A POLYCOM WHITEPAPER

More Scale at Lower Cost with Scalable Video Coding

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Executive Summary

Scalable Video Coding (SVC) is an adaptive, bandwidth-efficient technology that delivers a consistently high-quality user experience across networks with varying degrees of quality of service. SVC will increase the scalability of video networks and enable mass desktop video deployments while reducing total networking equipment cost.

As with any new technology, SVC suffers from lack of interoperability, and this leads to the creation of communication islands. Polycom's commitment to develop, deploy, and license royalty-free interoperable SVC technology will accelerate market growth and industry innovation by addressing the interoperability and licensing cost barriers that exist with SVC implementations today.

A founding member of the Unified Communication Interoperability Forum (UCIF), Polycom will drive SVC standards and interoperability in the industry. Polycom's approach leverages the power of royalty-free licensing with the critical mass that Microsoft and other Polycom Open Collaboration Network partners create to guarantee SVC ubiquity across the unified communications landscape.

For video users, SVC is expected to improve quality in unmanaged networks, such as the Internet, and reduce end-to-end delay on conference calls with more than two participants (multipoint calls). The resulting increased interactivity will make virtual meetings seamless and immersive, reducing participant fatigue and increasing productivity.

Introduction

The demand for personal video for organizational communication is growing rapidly. By 2015, over 200 million workers globally will run corporate-supplied video conferencing from their desktops. (Source: Gartner, "Predicts 2010: Video, Cloud and UC Services Loom Large in Enterprise Communications, Dec 3, 2009). Network architectures are evolving to meet this demand and will require cost-effective network resiliency, scalability, and interoperability, without compromising video quality. SVC has several of these attributes, promising cost efficiency and scalability while maintaining a high-quality communications experience.

Once SVC is accepted as an open standard and is utilized within a platform providing seamless interoperability with existing business applications (such as Microsoft® Lync™) and network resiliency (auto-failover), it will deliver a new era in business and communication efficiencies to organizations worldwide.

The Evolution of Video Technology

Video compression technology exploits similarities between neighbor groups of pixels in the same frame and between neighbor groups of pixels in different frames. Instead of transmitting full video frames (which requires a lot of network bandwidth) video codecs transmit only the difference between frames. This compression technique is the foundation of the popular H.264 Advanced Video Coding (AVC) standard from ITU-T that is widely used in video conferencing, telepresence, video streaming, video surveillance, and other video applications.

The AVC technology leads to the need for multipoint conferencing units (MCU) to translate between different formats, that is, different resolutions, frame rates, and bandwidth. This translation is called 'transcoding', and it ensures that each video endpoint receives optimum quality based on its capabilities and image layout as well as based on current network condition.

In 2007, ITU-T approved H.264 Annex G and standardized SVC as an alternative technique for compressing and transmitting video. Instead of sending one resolution, one frame rate, and one quality, as AVC video endpoints do, SVC video endpoints send multiple layers of resolutions, frame rates, and quality. This allows for "scalability," that is, for removing parts of the video without any video processing and for graceful degradation of the video quality.

SVC leads to a different distribution of the workload within the video network as video endpoints are required to become more complex while video infrastructure becomes simpler. Most prominently, pure SVC environments do not require a multipoint conferencing unit, although it continues to play an important role in mixed (SVC and non-SVC) networks where it becomes a scalable universal bridge. Pure SVC networks do require infrastructure in the form of a "media relay function" that does not transcode video but instead decides which video layers should go to which video endpoint. Figure 1 depicts a network of three SVC video endpoints connected in a multipoint conference.

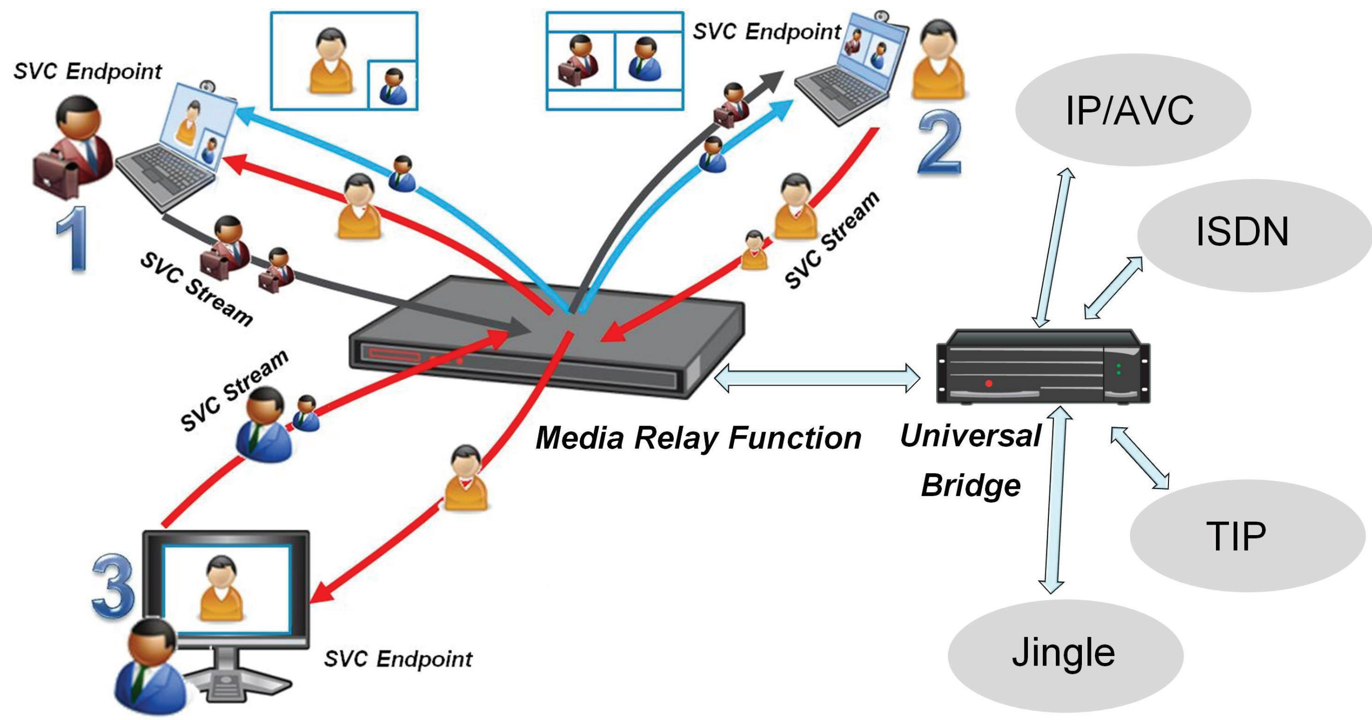

Figure 1: Multipoint Conference in the SVC Network

Each of the three video endpoints sends two quality levels—a low-quality level and a high-quality level (represented by a small and large icon). High quality is associated with high picture resolution and high frame rate. It is also important to highlight that with SVC the high-quality video is reconstructed from the low-quality version, carried in the so-called "base" layer, and additional information carried in "enhancement" layer(s). If the transmission of the complete video information is not possible, enhancement layers are dropped and the receiver uses information in the base layer to deliver best possible video quality. For simplicity, these details are not included in Figure 1.

Video endpoints with small screens, such as mobile phones, or those with large screens but using a layout that requires only a low-quality image from a certain participants, request the low-quality version of the video. For example, endpoint 1 receives only the low-quality version of the video from endpoint 2 because it displays the video in a small window.

Video endpoints with large screens, such as room conferencing systems, or telepresence systems request the high-quality version of the video. For example, endpoint 3 in Figure 1 receives high-quality video from endpoint 2.

In addition to the endpoint's capability and the current layout, other factors such as available network bandwidth can influence the quality of the video received by an SVC video endpoint. If the network experiences congestion, and starts dropping packets, an SVC video endpoint may ask the media relay function to stop forwarding high-quality video information and only forward low-quality video. This adaptive behavior allows for efficient delivery of high-quality user experience to endpoints with varying capabilities and across networks with varying degrees of quality of service.

SVC Benefits

SVC is an adaptive, bandwidth-efficient technology that delivers a consistently high-quality user experience across networks with varying degrees of quality of service.

The elimination of transcoding in the video network leads to immediate reduction of the end-to-end delay on multipoint calls. Since delay is the most important obstacle to interactivity, delay reduction is expected to lead to more natural and lively conversations on SVC multipoint calls.

SVC brings video closer to "cloud computing." The new media relay function in the video network is simpler than an MCU and can be implemented in software running on a general-purpose server. By applying virtualization technology, this would allow creating complete video infrastructure "in the cloud," and delivering visual communication services to small and medium businesses that cannot afford an on-premise implementation. SVC therefore is expected to substantially increase the addressable market for visual communication.

In addition, SVC architecture allows for video calls between endpoints with widely varying processor power and network performance characteristics while improving the resilience against packet loss in unmanaged network, including the Internet.

Interoperability Aspects

Unfortunately, there are no standards for signaling in SVC networks today, and direct interoperability between SVC and AVC is therefore not possible. Polycom is actively involved in the efforts in ITU-T, IETF, UCIF, and IMTC to standardize, test, and certify interoperability among SVC implementations in the industry. This process, while not fast, is the only way to ensure interoperability in the industry and avoid further creation of SVC islands, such as those that exist today, that do not connect to each other or to other standard-based legacy systems.

Standardization is also required in the area of packet loss recovery. It is important to highlight that SVC itself is not a packet loss recovery mechanism, although there have been attempts in the market to position SVC this way. An industry standard is required to allow for end-to-end packet loss recovery among systems from different vendors.

Finally, gateways will be needed in the foreseeable future to connect SVC networks with non-SVC networks, both IP and ISDN based. The currently available gateways are based on general purpose servers and therefore not scalable. Polycom will be using its expertise in creating scalable servers to create gateways that address the need of real customer networks with thousands of AVC, SVC, and ISDN endpoints.

Polycom's commitment to develop and deploy interoperable SVC technology will accelerate market growth and industry innovation by addressing the interoperability and licensing cost barriers that exist with SVC implementations today.

SVC and the Polycom RealPresence™ Platform

Polycom has addressed the increased scalability, resiliency, reliability, and redundancy requirements in video networks through the Polycom RealPresence™ Platform, a powerful, unique infrastructure solution that supports distributed video applications. The Polycom RealPresence™ Platform delivers innovations in bandwidth efficiency, network flexibility and resiliency, scale and redundancy, and native UC integration, all of which leads to overall low total cost of ownership (TCO).

SVC will be a natural addition to the Polycom RealPresence™ Platform and will help increase scalability even further. The reliability and failover concepts developed in Polycom RealPresence™ Platform will continue to be used with SVC. We expect that the Polycom DMA™ 7000 platform solution will take over additional functionality and become an even more important element in video deployments, while Polycom CMA® 5000 will be enhanced to manage SVC video endpoints.

Conclusion

SVC technology promises to increase the scalability of video networks to support mass desktop video deployments while reducing the cost of the video network. SVC is therefore poised to become the preferred method for multipoint conferencing.

SVC technology touches all elements of video network, and leads to functionality shifts among elements. The overall network functionality—implemented today in the Polycom RealPresence™ Platform—will evolve to combine new SVC techniques with existing scalability and reliability mechanisms.

Interoperability with the installed base of AVC equipment will continue to be an important requirement going forward. SVC and other protocols entering the visual communication market will drive demand for universal bridging, that is, the capability to connect communication islands into a global visual communication network.

About the Author

Stefan Karapetkov is Emerging Technologies Director at Polycom, Inc. where he focuses on the visual communications market and technology. He has MBA from Santa Clara University (USA) and an MS degree in Engineering from the University of Chemnitz (Germany). He has spent more than 15 years in product management, new technology development, and product definition. His blog is http://videonetworker.blogspot.com/.

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About Polycom

Polycom is the global leader in standards-based unified communications (UC) solutions for telepresence, video, and voice powered by the Polycom® RealPresence™ Platform. The RealPresence Platform interoperates with the broadest range of business, mobile, and social applications and devices. More than 400,000 organizations trust Polycom solutions to collaborate and meet face-to-face from any location for more productive and effective engagement with colleagues, partners, customers, and prospects. Polycom, together with its broad partner ecosystem, provides customers with the best TCO, scalability, and security—on-premises, hosted, or cloud delivered.

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