



Integrating Online Video and Pay TV Experiences

Rapid advances in technology have led to enormous growth in online video services, transforming consumer viewing habits beyond linear and on-demand pay-TV content. Improvements in broadband speed, the availability of superior user interfaces (UIs) and vast online content libraries, have allowed consumers to fashion their own bundles of web-based channels that are outside of the pay-TV ecosystem.

While the trends toward cord cutting and cord shaving have eroded pay-TV subscriber bases in the near term, the reality is that online video represents a significant opportunity for operators and content providers alike. Using new cloud virtualization technologies, online user interfaces and content libraries can be delivered to entire pay-TV subscriber footprints, preserving the value of the pay-TV bundle for operators and creating accelerated growth opportunities for online video providers.

Rendering Online Video Applications with CloudTV StreamCast

Stark differences between web technologies and pay-TV platforms historically have prevented pay-TV operators from integrating online video experiences into their content bundles. ActiveVideo® CloudTV StreamCast is enabling operators such as Cablevision and Liberty Global's UPC Hungary to deliver—to existing and next generation STBs—complete online video experiences that have been proven to drive engagement without cannibalizing linear and on-demand video services.

CloudTV StreamCast overcomes media format, content security and browser limitations of existing set-top boxes; it virtualizes those functions in the cloud and delivers user experiences to any cable QAM or IP STB that is supported by a downloadable or pre-installed client with a CloudTV Nano module. Using core capabilities of the ActiveVideo CloudTV platform, StreamCast:

- Renders HTML5 applications and interfaces in the cloud and delivers them as interactive MPEG streams;
- Passes through content whose video and security formats are supported by the targeted STBs; and
- Bridges unsupported web video and DRM formats into the video formats, conditional access systems and DRM formats specified by the set-top box

The result is a unified content search and discovery experience across linear, on-demand and online content; delivery of online content with a pay-TV Quality of Experience (QoE); and a seamless user experience that eliminates the need to switch inputs and remote controls between TV, STB and other devices.

Delivering Consistent Online Experiences Across Diverse STB Models

StreamCast effectively addresses the challenge to offer consistent online video consumption experience at rapid scale to a diverse STB footprint:

Pay-TV Operator's Challenge	StreamCast Solution
<p>Cord-cutting/Cord-shaving</p> <p>Consumers are embracing streaming and handheld devices for viewing OTT content</p>	<p>Preserves value of pay-TV bundles by providing integrated consumer access to pay-TV and online content libraries from existing STB</p>
<p>Support for Content Formats</p> <p>Multiple media formats used by a vast array of online content are not supported by STBs in the footprint</p>	<p>Media Bridge converts multiple online content formats to a single format supported by the receiving STB</p>
<p>Incompatible Security Systems</p> <p>DRM systems used to protect online content are often incompatible with pay-TV operators' conditional access systems or the existing DRM supported by the STB</p>	<p>DRM bridge supports multiple security paradigms of online content by terminating the ingest content DRM and securely using the pay-TV conditional access or third party DRM supported natively by the STB.</p>
<p>Limited Service Velocity with Online Content Apps</p> <p>Though online video applications are gaining momentum, operators are unable to quickly rollout new apps-based services for monetization and growth</p>	<p>Cloud based virtualization improves service velocity, and unlocks new and upsell opportunities through pay-TV and online content provider partnerships</p>
<p>Inconsistent and Inconvenient User Experience</p> <p>Switching TV inputs, boxes or remotes to go between pay-TV and online content viewing results in a confusing consumer experience</p>	<p>Integration of online content into STB channel lineup eliminates the unwieldy task of shifting between devices and remote controls.</p>

Maximizing Footprint for Online Content Through the Cloud

StreamCast supports different types of content flows, maximizing the availability of online content. These include handling of content source formats that can be decoded directly by STBs, and support for online video formats that require transcoding to a suitable format for the STB.

Video Pass-Through: When the pay-TV STB is able to natively decode the online content, the content passes through the CloudTV platform with no transcoding of the source video. Video pass through maintains the original content quality and improves overall CloudTV platform scalability to deliver full resolution video streams.

Direct Ingest Content Flow: In this flow, the CloudTV platform pulls content from online sources directly into Streaming Engine, the central component of the CloudTV platform. For STBs that support the online content source resolution, aspect ratio, and frame rate, the content is passed directly without any transcoding. For other STBs, the online content is transcoded into an MPEG2/H.264 format supported by the STB, using a hardware transcoder that resides in the CloudTV platform. Figure 1 shows the Direct Ingest content flow using StreamCast.

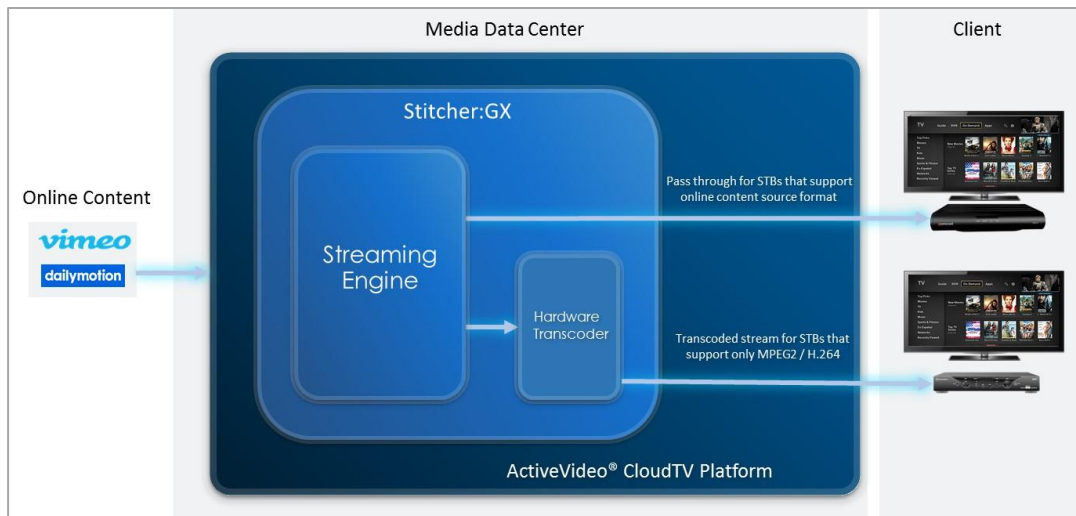


Figure 1. StreamCast Direct Ingest Flow.

Media Source Content Flow: In this flow, the CloudTV platform pulls content from the Online Content Provider’s content delivery network (CDN) into the Streaming Engine, through the use of JavaScript Media Source Player. The input content must use H.264 and must be in MPEG DASH format for transport. For STB clients that support the online content resolution, aspect ratio, and frame rate, the content is passed directly without any transcoding. For other STBs, the online content is transcoded into an MPEG2/H.264 format supported by the STB, through a hardware transcoder that resides in the CloudTV platform. Popular online video providers such as YouTube and Hulu currently use the JavaScript Media Source Extensions to specify and stream media to any web browser—the CloudTV Application Engine supports this method as well, broadening StreamCast ingest support. Figure 2 shows the Media Source content flow using StreamCast.

Server-side and Client-side Overlays

Overlays are HTML5 elements such as information or playback progress bars, quick menus, warning or alert notifications—typically static information of short and transient duration that does not interrupt video viewing. StreamCast supports server-side overlays, in which partial screen user interface images are stitched along with the video content. This is particularly useful when the STBs are not able to support overlay functions. If the STB client is capable of handling overlay images, StreamCast leverages the Dual-Path Rendering technique to optimally deliver overlays. StreamCast does not support partial screen videos since the content is pulled directly into CloudTV platform without any media pre-processing.

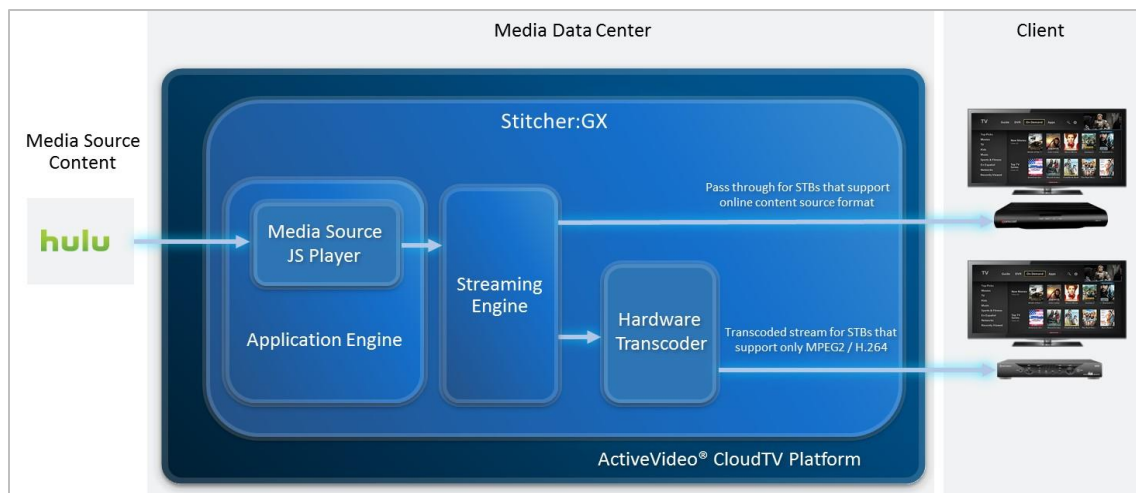


Figure 2. StreamCast Media Source Content Flow.

Transcoding in the Cloud to Bridge Media Formats

In order to ensure media format compatibility between online content and STBs, StreamCast Media Bridge performs a full transcode of the source video into the supported pay-TV format—transforming content from online transport, container, video and audio formats, such as HLS, DASH, MP4, H.264 and AAC, into pay-TV STB transport, container, video and audio formats such as MPEG2 Transport, MPEG2 video and AC3. The Media Bridge supports multiple transport methods of content ingest, such as HLS and DASH, as well as content transformations from simple re-multiplexing of the transport container format to full transcoding at the required bitrate and codec profiles. This capability uses the real-time hardware video transcoder that is part of the CloudTV platform.



Real Time Transcoding allows StreamCast to deliver online video at scale to pay-TV STBs through the use of dedicated off-the-shelf hardware video transcoder that transcodes any full-resolution video and audio source in any format into pay-TV provider video and audio formats.

Bridging Digital Rights Management in the Cloud to Preserve Content Security

To ensure maximum content security, StreamCast DRM Bridge converts online video providers' DRM systems, into pay-TV providers' conditional access systems (CAS) or a DRM that is supported by the STB. The DRM Bridge implements all of the required DRM license and key management within a trusted environment. All CAS or DRM system integrations are implemented in association with the CAS/DRM vendor, the pay-TV provider and the online video provider as applicable. The result is a DRM vendor-approved solution that securely delivers premium online content to pay-TV subscribers.

Optimized for Scale and Performance

ActiveVideo CloudTV StreamCast currently delivers millions of minutes of online video content every day, using optimization techniques that address pay-TV operators' network bandwidth and scaling issues. StreamCast leverages many of the optimization techniques used by ActiveVideo® CloudTV GuideCast, such as Dual-Path Rendering for overlays. For a discussion of the CloudTV optimization techniques, refer to the GuideCast whitepaper.

Expanding Pay TV with Online Video Experiences for Growth

Despite the phenomena of cord cutting and cord shaving, pay-TV content and services retain immense value. Moreover, the ability of pay-TV to partner with online video providers can significantly expand the depth and breadth of cost-effective, web-based content, driving subscriber retention and acquisition, increasing subscriber satisfaction and growing the value of the pay-TV bundle.

At the same time, online video providers are seeking differentiation in an increasingly competitive environment. By working with pay-TV operators, they can have immediate access to entire customer footprints with services that are delivered with pay-TV Quality of Experience and have the same look and feel, regardless of the end user's device.

ActiveVideo CloudTV StreamCast resolves these technical challenges to allow pay-TV providers to partner with online video providers, to expand content offerings and to deliver a consistent integrated search experience at scale to all set-top boxes.

About ActiveVideo

ActiveVideo is the developer of CloudTV, the only software platform that enables service providers, content aggregators and CE manufacturers to *virtualize CPE functions* in the cloud for the purposes of delivering online content, advanced user interfaces and interactive advertising for TV to all generations of set-top boxes and connected devices. CloudTV delivers consistent, branded video experiences from the cloud, eliminating the cost and time to market of writing content for multiple device makes and models. ActiveVideo is a joint venture of ARRIS Group, Inc. (NASDAQ: ARRS) and Charter Communications (NASDAQ: CHTR). For more information and contacts, please visit www.activevideo.com.