VOD Navigation:
A Network-Based Approach to Increasing Customer Satisfaction and Operator Revenue

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Abstract

As on-demand viewing has grown in popularity and the capacity of digital networks has increased, cable system operators have recognized the competitive value of providing the most expansive library possible of quality, on-demand video entertainment. At the 2008 Consumer Electronics Show, for example, Comcast announced "Project Infinity" – described in the company's news release as Comcast's vision "to give consumers the ability to watch any movie, television show, user generated content or other video that a producer wants to make available On Demand."

While cable operators continue to expand the array of VOD programming available, however, a key part of the subscriber service – the ability to quickly and easily browse and find desired content amidst thousands of titles – has been hindered by the limited capabilities of the deployed base of set-top boxes. At the same time, consumers have come to enjoy the speed and convenience of content discovery and searches from exposure to the Web. As a result, operators are taking the initiative to develop new ways of navigation that enhance the customer experience and increase on-demand revenues.

One approach under consideration leverages the power of network-based processing to allow subscribers to conduct Web-type searches through tens of thousands of available offerings. These searches can find content by title, by genre, by actor or by other criteria, with a breadth and depth that is similar to those that are available on the Web through Netflix or Amazon.

Utilizing such an approach as the "front end" of its VOD solution, operators can significantly enhance the overall customer experience by delivering previews, special features and other Web-based content that can move viewers toward a VOD order. In addition, the approach supports recommendation engines that can help content of interest "find" the viewer. Finally, having a network-centric service for delivery to cable set-top boxes can be easily leveraged into an "anywhere world". By constructing a delivery mechanism that uses existing Web technologies to deliver content and applications to cable set-top boxes, the issues of scalability and heterogeneity can be sidestepped while simultaneously addressing new market requirements for multiple-screen content delivery.

INTRODUCTION

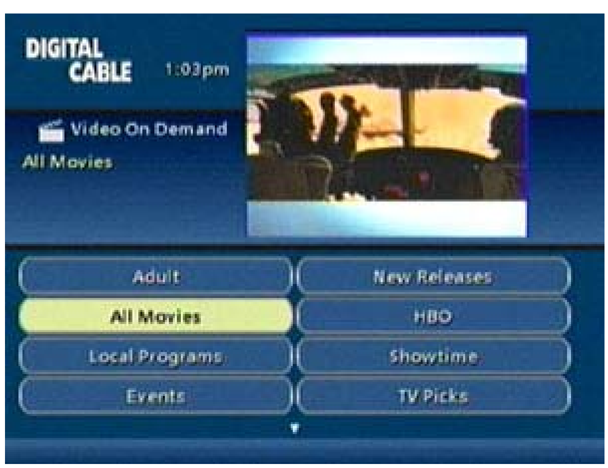
In the world of "Interactive TV 1.0", Video on Demand is the grandfather of the industry. Designed and deployed almost two decades ago, the user experience began life as simple, text-based menu designed to sell movies that would be delivered to set-top boxes that were small and slow. Subscribers could consider themselves fortunate if there were even a few hundred movie titles in the content catalogs.

The last decade has seen an explosion in content, as well as a strong proliferation in various technologies for browsing and consuming video. Switched Digital, DVRs, Network DVRs, broadcast content and "long-tail" video have brought a far greater array of choices via the traditional video plant, while the ability to distribute and consume web-sourced video through the cable broadband infrastructure has increased the availability of content exponentially.

VOD has grown beyond pay-per-view movies, with many operators already offering broadcast network and cable episodes and clips, sporting events, outtakes and supplemental materials, etc. On-demand now has the possibility to include user generated content (UGC), webcams (live feeds of traffic or surf conditions, for example) and other emerging video forms being developed and distributed over the Internet.

While the *amount* of content has improved, the same cannot be said for the user experience. The ability both to find and to manage on-demand content has been limited by the capabilities of the set-top box, leaving on the table potential additional usage by subscribers and revenue for cable operators and on-demand programmers.

For the cable consumer, the overabundance of choice available on today's video networks is almost always presented to them through outdated interface paradigms: an EPG extension, where VOD titles are listed as if each movie is a separate "channel"; and a flat category and title menu system, which leads to a preponderance of purchases of movies with titles that start at the beginning of the alphabet.



Another issue in today's VOD landscape is the concept of content silos. The grid provides guide data for linear broadcast programming. VOD menus list movies in various categories, but the categories are determined by metadata and are fairly rigid. DVR recordings are listed separately and in chronological order. Few and far between are the applications interfaces that break these rules – but when one does, the benefit to the consumer is immediately apparent, and the financial rewards to the MSO are evident.

When the benefit to both consumer and operator are so easy to verify, why is it that there is not yet industry-wide change to take advantage? The underlying issue is the set-top box. There are still tens of millions of devices in homes that were designed and rolled out more than a decade ago. These legacy boxes are unable to run tru2way, and some even struggle to run the lower profiles in the EBIF specification. They have limited application memory and low power CPUs with barely enough horsepower to execute very simple grid guide applications.

The limited capabilities of these boxes severely restrict the returns cable operators can expect from the time, money and effort that they have invested in their advanced interactive platforms. As a result, the timeline for the rollout of advanced interactive video services has been measured in "a few years" for more than a decade now, and shows no sign of reaching completion.

In addition, consumers increasingly are demanding video delivery over non-traditional devices and networks. While the industry is addressing the ongoing issue of advanced application rollout to set-top boxes, it simultaneously faces a need to deliver the same content and user experience to other devices.

There are initiatives underway in multiple companies (including major cable operator R&D groups) to address the legacy set-top box issue. If an application requires more resources (or different resources) than the device has available, the obvious response is to run all or part of the application somewhere else. On the Web, these initiatives have been labeled "cloud computing," "software as a service," "network-based processing," and many other similar terms. The essential concept is to run an application on a server somewhere in the network instead of on the client device, with the output being sent only from the application to the user. A good analogy is Microsoft's new release of Online Office. Until recently, consumers had to purchase Office. This required having enough hardware to load and run the various programs, as well as the need for keeping them updated. Running Office Online from a web service and browser provides the same functionality without hardware and update concerns.

Before investigating the details and implications of network-based applications in the cable environment, it is useful to briefly look at how it has matured as a concept and in implementation on the Web.

CLOUD COMPUTING OVERVIEW

Besides a few short-lived attempts (such as those of General Magic in 1995), it was not until 1999 that a major innovation in cloud computing was commercially deployed. At that time, Salesforce.com released their Customer Resource Management platform as a web service. Prior to this release, companies had to purchase expensive software solutions and powerful servers in order to manage large databases of customers and related information. Salesforce.com allows companies to essentially rent database storage capacity and the software interfaces as needed for a much lower overall cost. This was the first real implementation of the concept of "On Demand" and SaaS (Software as a Service). Other companies were able to leverage Salesforce.com's servers and software applications on a small, individual basis without great investment in hardware or technical support groups. This model was incredibly successful, turning Salesforce.com into a multi-billion dollar company.

When Amazon upgraded its internal server network and web services platform in order to improve efficiency and reduce costs, the company realized the value of its infrastructure and offered Amazon Web Services (AWS) from this network to the public. The Elastic Cloud Computing resource (EC2) in particular allows companies to run virtual servers on demand, turning on and off additional web server capacity essentially in real time to handle server load capacity.

These types of network hosted services have since been successfully implemented by many other companies as well, resulting in economic acceleration of many businesses and ventures on the Web who are now able to implement and deploy complex and scalable server-side applications and services without requiring investment in capital expenditures.

One of the most powerful features of network-based processing to have emerged as standards have matured is the capability of a browser to leverage network resources when rendering web page requests. An example is Google search results, in which a simple query typed into google.com returns matched web pages from around the world in less than a second. The query running behind this simple, efficient and very fast interface is comparing data from hundreds of billions of websites that have been crawled and indexed by Google's servers. It is physically impossible for a PC to store or sort through even a small fraction of this data.

Google has since enhanced this interface with AJAX (Asynchronous JavaScript and XML) so that the user sees a dropdown list of possible search terms as each character is typed and often is provided with the intended search term long before the entire term is entered. Not only does this accelerate the search process, but it also provides contextual information that might actually help the searcher find what he or she is looking for much more quickly by suggesting terms to add to the basic search that will return more focused and useful results. None of this logic is running on the PC itself – the entire interface, except for the trivial key collection and text rendering functions, is performed on servers running in the network cloud.

CLOUD COMPUTING AND CABLE

The benefits of cloud computing apply to interactive television, as well. Leveraging network resources would remove workflow gaps and bridge the application and media processing requirements between head-ends and set-tops. A cloud approach also would enable developers of programming and advanced advertising to use familiar, web-based development tools that are similar to or the same as those used to provide interactivity within a web site (e.g., DHTML, JavaScript, etc.).

Generally speaking, investment in server-based computing and network bandwidth allows less expensive CPE to provide a wider array of video services. Reflecting on the Google search example previously discussed, it should be clear that there is no CPE device capable of running a certain class of applications that are data rich or operationally very intensive. VOD navigation, or content discovery in general, certainly falls into this class.

With respect to the investment in client software technologies, the greatest expense often is in targeted development, integration and regression testing across dozens of different CPE platforms -- each with its own performance characteristics, graphics display capabilities, and consequent impact on the viewer experience. While tru2way, EBIF, and other standard client software platforms are certainly a great improvement, they do not solve the cross-platform compatibility issue when the context of “TV Anywhere” is brought into the picture.

This is not an issue just for the cable world – even web browsers have differing capabilities across Macs and PCs, and across different OS installations on those devices as well. It is necessary when developing a robust website to test it against all significant browsers in use. In cable, however, a new release of the GuideWorks based EPG and VOD menu software package can take between one and two years for development, testing, and certification before it is made available to operators for deployment across a family of set-top boxes.

The server-centric approach allows an application to be developed, integrated, and regression tested on a single software platform, instead of requiring that it be written for and tested against every CE device variant. The time to realize a new or modified application can be measured in months (if not weeks). The server-centric approach takes advantage of powerful computing resources to enable sophisticated, media-rich applications that can meet the operators' collective need for a rapid and repeatable way to redefine an industry by continually creating must-have features that are unique to the video platform.

A key question for multichannel video operators relates to development and deployment of new video services that maximize their investments in their robust, high-QoS "last mile networks" for both traditional HFC and IP connected devices: What is the appropriate application software model for video applications - via the server cloud or the set-top client?

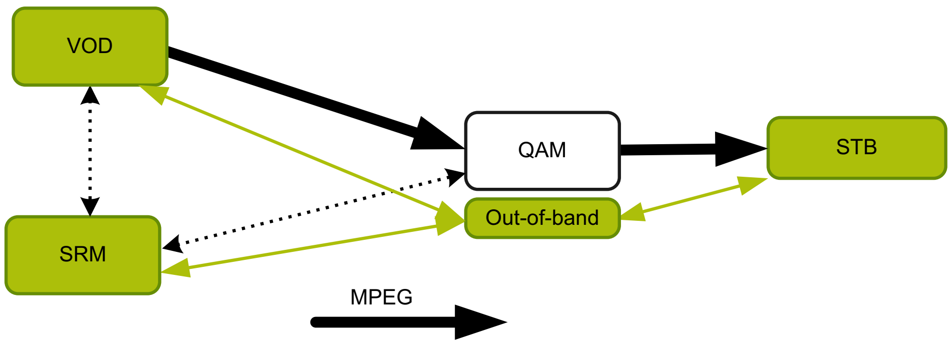
Multichannel video operators can share the benefit of the Web approach and utilize network-based servers to support complicated, media-rich applications -- but they cannot depend on the set-top client for "heavy lifting." Unlike the ubiquity of just one or two operating systems and common APIs, the multichannel video provider has dozens of set-top platforms - all differing in the details of capabilities and performance.

This network-enhanced approach to application authoring and deployment does not necessitate a wholesale revamping of the infrastructure already in place. At one extreme, the entire application can be run in the network and then sent to the set-top as a video stream. From a network buildout standpoint, this looks exactly like existing VOD deployments, with the video pump replaced by a smarter streaming application server.

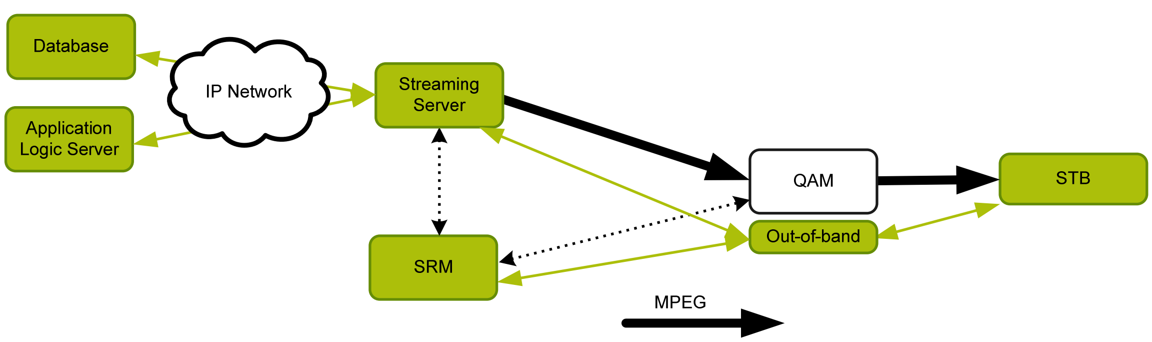
In this approach, the technical implementation of the streaming application server is immaterial, as long as it produces a standard MPEG compliant unicast video stream for insertion into the cable plant. An implementation that is based on open standards such as HTML, Java, tru2way, or innumerable others can take advantage of existing talent pools and development resources, but this still leaves room for proprietary solutions as well.

The additional session load on the existing QAM bandwidth allocated for on-demand services must be taken into account. However, there are some mitigating factors that make this less onerous. Interactive services rendered as video consume less bandwidth on a per-session basis than a standard VOD movie, as large portions of the screen are static or very infrequently updated. A sampling of applications deployed currently shows that the average bitrate is between half and two-thirds of a VOD stream (between 1.8 Mbps and 2.5 Mbps).

When specifically considering the VOD Navigation use-case, the net effect is not measured in additional sessions, but in adding a few minutes of browsing to the vast majority of VOD streaming sessions that are already accounted for. In other words, the network-based streaming VOD Navigation menu does not add a large number of new sessions, it just makes the movie-playout session slightly longer.

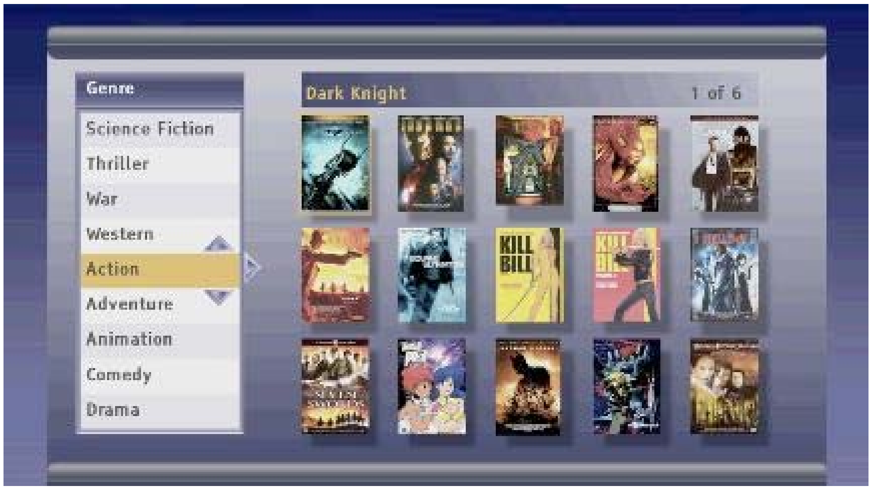


In a typical example, the set-top box requests a unicast session when an application is launched, and the Session Resource Manager (SRM) allocates a section of QAM bandwidth for downstream video transmission. The set-top then uses existing back-channel communication routes to send keystrokes into the network, where they are received and processed by the application running on the streaming server. This cycle of keystroke and video modification continues until the session is ended.



At any time, the application may contact external servers such as billing systems, linkage to social networks or other relevant databases, or servers dedicated to other purposes.

It is also quite valid to run a network-enhanced application on the set-top box itself, if enough resources are available – tru2way enhanced set-tops are an excellent example of this use case.



tru2way VOD menu application (from Zodiac and Macrovision)

Here the application is launched at will by the user. According to application logic, it may make synchronous or asynchronous requests to a server running in the network for additional data or even to offload some processing tasks such as complicated database queries. Only the request and the results are necessary to be implemented and supported on each set-top box – the bulk of the application logic runs on a single platform in the network, where computational resources are plentiful and standardized as well.

THE CLOUD-BASED VOD SOLUTION

One of the foremost goals in a new VOD navigation schema is to greatly simplify the act of converting impulse and desire into an actual viewing event. There is no one menu structure that will meet every consumer's needs, or even a single consumer's needs from one session to the next. Consumers often do not know what they want or need every time they browse for something to watch.

It is important to realize the value of investing in these new schemas. Even as far back as the mid 1990s, when DIVA Systems, Inc. released the powerful, network-based OnSet navigation system, customer satisfaction and take rates in systems in which OnSet was deployed were higher than those in the rest of the industry.

INTERACTIVE VOD NAVIGATION EXAMPLE

<u>Following are examples of navigation menus that could be implemented in a cloud-based approach that would not be dependent on set-top box resources.</u>

This VOD navigation menu has many advantages in its favor:

- Previews and Trailers are instantly available as viewers browse through the catalog;
- Links to related titles, recommended titles or personal favorites are embedded at every opportunity to encourage browsing and discovery;
- Branded menus and landing pages are easily configured and enabled from the server, so that sponsorships, advertising and promotional agreements may be quickly deployed;
- All menus are personalized – cookies are supported, and previous viewing history and other user data is easily accessible; and
- The TV menu is pulling from the same database as a linked website, so that a PC, laptop or smartphone can be used for deep search and keyboard access when required; alternatively, all purchased or rented videos can easily be streamed to one of those devices from the network (TV Everywhere).

This last point is important enough to spend some additional time discussing. Once the application is moved partially or completely into the network, the range of devices that can support interacting with the application logic is exponentially increased. Mobile phones, PCs, connected media devices, and cable set-top boxes are all much more easily supported. Additionally, the MSO can move toward a unified solution life-cycle across all of these devices, simplifying development, deployment and support.

<u>CONCLUSION</u>

Modern interactive TV application requirements are already pushing the limits of even the most advanced set-top boxes. Each new application deployed adds features and functionality in order to reduce customer churn, entice new subscribers or most importantly, increase revenues for operators and programmers. VOD navigation has been shown to be important to both the consumer and the operator for all of these reasons. The fundamental need to leverage network-based resources to enhance the capabilities of the set-top box is clear, and the rewards (financial and other) to the operator are within reach.