm provides accurate timing processing in the order of 60 microseconds, which allows developers to create realistic models of network delay and jitter. Finally, PacketStorm's layer 2 and 3 processing capability enables users to simulate both local and wide area IP network environments.

Conclusion

Path 1 has developed broadcast quality video-over-IP gateway products that have been successfully deployed both in the customer field trials as well as in revenue-generating broadcast IP video networks. The PacketStorm2600E network emulator has been a critical tool in helping Path 1 quickly develop and test products that meet the stringent requirement of broadcast customers. With the PacketStorm emulator, Path 1 is able to meet its development deadlines with substantial savings in resources resulting from an extensive debugging process in the laboratory prior to testing in the real network environment.