



The Cloud-Based User Interface

Bringing New Flexibility to UI/UX Deployment

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Introduction

Pay TV Operators are embracing a cloud-based user interface (UI) model that provides several advantages over the traditional practice of hosting the UI in set-top boxes and other delivery devices. A cloud-based UI allows the operator to quickly respond to changes in viewing habits and deliver to new viewing platforms, such as tablets and mobiles, while continuing to support legacy devices. Effective Cloud UI offerings can also enable rapid software-based updates and on-line deployments offer lower costs by reducing the need for expensive field upgrades and truck rolls.

Cloud UI

Today's viewers expect high-quality video delivered to their TVs and mobile devices promptly and without hassle. The best user experience (UX) is delivered by a user interface (UI) that:

- Manages the sheer volume of available video and metadata in a simple straightforward way
- Does so consistently on all viewing platforms, large and small, tethered and mobile
- Is easily understood and responds quickly
- Is personal and attractive

The successful UI must assemble content, arrange graphically for the intended viewing device, then receive and act upon user input. For efficiency and to best take advantage of the features of the individual delivery device, these operations were traditionally performed as far along the delivery chain as possible, in the client device. This traditional model capitalized on technological advances in delivery devices (high-powered STBs, computationally-empowered mobiles), but at the expense of expensive hardware deployments and cumbersome "thick client" software.

Thanks to advances in cloud technology, nearly all of the key UI functions, including near-final rendering, can be performed in the cloud. Increases in network speed and reliability have reduced latency to the point where a keystroke or gesture on the user's device can be dispatched to a cloud-based server, and the response delivered in a time frame that the user

perceives as having been handled locally. The ever-growing arsenal of cloud-based tools, including virtual 2D and 3D graphics accelerators, allows the UI's presentation to be composed almost entirely in the cloud and sent to the end device ready to display by lightweight software, a "thin client."

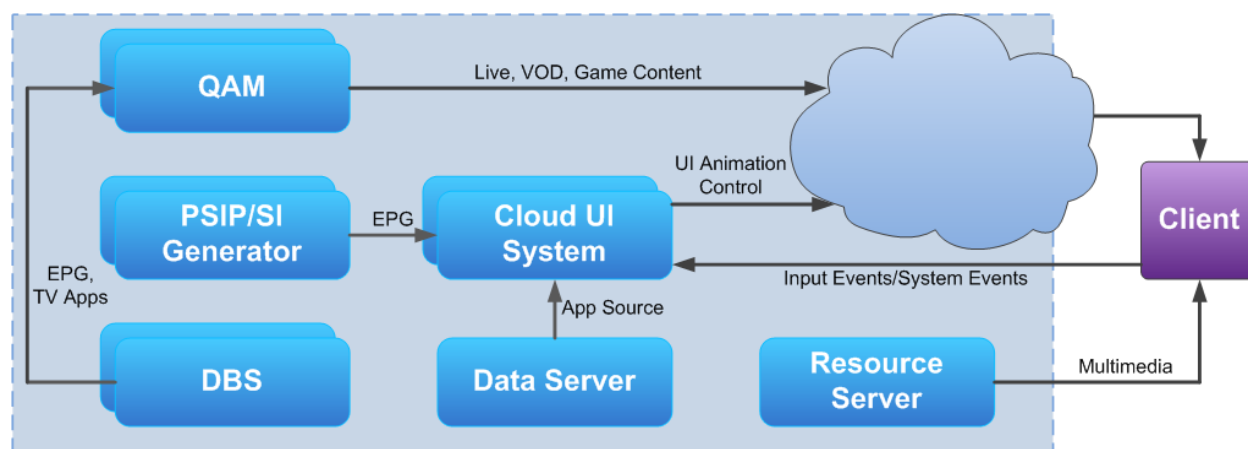
The advantages to Pay TV operators of this shift to cloud-based UIs are compelling. A thin client enables operators to use lower-powered STBs and preserve legacy equipment in the field. New UX designs that once would have demanded field upgrades to support their features can be preprocessed on the server and rendered on legacy clients. Imagine the cost savings of installing a few cloud-based servers to support thousands of users compared to the cost of decommissioning legacy boxes and replacing them with new STBs.

The Thin Client

Together, the server and client components constitute a sophisticated UX delivery system. The cloud-based model capitalizes on server-side computational power to do the heavy lifting. The server-side rendering engine collects all the constituent parts that make up the UI, preprocesses the visual presentation, and adds metadata and instructions for the final rendering. The network then delivers the necessary components and instructions to do the final rendering.

On the box, a client rendering engine takes the instructions from the server and executes them. The ideal thin client renders almost instantly, presenting an extremely fast, high performance UI. In the other direction, the thin client simply fields keystrokes and gestures and dispatches them immediately to the cloud-based UI for processing.

A distinguishing feature of a Cloud UI solution is the balance the vendor strikes between server-based and client-based tasks. Especially interesting are server/client solutions that don't require a tuner on the client.



Benefits

When the service provider places as much intelligence as possible in the cloud, not only is the cost of developing, testing, and deploying UIs simpler, but further cost savings are achieved by reducing the requirements for the delivery device and extending the life of deployed legacy hardware.

Consumers have grown accustomed to the frequent update cycle of apps for OTT devices. Resistance to change has given way to an expectation of continuous improvement in UX performance and capabilities. The Cloud UI model allows operators to more easily extend this same approach to the TV platform, presenting a more uniform quality of service across all delivery devices.

The speed with which UIs can be updated is accelerated tremendously by having a consistent interface to video content (EPG or similar), including broadcast channels, VOD, PVR, time-shifted, on-demand, and OTT material. Common visual elements, such as branding and colors, plus shapes and behaviors of controls, create a comfort zone within which the UI becomes the user's ally, as opposed to an obstacle, in retrieving content.

Considerations

Clearly, the success of Cloud UI depends on minimal network latency. At first glance, one is tempted to ask, "How much bandwidth is consumed by sending the entire UI from the cloud to the client?" On further reflection, though, one can see that in order to present a full UI, the quantity of data to be displayed is the same; the difference is that in the thin client model, the efficiencies of composing the stream or images in the cloud, coupled

with tools such as virtual graphics accelerators, can optimize the preprocessed UI.

Many modern client devices support OpenGL for graphics rendering. In a well designed Cloud UI system, legacy boxes that may not have support for Open GL can often utilize modified rendering intelligence on the client to handle complex animation needs. There may be limits to the minimum STB performance, but Cloud UI can handle a very broad set of legacy systems.

One issue with HTML5 based UIs, in particular, is that UIs targeted for embedded devices require optimization to reduce the number of server calls. By pregathering everything and executing most of the javascript, the server-side renderer maximizes efficient bandwidth usage.

What happens if the client device loses its internet connection to the cloud? Typically a small client (mini-guide) allows the user to change channels and see a snapshot of a downloaded guide. Such a mini-guide might be implemented in Java to support legacy equipment, would typically support channel changing, and might consist of a few days of guide data, plus enough metadata to display titles of shows and parental information.

Trends

The traditional TV interface assumed a roomfull of viewers of various ages and interests engaged in a passive, "lean-back" experience. The modern UI takes advantage of new UX modalities emerging from mobile devices: personalized, interactive "lean-forward" viewing. [1]

For example, Cloud UI can deliver a different user experience to different devices in a single household, tailored to different people in the house, such as children, or specifically designed to enhance genre viewing, such as sports. UI selection could be performed by individual household members, within boundaries established by parental controls.

Pay TV operators, too, can tailor a variety of UIs to a range of target audiences. For example:

- The Operator can provide new users with a beginner UI containing lots of help and additional descriptions
- The Operator can send a test UI to a small group of selected users

- The Operator can send a UI that queries/diagnoses customer equipment to save truck rolls

Summary

The Cloud UI model delivers a top-quality viewing experience while offering considerable advantages to Pay TV operators. Because Cloud UI is based on an efficient scalable client-server thin client model, where the UI is cloud-rendered and delivered to the viewing device, it has the ability to support the full end-device ecosystem, including tablets and mobile. Not only does cloud-resident preprocessing of the UI reduce demands on client hardware, the ability to present a different UI to each device provides UX choices for each device or user and allows the operator to take advantage of UX trials, training and diagnostics for sub-groups. This flexibility results in greater customer satisfaction by providing more options to better suit viewing habits, plus infrastructure and development economies for the Pay TV Operator.

Sources

[1] Younghwan Pan and Young Sam Ryu, Insights for the TV Interface from the Mobile Phone Interface, *Journal of Usability Studies*, v4 issue 4, <http://uxpajournal.org/insights-for-the-tv-interface-from-the-mobile-phone-interface/> August, 2009.

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