Emerging Agile Video Technologies Increase QoE, Reduce OpEx

Combining the Viavi Video Service Assurance platform with just-in-time packaging and new codecs

As demand for high-quality/high-definition video continues to grow, so do the strains on service providers—from both a network and financial perspective. This paper explores three technologies that can reduce network congestion and operating expenses while greatly improving video quality and customer QoE.

The ways people access video are changing rapidly—end-users want to watch video anytime, anywhere, and on any device. However, this convenience leaves service providers with a serious challenge. How can they offer high-quality video services when they lack control of the end device, the location, and in some cases, the networks through which the services travel?

The days of dedicated video networks are waning as service providers converge traditional linear video networks with data networks to keep up with demand. Data networks are better suited for on-demand video, but these types of services are hard to predict and can create massive swings in traffic volume. These factors strain networks that carry service providers' multiscreen video services.

To make matters worse, demand for higher-resolution services such as ultra high definition (UHD) and 4K are beginning to strain networks even further. Competitors like Netflix and YouTube use operator networks and mine data regarding service provider performance—and publish it to viewers, even to the point of ranking or qualifying them for standard definition or high definition. In order to compete, service providers need better visibility into, and control over, viewer QoE.

Current networks are designed with hardware sized to peak loads. The fact that video changes on a network in real time means hardware-based solutions can't economically keep up with the needs of content providers. Service providers can either build their networks out to handle heavy peaks or design agile networks that can scale at a moment's notice.

Agility is the key to solving the video issues facing service providers. To make their networks less costly and more efficient, many providers have begun moving away from hardware to virtualized networks. These new, software-based networks are not only cheaper to operate, they also have the ability to change their characteristics in real time to meet viewer needs.

Network virtualization and software defined networks (SDN) open up several possibilities for increasing QoE to improve customer retention. Virtualization and SDN also provide paths to further reduce operational costs and improve network performance with new, complementary technologies.

Video Service Assurance

One such technology is the Viavi Video Service Assurance (VSA) platform. VSA is a software-based video monitoring solution that can monitor video—no matter the source—from its origination point all the way to a viewer's device. For the first time, network operators gain detailed visibility into video service quality as it relates to network performance.

VSA works by placing software agents throughout a network, from video ingest to end-user video players. These agents can qualify video service at different locations. The information then combines to give service providers accurate, real-time measurements on the quality viewers are experiencing network-wide. The data also shows how different elements of the network contribute to the experience. In addition, these agents ensure that the full video service, from authentication and authorization to billing, works as designed and supports the number of expected simultaneous video viewers.

An important VSA feature is the ability to embed agents in the media player on a mobile device (for example, a smartphone or tablet) so service providers can actually see what the customer sees. This, in itself, will dramatically improve monitoring by letting providers make real-time adjustments based on what the viewer is currently seeing. In addition, it provides valuable information on the most volatile part of the network—the subscriber's home environment. By combining agents in home routers and residential gateways with agents in end devices, an accurate and economical depiction of the home is possible.

With this type of visibility, it is also easy to understand customer behavior and viewing habits in order to compete with content providers who also track this information. By understanding what services are consumed and how they compete with one another, service providers can improve QoE for the most important services as well as better understand how to monetize them.

VSA is not limited to conventional home networks. It works across virtually all types of access networks including Ethernet, xDSL, FTTx, PON, Fiber, HFC, WiFi, 3G, and 4G LTE, giving service providers the ability to monitor video quality no matter what type of network is used to access videos.

This gives service providers unprecedented flexibility, particularly as virtualized networks increasingly cache video on servers located at the edges of different networks to reduce download times. Visibility of the behavior of players with respect to load balancing across content delivery networks (CDNs) lets service providers better anticipate when additional capacity is needed. This helps predict the CapEx needed to reduce strain on networks and reduce download times for viewers.

Just-in-Time Packaging

This technology takes popular video and multicasts it to CDNs located at the edge of a network. In many cases, multicast video can be sent all the way to the viewer's home by using the home gateway as a virtual CDN. The video can then be converted to unicast so the homeowner can watch the video on any device at their convenience, using the optimum delivery format for the operator's network.

Using just-in-time packaging has many benefits. Popular video, such as hit TV shows, can be multicast across the main networks to an edge CDN. If a million people view the show each week, that show can be sent across the main networks once using multicast for all viewers. This greatly reduces the amount of traffic on the main access networks, reduces spikes in traffic, and greatly reduces operating costs—even as content demand continues to grow.

Using VSA in this environment increases viewer QoE dramatically. VSA can probe the multicast, as is done with conventional cable and IPTV applications, to ensure availability of popular content. VSA also uses agents distributed across the network to probe unicast services running in parallel, measuring customer QoE for both.

It is important to monitor video multicast up to the point where it becomes unicast. This makes a scalable software model even more important. Deploying hardware at multiple points in the network to monitor all video traffic simply does not scale cost-effectively for unicast services. By using proactive monitoring agents distributed all the way to the end device—in conjunction with agents using an active test methodology—service providers can be sure their services are always available.

VSA is not just about ensuring program availability and QoE, however. It also verifies CDNs by load testing prior to a new service introduction, by verifying new content prior to launch, and by ensuring premium services are always available.

High-Efficiency Video Coding

Advanced video coding (AVC H.264) has brought high definition into the mainstream, but with the advent of UHD and 4K, better compression methods are needed. A third technology, high efficiency video coding (HEVC H.265), will bring a smarter form of compression that is able to compress video much further without affecting quality.

HEVC works by looking at individual video frames and seeing what elements in the image change. Only the elements that change from frame-to-frame are encoded and sent. This is similar to the way AVC works, but HEVC has the ability to take this macroblocking technique and increase the size of the blocks for further compression without a reduction in quality. HEVC also has improved motion compensation and spatial prediction to ensure smooth viewing for a customer watching a video.

HEVC's smarter compression further reduces network congestion by sending video at a lower data rate while also improving quality. This is interesting for several reasons. UHD and 4K can now be supported without further network build-out or expense. It also means that many more viewers can receive consistent HD-level services than was possible with AVC since networks will have more available bandwidth with HEVC in place.

Conclusions

In a time when demand for high-quality video services delivered in higher and higher definition continues to grow, service providers are feeling the strain. This is true both in terms of stresses on the physical network and financial pressures as operating expenses continue to rise.

However, there is a solution. Deploying three new technologies, service providers will not only be able to keep up with demand, but also increase QoE while reducing operating expenses and network congestion. Each of these technologies can be implemented individually, but the true strength comes when all three are deployed together.

VSA works with just-in-time packaging and new codecs like HEVC. Combined, they constitute a cohesive solution that gives service providers true visibility throughout their networks in real time. For the first time, service providers will be able to see what the viewer sees and be able to make real-time adjustments so that viewing from any device is a pleasure.