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CDNs and the quest to conquer streaming's challenges

Broadcasting's history has long been dominated by technological advances. Though perhaps no time has been as disruptive as the present, as broadcasters and media companies grapple with the transition to IP and an increasingly on-the-go, quality-demanding consumer. TV has gone mobile and brought with it delivery complexities, quality challenges, and the need for new business models that ensure digital content monetisation. Kyle Goodwin, Vice President of Product and Innovation at Vecima Networks, outlines the challenges in today's streaming ecosystem.

Latency and compatibility with legacy broadcast infrastructures are perhaps the most significant issues facing traditional media companies. The ability to deliver consistent, broadcast-like quality is an ongoing struggle. IP network bottlenecks and delays, client and player latencies, and the 'retry model' for IP delivery all create a less-than-stellar experience. Internet-delivered content should be consistently low latency. That's what consumers expect and enjoy with their television experience. Content shouldn't pop around in different bitrates, looking good sometimes and bad at others. And when viewers want to change channels, they should be able to do so relatively instantly and without waiting for a stream to buffer.

These basic concerns remain true, whether consumers view digital content through connected devices, via a set-top box or a smart TV. In the home, successful IP deployment can be defined as undetectable. The switch from a clone box to the IP box should go unnoticed. Maybe consumers

recognize extra features or that they can do cloud DVR recordings, but there should not be a discernable difference. IP should be an unnoticed benefit that produces an operational advantage for operators, including less bandwidth required per video.

The modern CDN

These challenges have paved the way for the rapid growth of the content delivery network (CDN), a geographically distributed group of servers that work together to provide fast delivery of Internet content. To minimize the distance between visitors and a website's server, a CDN stores a cached version of its content, enabling content providers, including broadcasters, to deliver content efficiently to Internet-enabled devices.

The migration to over the top (OTT) TV has been meteoric, with some analysts predicting that OTT will surpass over the air (OTA) free television in the next five years. Dense



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populations in urban areas provide a clear opportunity for focused CDN-based delivery to reach large numbers of people able to leverage fast IP-networks and access content services – audiences that broadcasters can't ignore. A staggering 337,000 petabytes of video was delivered via CDNs in 2016, representing 67 percent of total consumer video traffic. It's forecast that by 2021, CDNs will carry 1,470,000 Petabytes (440 percent growth vs. 2016), representing 77 percent of total consumer video traffic.

The growing importance of live

While video on demand (VOD) currently represents 90 percent of OTT traffic, consumption of live content is growing exponentially, especially for live sports. According to Google, 30 percent of all adults have streamed a game to their phone. The Center for the Digital Future at USC Annenberg reports that 65 percent of viewers under the age of 35 stream their sports on a mobile device and 63 percent of sports fans would pay for an all-sports OTT service.

While live sports represent a lucrative growth area, live OTT TV service is susceptible to significant video latency. A video stream is divided into chunks or files, which suggests that a level of buffering must be applied in the streaming server. In addition, buffering is needed in the end device to circumvent network jitter and server overloads. As a

consequence, end-to-end delay experienced by users is much larger than in the case of traditional broadcast, DTT, cable or IPTV service. The issue of end-to-end (e2e) delay, also known as 'second-screen experiences' is a significant factor for overall Quality of Experience (QoE) of OTT services.

Formats and codecs

The encoding format has a significant effect on the latency of OTT applications. Apple's HLS format is among the most widely used streaming protocols, but it isn't suitable for low-latency streaming. As an HTTP-based protocol, HLS streams chunks of data, and video players need a certain number of chunks - typically three - before they start playing. HLS has longer segments than DASH does, with segment duration effectively serving as a floor on how low your latency can go. The Apple HLS recommendation of 10 seconds or its new recommendation of six seconds means you're already 30 to 45 seconds behind the actual live content. Latency is a remnant of the HTTP technology not developed for 4K HDTV or even traditional digital-quality broadcast.

Codecs can also have an effect because the transcoder introduces a lot of latency when it's generating the multi-bitrate profile. And how much latency it introduces depends on the input. If you have input video, regardless of the codec (HEVC or AVC), you can select the group of pictures (GOP) size, which is essentially how often the full screen is refreshed. The longer the GOP, the more latency is introduced into the transmitter. If you have a long GOP at your input and a long GOP at your output, you get even more latency than if you have short GOP at your output but still have a long GOP at your input.

Meeting the monetization challenge

In today's highly competitive environment, broadcasters and content providers must monetize their OTT video content. A CDN provides the control and monitoring to help. Broadcasters can deliver targeted ads on live linear OTT feeds for sports and news, though challenges around scalability, accuracy, and user experience remain. However, server-side ad insertion is a viable alternative for creating targeted advertising on multiscreen devices. Under this particular workflow, the ad insertion process is pushed upstream.

CDNs also help broadcasters gain inroads into territories not allowed via traditional broadcast. A broadcaster may restrict content in countries where they lack a licence to



broadcast or make their broadcasts available only to audiences in markets that can be monetised.

Consumers around the world are also demanding higher resolutions and better quality, and the appeal of 4K and UHD grows daily. It only makes sense that broadcasters want their ultra HD recordings and their live casts available everywhere. Everywhere means every platform, including mobile. Broadcasters must contend with the truly massive data loads of 4K streams.

With more and better-positioned CDNs across various points of presence (PoPs), broadcasters can reap the advantages of bandwidth distribution across multiple servers, reducing traffic load and ultimately, reducing latency.

Build your own?

Building and rolling out your own CDN or simply introducing your caches into partnering network providers provides much more granular control over how your CDN operates and performs. Using one of the big providers to set up your CDN, however, provides no control over where your caches sit, whether they're close or not to the customers that are important to you. With a provider's CDN you also have no control over how it's configured or whether protocols are in place to decrease latency.

There is no direct insight into monitoring. You know only what the CDN provider is willing to reveal. There is no option to get into your network and figure things out yourself. A hybrid

or private CDN approach provides much greater insight and control that can be extremely valuable long term.

Easing the transition: Hybrid CDNs

A hybrid CDN falls between using a completely outsourced CDN and having a fully owned-and-operated CDN. A combination of public and private infrastructure, a hybrid CDN comprises six basic elements: Storage, transcoding, packaging and origination, network, caches, and ISP connectivity. Hybrid CDNs represent a relatively simple operational model for cost-optimized, higher quality OTT content delivery.

Analysis shows that a hybrid CDN model has 30-50 percent lower total cost of ownership than an all-public CDN model. Looking longer-term, the benefits scale with audience size. OTT audience sizes will double, triple, and quadruple over the next 5-10 years as broadcast spectrum continues to reduce, telco and mobile networks improve, and IP-connected devices become the norm. The economics are clear.

How best to deliver content to audiences, who controls the process and economics must all be considered in the quest to provide the highest quality and most cost- and monetization-optimized digital content delivery. Hybrid CDNs are a smart choice given technology and network implementation challenges, costs and scalability. All CDNs are not created equal. Research and education are critical. The decision is just too important.

