Common Business Platforms for Greater Personalization Across Devices
Introduction

The transition from legacy infrastructure to IP and cloud-based technology is enabling the industry to innovate and introduce more personalized consumer experiences with greater agility. One example is the Reference Design Kit (RDK), a standardized software bundle designed to provide a common framework for powering TV service provider customer-premises equipment, including set-top boxes, gateways, and converged devices. This move to advanced IP devices and transparent, centralized services not only helps to accelerate the deployment of next-generation navigation, but it also enables integrated user profiles and services that can offer greater personalization. However, most subscribers still regularly use one or more legacy devices, and it is therefore important that systems enable a consistent experience across multiple consumer applications.

This paper will discuss how flexible, scalable business platforms allow operators to deliver a more relevant experience with smooth transitions between devices to all subscribers. By using an integrated suite of search and recommendation algorithms, real-time user profiles, business rules and audience analytics that span all content types and applications, operators can break down silos and balance business objectives with consumer satisfaction. Critical to this success are solutions that deliver, measure, analyze and tune the user experience based on viewer interaction across devices.

The closing section also includes real-world examples such as the Liberty Global multi-country deployment delivering fully personalized search and recommendations from a centralized platform serving both legacy and RDK clients along with Cox Communications Contour product offering “TV Just For Me” -- personalized recommendations on HD-STB and tablet applications with up to 8 profiles per household.

Evolution of the TV Viewing Experience

Anyone who has read a trade journal or attended a recent show knows that the evolving TV landscape is focused on owning the consumer experience across devices and content sources. This experience can be linear, DVR, NDVR, and VOD delivered over QAM or IP managed networks or TV Everywhere applications or online video content ranging from Netflix subscription VOD services to YouTube user generated content.

The explosion of available content, and resulting fragmentation, combined with much more capable, IP enabled consumer devices has shifted from a world of programmed TV viewing to algorithm driven viewing\(^1\). Regardless of where the content is viewed and whether it is a scheduled broadcast or on-demand, viewers are increasingly relying on algorithmic search, recommendations and voice navigation to find relevant content.
Figure 1 illustrates this evolution and the different eras of technology and consumer experiences. It is important to note that TV technology has a long lifespan, and at any given time, a subscriber household is typically using devices from multiple eras. And, the proliferation of IP enabled devices moves the viewing experience from a static, shared living room environment to a dynamic environment where viewers are moving between devices and locations with different content access rights, viewing patterns and personal versus shared interactions. For example, a recent report by Ofcom found that 22 percent of people watch different content from their family on different screens while in the same room. Figure 2 below provides a look at how multi-screen video viewing is dispersed across the primary set of device categories that are in use today.
The technical and operational challenges of deploying new platforms at scale can create vertical integrations that perform well in isolation, but do not provide a consistent consumer journey and restrict the commercial potential. For example, many tablet applications were initially designed as companion applications with limited VOD libraries and simple related content or mood based recommendations. However, as content delivery infrastructure and licensing agreements have evolved, companion applications are becoming fully featured viewing platforms with a blend of linear, VOD and online video content. Likewise, the underlying technology infrastructure may use a different video delivery platform, content management system, data collection methods and subscriber profiles, which results in a disjointed consumer experience and limits the ability to effectively market to subscribers and measure the impact.

The video industry is soundly within the era of navigation, and service operators need a holistic personalization and content monetization platform to delight their customers and maximize revenues. Achieving that goal requires solutions that understand the complex relationships between content, viewing context and viewer preferences, and can balance consumer experience against business objectives. It also requires the right architectural abstractions to integrate many different data sources and technologies, and allow products to evolve on independent timelines.
Elements of a Holistic Solution

A holistic approach to personalization consists of four essential components:

- Content
- Viewing Context
- Viewer Preferences
- Commercial Objectives

Content
As navigation has evolved from grid guides and VOD menus to advanced entertainment portals, so too has metadata evolved from a basic enabler to a valuable data source in its own right. The metadata framework is still the linear listings and VOD catalogs. However, successful content discovery require much richer datasets that build multi-dimensional associations between content and viewers. Each content item’s intrinsic characteristics and associations can then be matched against the selected catalogs to find the most relevant content available within a given time period and viewing context.

Datasets start with editorial metadata, such as genre, actors and parental control ratings, plus technical and business metadata such as video format and availability windows. That data is then married with information derived from algorithmic processing, social media data and user generated data to fully characterize each content item.

Linear TV content is especially demanding due to the volume of programming, availability of content within the broadcast schedule and subscription packages, the complexity of network channel maps and time zones, and the rate at which schedules change. However, live TV viewing still represents an important piece of TV viewership today, making up 51 percent of all TV viewing.

Viewing Context
The shift to multi-screen viewing mandates the need for contextual awareness within content discovery platforms. Viewers will quickly stop using systems that recommend content to which they do not have access. And, smaller screens require even faster navigation paths. So, optimizing recommendations based on the viewing pattern of each device can greatly increase conversion rates. For example, the personalization techniques and video consumption patterns are very different on a shared family room set-top box (STB) and than on a personal, small screen mobile device.

The user experience also determines the viewing context and greatly impacts which techniques will be most effective. For instance, collaborative filtering recommendations
based on the behavior of a cohort of similar viewers works well in VOD stores containing popular content with a statistically interesting viewing history. However, they do not work well for broadcast linear sources with a large amount of new programming and live events.

Factors that determine viewing context:
- Location
- Time of day / Day of week
- Subscription packages
- Device characteristics
- Content Source (linear, VOD, DVR, OTT)
- Location within the user experience
- Current events and trends

Applications can greatly optimize limited shelf space by understanding the impact on behavior as consumers transition between viewing contexts.

**Viewer Preferences**

Viewer preferences represent the aggregate behavior of a viewer and are weighted based on user intent. Explicit preferences include information that the consumer deliberately tells the system such as, “I like/don’t like the following content” or rating content 1 – 5 stars. These can provide good insight into a viewer’s tastes, but require more interaction than many viewers want and they easily become stale over time.

Implicit preferences, on the other hand, are based on what can be learned from the consumer’s actions like watching a program, recording, or sharing on social media. The art of user profiles is blending both implicit and explicit behavior, determining which events are meaningful, and dynamically adapting as viewing habits change over time.

In order to have a consistent user experience, both explicit and implicit actions should update the same customer profile regardless of which client device is used. For example, viewers will have a disjointed experience if content is recommended on one device when they explicitly disliked it on another device.

Language is another often overlooked aspect of user preferences, and yet it is probably one of our most personal characteristics. Even in English speaking countries, a large percentage of households are multi-lingual. A recent California census found that 40% of California households speak languages other than English at home. Therefore, the user experience can be greatly improved if personalization systems understand multi-lingual content and learn language preferences, particularly on shared devices like STBs that may view content with a mixture of languages.

**Business Objectives**

Consumer marketing techniques are evolving and new opportunities are arising as TV navigation becomes more algorithmic. Search and recommendations provide tremendous consumer value, but they are also a highly effective marketing and content...
monetization tool. And, a centralized view of the consumer, business rules and feedback loops is required to unlock the full potential.

Business teams require management consoles that can configure and measure business objectives for all subscribers and applications. Business rules can range from tuning the navigation parameters to advanced content promotion including:

- Adjusting recommendations based on viewing context
- Managing the spread of recommended content to encourage content discovery
- Promoting high value HD, TVOD or DAI content
- Upsell offers

The highest impact business rules will vary by service operator, geography and the design of the user experience. Therefore, the system should operate in a continual feedback loop that can measure and tune based on real results. This once again highlights the need for centralized systems because the results should account for behavior across all consumer platforms and rules should be tested and deployed once.
System Architecture and Abstraction Layers

The challenge for any centralized, multi-platform system is integrating vastly different technologies, delivery networks and use cases within a single business solution. The system architecture must provide the right abstractions and integration touch points that map the many infrastructure components into a singular understanding of the content, viewer context, viewer preferences and business objectives.

Figure 5: System Architecture

Centralized Core Services
The core of the system provides common services, management consoles and reporting across all of the delivery networks and client applications. On the front-end, both events for user profile learning and search and recommendation requests are surfaced via well-defined interfaces available directly to client devices or middleware proxies. Interfaces must also be designed to handle real-time requests at the scale required by peak primetime loads. Today’s viewers expect instant feedback and will quickly lose faith in systems that are slow or take too long to learn their preferences.

Business rules are managed from a single console and can be applied universally or conditionally to specific use cases or device types. Measurement data is aggregated
within the core and reports can break down interaction by any number of parameters including device type, content source, and UI location.

**Data Integration**
On the back-end, the data integration layer is a critical part of the architecture because the system must aggregate metadata feeds from a variety of sources using distinct transport mechanisms, schemas and lexicons.

Metadata is typically delivered either as XML files that trigger ingest processes or real-time web services returning XML or JSON. Metadata schemas and content identification methods include a mixture of proprietary protocols, industry standards and recommended best practices. Proprietary protocols may come from service operator internal sources, vendor systems, third party data providers, social media networks, and crowd sourced databases. Example metadata initiatives include:

- CableLabs VOD Metadata (aka ADI 1.1\textsuperscript{v} and ADI 3.0)
- MovieLabs Media Entertainment Common Metadata and Core Metadata\textsuperscript{vi}
- Open Authentication Technology Committee (OATC) Metadata Feed Recommended Practice Document\textsuperscript{vii}
- European Telecommunications Standards Institute (ETSI) TV Anytime\textsuperscript{viii}
- Entertainment Identifier Registry (EIDR)\textsuperscript{ix}

While momentum has been growing around these industry initiatives, it remains a pain point across the entire content distribution chain. And, this is made worse in multi-generational deployments operating parallel legacy and IP video infrastructure. It is therefore important for personalization platforms to buffer that complexity from the rest of the system.

Additionally, many datasets lack a shared lexicon and titles may have incomplete or inaccurate data, making it difficult to create quality associations. Effective solutions utilize a combination of normalization, natural language processing and data mining techniques along with automated quality control and human assisted curation to generate optimized datasets for their algorithms.

**Phased Integration**

Once a flexible personalization platform is integrated with the video infrastructure and business systems, it can serve as a toolkit available directly to any IP capable application or via legacy middleware proxies. User profiles will begin learning as soon as the first application comes online. As new applications are added, they can use the same profile to immediately offer a consistent, personalized experience and continue to expand the profile with learning from the new devices and use cases.
Figure 5 represents a hypothetical deployment consisting of legacy and IP STBs as well as Web and mobile/tablet applications. The numbers in the diagram illustrate how functionality can be deployed to different devices on different timelines. In this example, the Web and mobile platforms started with personalized search. Then, the personalization platform was integrated with the legacy middleware to provide related content recommendations on the legacy STB. The IP STB also added personalized search, and additional features were added to each of the applications over time. This kind of iterative integration and independent release cycles is particularly important for projects using agile development with frequent features releases in well-defined sprints.

Deployment Example

Liberty Global’s Horizon media and entertainment platform is one example of how personalized business platforms are enabling operators to deliver a more personalized and relevant experience to subscribers. By using a centralized platform, Horizon is able to deliver fully personalized search and recommendations that simultaneously serves both legacy and RDK clients. This centralized platform gives Liberty Global a suite of client services, real-time user profiles, business rules and audience analytics across...
content types and devices, breaking down silos and balancing business objectives with consumer satisfaction.

Figure 5: Deployment Example: Liberty Global Horizon

Critical to this success are solutions that deliver, measure, analyze and tune the user experience based on viewer interaction across devices. At the Cable Show 2014, Liberty Global previewed its next-generation RDK-based Horizon product that leveraged the architecture and phased integration approach presented in this paper. The operator deployed its recommendations platform with a suite of recommendation algorithms on first generation Horizon UI and the same recommendations platform, tested business rules and reporting data are enabling their next generation RDK deployment. Horizon was initially deployed in 2012 and is used by more than 500,000 customers in four countries and is currently finalizing its trials for a commercial launch of its next generation RDK-based Horizon product in Poland.

Mike Fries, President, CEO and Vice Chairman of Liberty Global, when asked what will be the most important development in cable TV said, “It has to do with bridging the functionality gap. The average cable home today has a relatively antiquated guide. If you look at what we’ve done with Horizon, what Comcast has done with X1…It’s 3-D graphics, it’s recommendation engines, cool navigation. So getting that functionality right, to me, is game, set, match because we’ve got all the content.”

Another example is Cox Communications’ Contour product. Contour’s “TV Just For Me” campaign launched their next generation personalized HD-DVR STB and iOS or Android tablet applications using a shared user profile, and support for up to 8 profiles per household.
Contour’s content discovery focused user experience has seen impressive results including a 40 percent increase in average channels watched - from 22 to 29 channels - across its subscriber base that is receiving content recommendations based on their individual viewing profiles.

Conclusion

The transition from legacy infrastructure to IP and cloud-based technology is presenting the industry with the opportunity to innovate and introduce more personalized consumer experiences with greater velocity. As consumers’ eyeballs have shifted from linear TV viewing to time-shifted and place-shifted viewing so has the end goal: owning the consumer experience across devices and content sources. The video industry is in a new era of navigation, and service operators need a holistic personalization and content monetization platform to satisfy customers and maximize revenues.

Achieving that goal requires solutions that understand the complex relationships between content, viewing context and viewer preferences, and can balance consumer experience against business objectives. It also requires the right architectural abstractions to integrate many different data sources and technologies, and allow products to evolve on independent timelines.

There are two deployment examples around the world where operators have successfully implemented a centralized architecture and are finding success marketing personalized services and content recommendations across both legacy and next-generation devices. By using a centralized platform, Liberty Global’s Horizon platform is
able to deliver fully personalized search and recommendations that simultaneously serves both legacy and RDK clients. Another example is Cox Communications’ Contour product that offers personalized services across set-top boxes and tablet applications all tied to a common personalization-centric marketing message.

Solutions that deliver, measure, analyze and tune the user experience based on multi-platform viewer interaction will be critical to the industry’s ability to successfully expand personalized services well into the future.
### Abbreviations & Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMS</td>
<td>Content Management System</td>
</tr>
<tr>
<td>DAI</td>
<td>Dynamic Advertising Insertion</td>
</tr>
<tr>
<td>DVR</td>
<td>Digital Video Recorder</td>
</tr>
<tr>
<td>EIDR</td>
<td>Entertainment Identifier Registry</td>
</tr>
<tr>
<td>ETSI</td>
<td>European Telecommunications Standards Institute</td>
</tr>
<tr>
<td>HD</td>
<td>High Definition</td>
</tr>
<tr>
<td>IP</td>
<td>Internet Protocol</td>
</tr>
<tr>
<td>JSON</td>
<td>JavaScript Object Notation</td>
</tr>
<tr>
<td>NDVR</td>
<td>Network Digital Video Recorder</td>
</tr>
<tr>
<td>OATC</td>
<td>Open Authentication Technology Committee</td>
</tr>
<tr>
<td>QAM</td>
<td>Quadrature Amplitude Modulation</td>
</tr>
<tr>
<td>RDK</td>
<td>Reference Design Kit</td>
</tr>
<tr>
<td>STB</td>
<td>Set-Top Box</td>
</tr>
<tr>
<td>TVOD</td>
<td>Television Video on Demand</td>
</tr>
<tr>
<td>UI</td>
<td>User Interface</td>
</tr>
<tr>
<td>VOD</td>
<td>Video on Demand</td>
</tr>
<tr>
<td>XML</td>
<td>Extensible Markup Language</td>
</tr>
</tbody>
</table>
References


ix Entertainment Identifier Registry http://eidr.org

x Liberty Global Horizon demonstration at Cable Show 2014, http://2014.thecableshow.com/videos/Play/83MWtwbTrTcXe9ukVSgk172ub5h7HdMS?i=so1#channel=*&i=so1

xi Liberty Global Horizon demonstration at Cable Show 2014, http://2014.thecableshow.com/videos/Play/83MWtwbTrTcXe9ukVSgk172ub5h7HdMS?i=so1#channel=*&i=so1

xiii Cox Contour, http://contour.cox.com

xiv Cox Contour demonstration at Cable Show 2014,
http://2014.thecables SHOW.com/videos/Play/9hd3hvbTqbj0cTtgYAbDaAUUVXGUVy_B#c
channel=*&i=so1