APPEX NETWORKS

Video Streaming Without Interruption

Adaptive bitrate and content delivery networks: Are they enough to achieve high quality, uninterrupted Internet video streaming?

Abstract

The increasing popularity of video delivery platforms on the Internet is driving the need for reliable content delivery services. Ninety percent of today's Internet traffic is video, with Netflix alone accounting for 21 percent, according to a Cisco Systems report. Cable companies, pay and broadcast networks, online media companies, and motion picture production and distribution services are searching for ways to improve performance in order to overcome the challenges of delivering video content smoothly, at high resolution and without the frustrating interruptions of re-buffering.

Since video streaming technology was introduced in the 1990s, new Internet protocols and data delivery technologies have been developed to provide a better viewing experience. Two of the most prominent developments in this area are adaptive bitrate streaming and Content Delivery Networks (CDNs). Both have improved video streaming and quality considerably. However, the stakes have been raised with the rapid growth of video traffic, the advent of HD streaming content, which requires high throughput rates, and a growing consumer expectation for cable-quality delivery.

Even with these advances, web-delivered video can be low resolution with jerky delivery. This is due to the unpredictable nature of data transport and latency on the Internet. The bursty nature of Internet traffic means frequent network congestion which holds up video packets and starves receive buffers on a video player, resulting in a pause for more data to refresh the buffer.

This paper discusses transport acceleration, a new video streaming technology, and how it can be deployed to deliver the uninterrupted, high quality video viewing experience today's Internet users expect.

History of Internet Video Streaming

The first attempts to display media on computers dates back at least four decades ago, but the rudimentary technology did not advance for many years due to lack of PC CPU power, bus bandwidth and network throughput.

In the late 1990s, the graphic power of PC and the bandwidth of the Internet finally caught up, making decent-quality video streaming possible. This paved the way for the advent of YouTube and showed the world the potential of the Internet for delivering video content.

Techniques for Improving Video Quality

The success of YouTube and other early video streaming players attracted new market entrants. These new entrants offer either for-pay or ad-supported video models – both of which require great performance to attract and keep viewers. This in turn has helped to spur the evolution of the HTTP protocol to support adaptive bitrate streaming to improve video performance.

Adaptive bitrate streaming technology is embedded into leading computer and tablet video players and communicates with the video server to control the video flow. It replaces earlier protocols such as the Real-time Transport Protocol (RTP) and the Real Time Streaming Protocol (RTSP).

Adaptive bitrate streaming works by monitoring the user's bandwidth and CPU performance in real-time and adjusting the quality of the stream accordingly throughout the viewing experience. The technology automatically adapts the user's network and playback conditions when conditions change, and allows video streaming of much higher quality than was previously possible.

Adaptive bitrate delivers faster start times and reduces buffering by constantly adjusting the resolution of the stream, but this compromises steadiness of the stream, resulting in fuzziness and distortion. This problem is exacerbated by new High-Definition (HD) picture technology, which offers higher resolution and therefore more data-heavy. In many cases, the resolution of an HD stream is diminished drastically to maintain the steady flow of the video, but sometimes, even that's not enough to keep the users from a buffer refresh.

CDNs

Another emerging technology for Internet video streaming is the Content Delivery Networks (CDNs). CDNs offer faster start times by caching video content in servers spread out geographically in Points-of-Presence (PoPs) that are close to end-users. A copy of the video is stored in each of these servers. When a user requests that video, the request is routed to the PoP closest to them, shortening the distance the content has to travel and improving quality by reducing latency. CDNs are complementary to adaptive bit rate streaming technology and the two can be combined together to provide even higher quality streaming.

But even the combined solution doesn't always result in perfect video delivery. While CDNs get the content closer to the customer, they don't address the last mile problem – the distance from the PoP to the end-user's device – and they can't completely solve the buffering issue. In addition, CDNs only address content that is stored in their PoPs, so they are not useful for live streaming that comes directly from the origin server.

Transport Acceleration

The stakes are high in the world of video delivery as user frustration can kill a business model. As such, the industry is adapting new technologies that promise to end buffer refresh pauses. Transport acceleration, a new method introduced to the market recently, works with both adaptive bitrate and CDNs to accelerate video streaming.

Transport acceleration boosts the speed of the video data from the server to the end-user – whether it's coming from an origin server or from a CDN PoP – by replacing bursty traffic patterns with a more even and high-speed data flow. This traffic flow is ideal for video and other real time traffic because it keeps video player receive buffers full, so that the play buffer is rarely waiting for content. This reduces annoying buffering pauses and other delays, thus delivering a smoother viewing experience.

Transport acceleration also delivers the highest quality video picture because the adaptive bitrate technology does not need to constantly adjust the resolution of the video in order to decrease buffering.

Transport acceleration technology is integrated into a network near the video server – either the origin server or the CDN PoP. This eliminates the issues of distance and the last mile connection quality because the video stream is accelerated all the way from the origin to the end user.

AppEx ZetaTCP®

AppEx ZetaTCP® is the leading transport acceleration software solution. It is based on the company's Learning Based Technology®, which was developed to boost data transport speeds.

AppEx transport acceleration combines patented algorithms to:
1) Dynamically adjust data transfer rates to match congestion levels,
2) Eliminate TCP slow-start,
3) Recover lost packets much more quickly than normal TCP, and
4) Dynamically adjust sender and receiver windows to maximize throughput.

ZetaTCP® accelerates dynamic websites, video streams, virtualized desktops and file downloads by combining intelligent window sizing and smart congestion control to reduce the effects of network latency and packet loss. It accelerates video streaming and downloads across the Internet or private networks to improve quality and playback performance. Videos start up to five times faster and streaming is smoothed out to eliminate playback hiccups and delays.

AppEx ZetaTCP® excels at higher latencies. It increases throughput, keeps packets flowing smoothly, recovers from data and packet loss quickly, smooths out video transmission, and enables faster transfer speeds.

Figure 1. Average initial start time of VoD customers

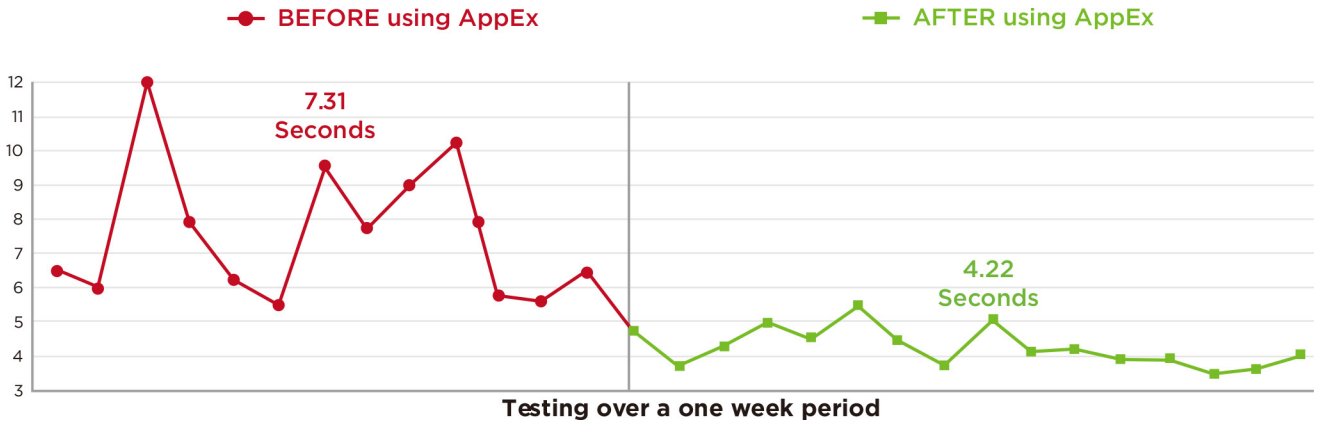

Figure 2. Re-buffering reduced or eliminated

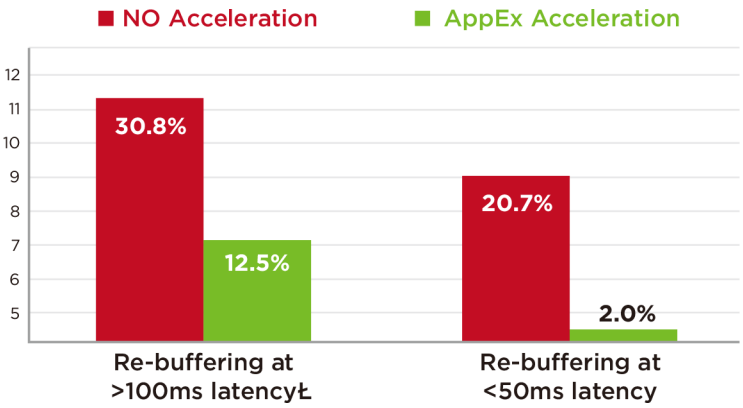

Figure 1. The dramatic difference in video throughput being streamed with and without AppEx acceleration technology implemented. Content was delivered from a cloud infrastructure from the United States to Asia. With AppEx acceleration technology, initial start time decreases dramatically. AppEx smooths the performance as well.

Figure 2. Average re-buffer rate per session hour of video on demand being served from the United States to Asia. With AppEx acceleration technology, the re-buffering rate drops significantly.

AppEx works in conjunction with CDNs and Front End Optimization (FEO) solutions. AppEx strives to deliver the best viewing experience possible by stabilizing the video streams and minimizing the effects of packet loss and jitter. It ensures that data streams from the server to the end user's video player at a constant rate, with minimal delay. This virtually eliminates the last mile delivery problem.

Adaptive bitrate technology also benefits from AppEx technology. AppEx acceleration technology ensures that the maximum bitrate quality and minimum buffer refreshes in the end user's video player.

Conclusion

Advancements in fixed and mobile network technology and Internet protocols have unfolded a whole new world of entertainment for web users. It has also opened up a golden revenue-generating opportunity for cable companies, pay and broadcast networks and online media companies to offer media streaming services over the Internet.

When video streaming technology was in its infancy, early adopters were so excited about the possibility of watching videos on their computers that they were willing to tolerate poor picture quality, frequent pauses and interruptions. Now that the technology has advanced and video streaming has become a prevalent form of entertainment for even the most technology-ignorant users, poor quality and frequent buffering pauses are no longer tolerated – especially if the user has paid a service provider for the content.

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