Accelerating UIs from the cloud with CloudTV

Introduction

Consumers accustomed to app-like search, discovery and navigation experiences expect the same smooth user experience from their big-screen TV viewing. Some pay-TV providers have worked to match the online experience by deploying powerful, next-generation set-top boxes (STBs), but rolling these out across the entire installed base takes a number of years and won't deliver a consistent, branded experience to all subscribers. Device upgrades impact CapEx and OpEx, with purchase and deployment of new devices - investing in the STB buys just a little more time, as the ever-increasing technical demands of new video services continue to outpace the capabilities of the hardware.

Through the use of cloud and virtualization technologies, pay-TV providers now have a proven way to accelerate delivery of advanced and consistent user experiences (UXs) to all existing and forthcoming STBs in an operator's footprint. Using a cloud-based approach, operators align their video services experience across their STB generational footprint without upgrading every STB to offer the web-like user interfaces (UIs) their customers expect.

Virtualizing Set-Top Functions with CloudTV

Implementing a consistent operator branded user experience across any multi-generational STB installed base is an enormous challenge. Not least because a large portion of the operators STBs are just not capable of delivering rich graphical experiences. CloudTV is an alternative solution that enables operators such as Charter Communications to accelerate the availability of advanced user experiences that can increase subscriber loyalty, and can provide additional monetization opportunities by providing premium content services across their footprint.

CloudTV virtualizes STB functionality. It is a private-cloud-based platform that decouples the user experience from the limitations of the device hardware, such as CPU speed, memory size and graphics capabilities that restrict the delivery of advanced user experiences. Using CloudTV, pay-TV operators can render a state-of-the-art HTML5 user interface in the cloud, and deliver the output as an interactive MPEG video stream to any cable QAM or IP STB equipped with the downloadable or pre- installed CloudTV nano-client. Putting the app into the cloud, and using the available horsepower there, enables delivery of new experiences with rapid roll-out, at web-like scale.
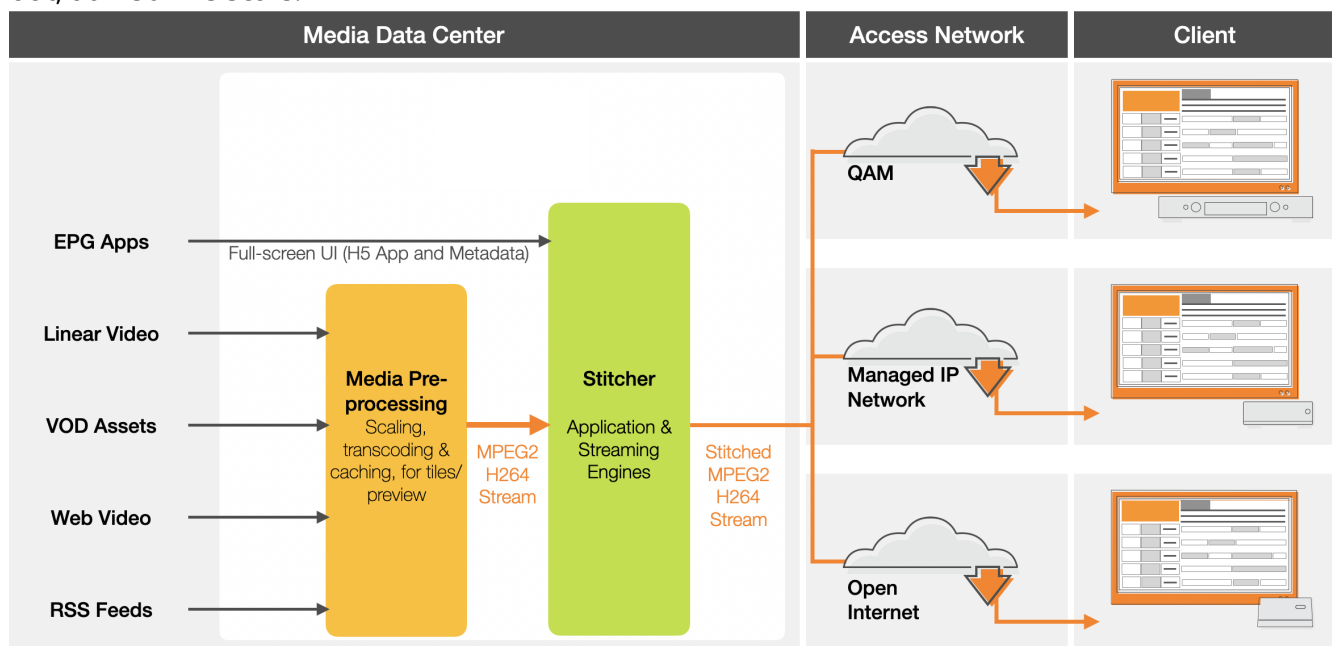

Figure 1. Stitchable UI Content and Application Flow with CloudTV.

Figure 1 shows the virtualized flow of UI from the operator's media data center to the consumer STBs using CloudTV. The linear TV or VOD UI is rendered by the HTML5 application engine within the CloudTV platform, and the UI components such as the guide metadata, VoD libraries, mosaic or preview video components from different sources are scaled, transcoded or cached as necessary, and stitched into a single MPEG2 or H.264 UI stream for the different STBs on the operator's network.
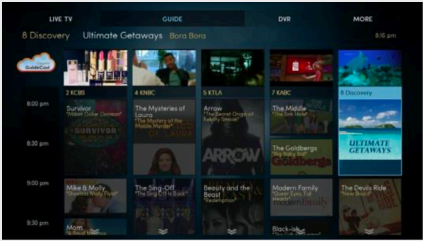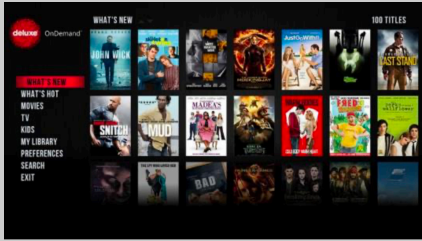
Delivering a consistent user experience

The answer, of course, is to deliver app output as an MPEG stream. Over the years, a pay-TV provider may have deployed dozens of different STB models across the subscriber footprint -these all have different capabilities and likely run different chipsets across a range of OEMs. Providing a uniform, branded experience across multiple generations and diverse hardware footprints is a well-known problem with very few proper solutions. CloudTV is the best approach because it combines the functionality of HTML5 with the simplicity of MPEG, ensuring the same user experience across all STB makes, models, brands, and years.

Challenge facing PayTV Operator	CloudTV Solution
Slow Pace of Innovation: While OTT competitors innovate at web-speed, developing new STB video experiences takes months or even years to deliver	• Introduces modern UIs to all devices immediately, including ability to change to preferred UI view on the click of a button • Accelerates innovation through rapid development, testing and rollout from the cloud
Deployed Base Limits Growth: Deployed STBs that cannot support modern UIs limit rollout of new video services and impede revenue growth	• Unlocks new revenue generating services such as VOD, personalized and recommendations and advanced advertising • Improves customer satisfaction and loyalty
Inconsistent User Experience: Different STB development environments result in inconsistent UI experiences across the footprint	• Ability to design HTML5 UI once and deliver to every STB. Consistent, branded UI across every STB make/model
Limits on Scale, Efficiency and ROIC: Interim fixes with firmware upgrades or non-optimized cloud solutions do not scale to entire footprint and reduce operator's return on invested capital.	• Patented breakthroughs such as MPEG stitching and innovative optimizations for bandwidth management, overlay handling, complex and smooth animations allow CloudTV to scale efficiently (6X vs. STB-centric approaches) across large footprints
High Operational Costs/Complexity: Create and maintain multiple software versions for each service (Linear TV, VOD, online video). Limited number of STB software specialists.	• HTML5 development environment & cloud rendering • Reduced cost/complexity associated with technology updates and software versions for diverse devices • Resources from the large pool of web developers
Difficulty of Back-office Migration: Any upgrade of operator back office systems is complicated as deployed STBs need to be supported while the upgrade is in effect.	• CloudTV can efficiently support deployed STBs, thus reducing the dependency on back-office systems during an upgrade cycle

Reaching wide with different user interface formats and features

CloudTV output streams are encapsulated in MPEG-2 or H.264 transport streams that are sent over UDP/IP unicast or HTTP/HTTPS, with support for constant or variable bitrates (CBR/VBR) and multiple video profiles. Pay-TV operators that have deployed a dozen or more types of STBs over decades have successfully used CloudTV to upgrade any box to the latest UI/UX. Despite middleware differences, STBs are integrated with modules based on the CloudTV Nano SDK family. The CloudTV Nano SDK uses the Binary Control Protocol (BCP) to interface with ALOHA or DAVIC (SCTE-55) based STBs, or they use the Remote Frame Buffer (RFB) protocol with extensions to interface with IP STBs. The innovative UI rendered by CloudTV unlocks possibilities that are as diverse as the capabilities of an HTML5 application. CloudTV supports the following features:

- Linear TV Electronic Program Guide (EPG) applications: Full screen or partial screen menus or EPGs that are developed in HTML5, either by the pay-TV operator or through a third party

- Grid, Graphic, Calendar or Mosaic views, animated UIs and preview videos for multiple rich UI options and improved versions of traditional guides

- Ability to switch between guide views at the push of a button

- VOD storefront applications and operator-owned VOD UI with support for popular VOD servers

- Integration of guide UI with back-end content meta-data and analytics

- Web-based cloud driven experiences such as catch-up TV with full UI functionality and trick play modes

- Live video previews and overlays across linear TV guides, VOD catalogs and online video content

- Multiple tiles of live video previews, ranked by popularity if desired, on single tuner STBs

Boosting Scalability and Reducing Network Impact

While the functions of a guide can easily be ported into HTML5 and executed in the cloud, service providers are naturally concerned about the impact this might have on their infrastructure - namely the network bandwidth, server costs and the scalability of the platform to satisfy high concurrent usage.

CloudTV is currently operation in some of the largest pay-TV operators in the world, proving the concept and providing data to accurately model deployment, feasibility and performance. CloudTV servers use only incremental bandwidth for UIs, and are able to deliver actual full-screen, grid based 720p HD guide sessions within 2Mbps. CloudTV UI rendering also meets operator expectations on peak concurrency, which has been below 1.0% for the most part, even during special live events[1]. CloudTV components add less than 100ms to the overall roundtrip latency, while maintaining the responsiveness and TV viewing experience that customers demand[2]. CloudTV includes new innovations that dramatically improve the scalability and bandwidth efficiency of the system:

Smart Multiplexing: Typically, CloudTV sessions are VBR streams that use only a fraction of the allocated bandwidth for streaming UI. In a cable QAM environment, the CloudTV platform can interface and negotiate bandwidth from several Session Resource Managers, such as those provided by vendors such as Cisco and SeaChange. With Smart Multiplexing, the CloudTV platform requests either the maximum-allowed or a predefined amount of CBR stream bandwidth across one or more QAM channels, and automatically manages the cumulative streaming bandwidth through those channels. CloudTV has the intelligence to ensure that the cumulative bitrate of all sessions does not exceed bandwidth capacity, instead adjusting the output bitrates and delaying the delivery of a small amount of video data from all streams, whire retaining a consistent viewing experience. Smart Multiplexing enables as many as 10X more CloudTV sessions within existing QAM network capacity, resulting in up to 50% less network capacity required for UI delivery.

Dual-Path Rendering: Guide functions that render partial-screen user interfaces displayed over full-screen video ("overlays") are handled using Dual-Path Rendering. This key innovation of the CloudTV platform allows pay-TV operators to simultaneously and independently deliver any full-screen UI cloud-generated overlays. This ensure that HTML5 elements such as info or playback progress bars, quick menus, error or reminder notifications are generated and rendered into images by components in the CloudTV platform. When CloudTV performsDual-Path Rendering, both the QAM video and OOB paths deliver elements of the UI: the video path delivers full-screen UIs as MPEG2/H.264 streams, while the OOB path delivers partial screen UIs as graphic images in formats such as PNG, JPG, GIF or bitmap. Dual-Path rendering is specifically designed for pay-TV operators using DOCSIS technology, which has sufficient out-of-band or control network capacity to support higher-bandwidth OOB communications for transmitting graphic images.

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[1] For details on scalability and performance metrics, please contact the sales representative for your region. [2] For more

details on managing cloud UI latency components, please read our Cloud UI Latency Whitepaper

Delivering Tomorrow's Pay-TV Experience Today

STB-based UIs have served pay-TV operators well for many years, but they are long-in-the-tooth and customers are clamouring for modern interfaces. CloudTV is a proven way to eliminate technological barriers and deliver interactive, state-of- the-art user experiences that have the same look and feel across multiple generations of STBs. With CloudTV's dazzling interfaces and intelligent bandwidth use, pay-TV operators can improve customer loyalty, lower operating costs, unlock new revenue-generating services, and accelerate the pace of innovation.