



Consumers accustomed to the search, discovery and navigation experiences of the Web on a variety of devices expect their big screen TV viewing to be just as sleek and easy to use. While some pay-TV providers have attempted to match the online experience by deploying powerful, next-generation set-top boxes, the time-to-market required for replacing STBs in every home decreases overall customer satisfaction and fails to realize the benefits of subscriber retention.

Through the use of cloud and virtualization technologies, pay-TV providers now have a proven way to accelerate delivery of advanced user experiences (UXs) that are made available uniformly on existing and next-generation STBs in a pay-TV operator’s footprint. As a result, operators no longer have to wait for the next set-top box upgrade cycle to offer the web-like user interfaces (UIs) their customers desire.

### Virtualizing STB Functions with ActiveVideo® CloudTV GuideCast

Evolving pay-TV to provide state-of-the-art user experiences is an enormous challenge that is beyond the capabilities of the vast majority of STBs in the field today, and it can take up to a decade to deploy next-generation STBs. ActiveVideo® CloudTV GuideCast is an alternative 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.

ActiveVideo CloudTV GuideCast virtualizes STB functionality. It is a cloud-based platform that decouples the user experience from device dependencies such as CPU speed, memory size and graphics capabilities that restrict advanced UXs. Using GuideCast, 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 that is supported by a downloadable or pre- installed client with a CloudTV Nano module. Built on ActiveVideo’s CloudTV platform, GuideCast enables delivery of new experiences with rapid service velocity and at web scale. Virtualization of STB functions using GuideCast can also be extended to next generation devices: this allows STB advancements to focus on advanced codecs and high quality video formats instead of UX functionality, and enables delivery of uncompromised pay-TV user experiences to HDMI dongles and low-cost CPEs.

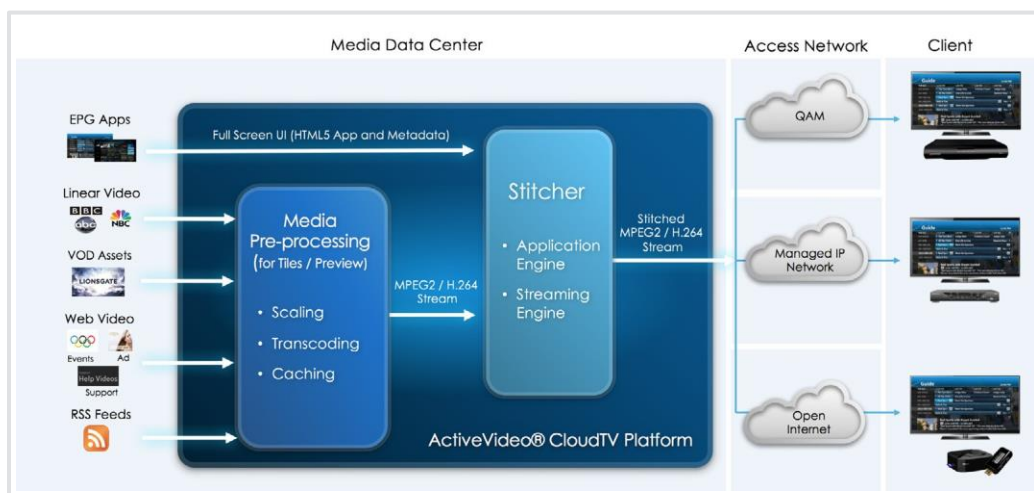


Figure 1. Stitchable UI Content and Application Flow with GuideCast.

Figure 1 shows the virtualized flow of UI from the operator’s media data center to the consumer STBs using GuideCast.

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, 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.

### Rapidly Delivering Consistent UX across Diverse STB Models

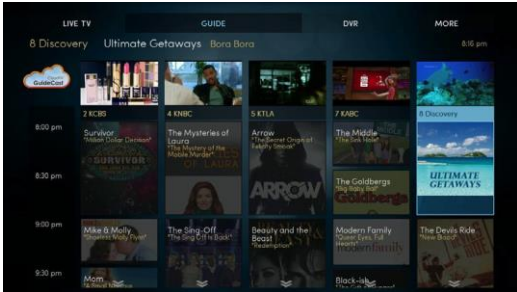
Over the years, a pay-TV provider may have deployed dozens of different STB models across the subscriber footprint. GuideCast addresses the challenge to offer consistent user experiences at rapid scale to a diverse footprint:

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

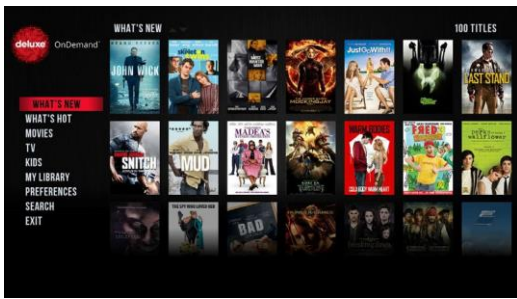
## Reaching Wide with Different UI Formats and Features

GuideCast 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 GuideCast to upgrade to the latest UI/UX. Despite middleware differences, these STBs have been 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 ActiveVideo extensions to interface with IP STBs.

The innovative UI rendered in the cloud by GuideCast unlocks possibilities that are as diverse as the capabilities of an HTML5 application. GuideCast supports the following advanced 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

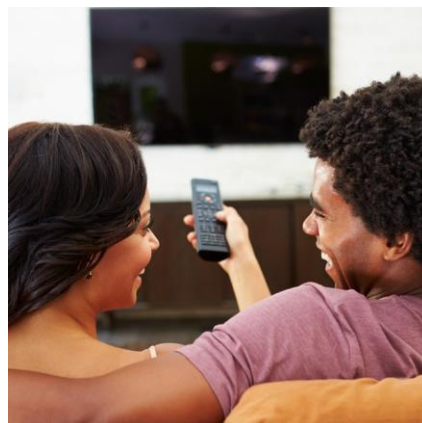
While the functions of a guide can easily be ported into HTML5 and executed in the cloud, service providers are naturally concerned about the impact this might have on their network bandwidth, server costs and the scalability of the platform to satisfy high concurrent usage. ActiveVideo is now live and proven with some of the largest pay-TV operators in the world, making real deployment data available on feasibility and performance. GuideCast servers use only incremental bandwidth for UIs, and are able to deliver actual full screen grid based 720p HD guide sessions within 2Mbps. GuideCast UI rendering also meets operator expectations on peak concurrency, which has been below 1.0% for the most part, even during special live events<sup>1</sup>. CloudTV components add less than 100ms to the overall roundtrip latency, while maintaining the responsiveness and TV viewing experience that customers demand<sup>2</sup>.

<sup>1</sup> For details on scalability and performance metrics, please contact the ActiveVideo sales representative for your region.

<sup>2</sup> For more details on managing cloud UI latency components, please read our [Cloud UI Latency Whitepaper](#).

GuideCast includes new CloudTV innovations that dramatically improve the scalability and bandwidth efficiency of the system:

**Smart Multiplexing:** Typical CloudTV sessions are VBR streams and only use 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 (SRMs) provided by vendors such as Cisco and SeaChange. With Smart Multiplexing, the CloudTV platform requests either the maximum allowed or a pre-defined amount of CBR stream bandwidth across one or more QAM channels, and automatically manages the cumulative streaming bandwidth through those channels. Before the cumulative bitrate of all the sessions exceeds the bandwidth capacity, the CloudTV platform will adjust the output bitrates and delay the delivery of a small amount of video data from all streams, without impacting the viewing experience. Smart Multiplexing enables as many as 10X more GuideCast sessions without exceeding the 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 (“Overlays”) displayed over full-screen video can be 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 and overlays from the cloud. Overlays are HTML5 elements such as info or playback progress bars, quick menus, error or reminder notifications—typically static information of short and transient duration so as not to interrupt video viewing—that are generated and rendered into images by components in the CloudTV platform. In Dual-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 the partial screen UIs as graphic images in formats such as PNG, JPG, GIF or bitmap. Dual-Path rendering is ideal 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.

## Delivering Tomorrow’s Pay-TV Experience Today

Yesterday’s STB-based UIs have served pay-TV operators well for many years, but customers are clamoring for advanced interfaces. GuideCast is a proven way to eliminate technological barriers and deliver interactive, state-of-the-art user experiences that have the same look and feel on existing and next generation STBs. Using GuideCast, pay-TV operators can improve customer loyalty, lower operating costs, unlock new revenue-generating services, and accelerate the pace of innovation.

## 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](http://www.activevideo.com).