Video On Demand – More Than Movies

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Abstract

As real-time 2-way networks are becoming common place, the industry has begun to shift its focus to the advanced services that can now be offered in our digital network environments. Applications such as Internet-on-TV and Video on Demand are in initial deployment and trial phases worldwide. Video on Demand, however, tends to be associated mostly with "Movies on Demand" – allowing subscribers to watch a movie whenever they wish and having VCR-like capabilities. There are, however, many different applications of Video on Demand, each bringing unique revenue opportunities and technical challenges.

As we begin to move past the initial deployments and become comfortable with basic Video on Demand services, such as Movies on Demand, we can begin to explore other applications that utilize on demand video streaming, and thus leveraging our investments. This paper will review various Video on Demand applications, their technical infrastructure, business model overviews, and technical challenges ahead.

WHAT IS VIDEO ON DEMAND

As costs have decreased and digital platforms have been deployed, Video on Demand has become a topic of renewed interest within the cable industry. It is surprising, however, that as most MSOs are preparing for initial VOD deployments or trials, the business of what Video on Demand will be used for remains somewhat undefined. There are many different businesses that can utilize on demand video streams including Pay-Per-View movies on demand, Subscription-based movies on demand, after-broadcast programming on demand, interactive advertising, news on demand, walled garden streaming, and much more. As MSOs are evaluating these potential applications, several key questions are being asked –

- What is the business model (cost payback, revenue modeling, cash flow, etc.) for these services?
- What is the technical infrastructure?
- How deployment-ready is the application and what are the remaining technical hurdles?

Certainly, maintaining a competitive edge is a major factor in launching advanced interactive services, but the above issues are also serious considerations in selecting one service over another. Let us first look at the infrastructure of a Video on Demand network and then evaluate what services there are in addition to movies.

THE VIDEO ON DEMAND INFRASTRUCTURE

A typical Video on Demand system is broken into seven major categories, as depicted in Figure 1. Depending on the digital network, these components communicate differently. Some of these components were built with broadcast television in mind, and others are new to the digital infrastructure. We will attempt to address the general Video on

Demand issues for each of these components.

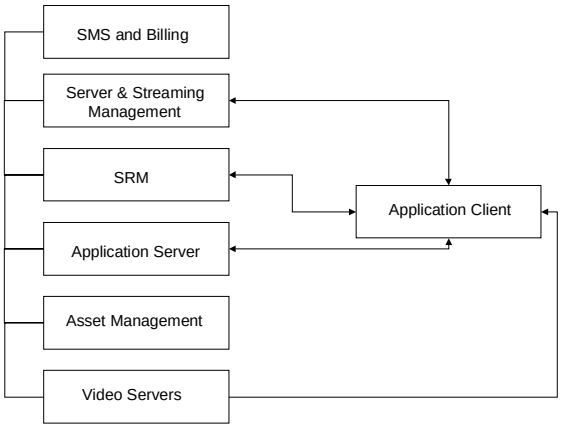

Figure 1. Typical VOD Components

SMS and Billing

Subscriber Management Systems (SMS) and Billing interfaces have traditionally been built for broadcast systems and are also closely linked with encryption processes. Typically, a pre-scheduled program is entered into the system and the encryption and views (billable events) reference this scheduled event.

With the addition of Video on Demand, billing systems need to support flexible schedules – i.e. having a program play at any time as opposed to a scheduled time. Encryption likewise needs to be supported on a flexible basis (either the content needs to be pre-encrypted, or the content needs to be encrypted on an arbitrary schedule as it is played out of video servers). Since billing systems are also the Subscriber Management Systems, they need to support real time management of subscriber information and non-movie purchases.

Many of these VOD requirements are new to billing systems and have been worked around by making VOD events look like Pay-Per-View (PPV) events and by having separate SMS platforms. With the addition of non-movie services, however, the need for advanced billing and subscriber management systems is increased.

Server and Streaming Management

The management of VOD servers and the constant establishment and teardown of interactive streams is typically done in software developed by VOD server vendors. The key to the success of these components is their scalability and fault tolerance, which differs from one vendor to another.

System Resource Manager (SRM)

A SRM manages the topology of the network and RF spectrum as it relates to VOD streaming resources. In some networks the SRM is a part of the standard digital platform; in others it is the responsibility of the VOD server vendor to provide a SRM. Having a successful SRM depends on the ability to support key VOD requirements such as narrowcasting.

Application Server

The application server is the headend or hub based component that is the counterpart of the set-top based Application Client. There can be many application servers in a network, one for each application such as Movies on Demand, Sports on Demand, News on Demand, etc. In a truly open network, each application server can even be developed by different software development companies, allowing various VOD applications to become a new business opportunity. The technical hurdles and status of various applications will be discussed later in this paper.

Asset Manager

The Asset Manager is a critical VOD

component. It manages the content, content groups, and content information for each asset (movie, artwork, fonts, etc.) on the system. The function and capabilities of the Asset Manager are key to the operational ease of running a Video on Demand system. This component is typically a key software platform developed by video server vendors.

Video Servers

The video servers are obviously the heart of any Video on Demand system. Much development spending in the last 5 years has resulted in improvements in efficiency and cost reduction. Video servers that used to cost thousands of dollars per stream are now hundreds of dollars per stream and a fraction of the size. Some of the critical factors in selecting a good video server are its scalability, fault tolerance, and streaming efficiency.

Video server providers have also taken various approaches towards on demand conditional access and encryption, from building in QAMs and pre-encrypting content to supporting unique session-based encryption in external components, and some without any encryption at all.

Application Clients

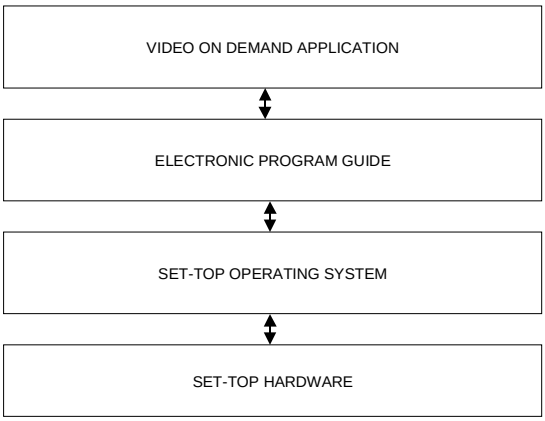

Figure 2. VOD Set-top Layers Today

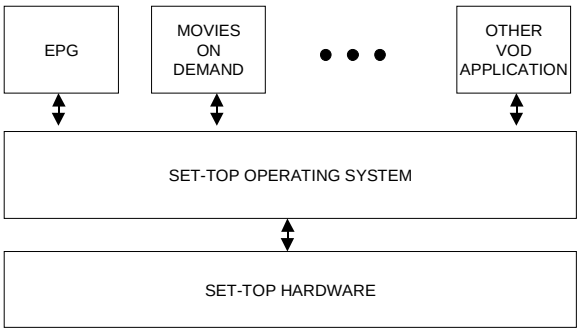

Figure 3. VOD Set-top Layers In Progress

In order to deploy multiple applications, the set-top box has to be able to support switching between these applications. In a traditional digital broadcast environment, the Electronic Program Guide controls all set-top activity. These were built without "application sharing" in mind. In addition, there is no industry standard for application interfaces. These two points mean that each application developer today must build the application specific to the set-top box and with special integration efforts with the EPG vendor, as depicted in Figure 2.

It has become obvious that moving between various interactive applications, and offering a variety of new services, is a requirement in todays networks. There are two methods in progress to ease application sharing. In the first, shown in Figure 3, the operating system, such as PowerTV or WindowsCE, manages the various applications. Since it is likely that some applications will require sharing information (such as parental control), the Operating System must also enable such application data exchange.

The second option, for ease of application sharing that is in progress, is adding a middle-ware layer on top of the Operating System, as depicted in Figure 4. This allows the concept of application porting from one set-top platform to another in that the operating system is masked to the

application software. The EPG could also perform such a middle-ware function. In many cases, this middle-ware is also being designed to support common functionality, such as HTML support and Video on Demand streaming session setup and control. This allows applications to use common functions in a consistent manner and enables new applications to deploy easier.

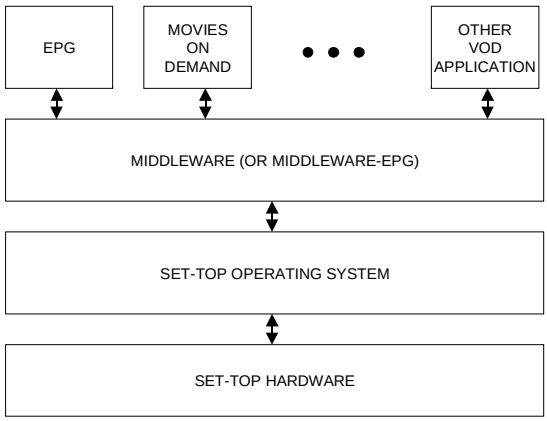

Figure 4. Set-top Layers with Middle-ware

There is much work to be done to enable set-top application development to become as common place as PC software development is, but the focus on application sharing and common middle-ware is an important step in that direction. Having common set-top software standards is also a key part of enabling open set-top hardware.

Component Summary

Of course there are several other parts to a VOD system such as content acquisition and general distribution that are not discussed in this paper. To summarize site-based technical components, current VOD deployments that support only Movies on Demand, have worked out all of the requirements to properly fit into a typical digital network. These platforms are readily deployable today. Much of the key functionality has been developed, either by the digital network platform, or the video server vendor.

In the future, however, as other on demand services become commonplace, subscriber management and billing interfaces will need to become more flexible in order to avoid requiring duplicate databases of subscriber information. In addition, the ability to switch seamlessly and efficiently between applications is the key towards allowing new applications (and businesses) to be deployed on our networks. Platforms that will enable this application switching in a cost-effective manner will become critical in the interactive era.

VIDEO ON DEMAND APPLICATIONS AND SERVICES

Now let us look at various applications that fall into the “Video” on Demand category. As we will see, each of these applications has its own business model and technical accomplishments and pending hurdles.

Movies on Demand

Movies on Demand – having a list of movies to select from and being able to view it whenever one wishes. Once rented, the movie is typically available for viewing within 24 hours and can be put “in progress”. The comparison to traditional PPV is the ability to have a dedicated movie copy with VCR-like controls.

Movies on Demand (MOD) is clearly the most common application of Video on Demand. Many times the term VOD is used to describe what really is MOD. There has been much analysis of the Movies on Demand business model. Taking some general assumptions, a high-level business model is summarized below.

Total Homes Passed:	200,000	
Total Subscribers:	140,000	(70%)
Digital Subscribers:	56,000	(40%)

Buys Per Month	3
Weighted Avg Movie Cost:	$4.25

(Averages adult and non-adult pricing)

Per Subscriber Revenue:	$ 12.75
Monthly Revenue:	$ 714,000
Cost Per Subscriber:	$ 80.00

As we can see, there is a significant revenue potential with Movies on Demand. The service easily reaches all digital subscribers, and adds a cost of $80 per subscriber (a relatively small amount in comparison to the recent investment of hundreds of dollars per digital subscriber for the set-top box), and can bring in approximately $12.75 per subscriber per month.

Movies on Demand Accomplishments:

- The building block for VOD as a whole has been established through Movies on Demand deployment planning.
- Integration into various digital networks has taken place.
- Movies on Demand is deployed today.
- Substantial business models are being developed from early deployments.

Movies on Demand Hurdles:

- Encryption techniques and costs must still be worked out.
- Flexible, two-way billing and subscriber management must still be enhanced and developed.
- Content acquisition and distribution details are still in progress, including the determination of what the cable MOD licensing window will be.
- Application switching and integration into set-tops and EPGs must continue to be enhanced.

Subscription-Based Movies (SVOD)

SVOD – The ability to watch certain movies from a package at any time, or to join on a movie that is in progress from the beginning. Currently all movie packages are scheduled events, SVOD will allow subscribers to have on demand access to certain movies within the package for a fixed monthly fee.

Since SVOD is a new service, there is no proven business model. Taking the same system-wide subscriber numbers that were used in the Movies on Demand example, and assuming a 40% digital take rate of a SVOD service, a high level revenue model is listed below.

Total Homes Passed:	200,000	
Total Subscribers:	140,000	(70%)
Digital Subscribers:	56,000	(40%)
SVOD Subscribers:	22,400	(40%)

Per Subscriber Revenue:	$ 15.00
Monthly Revenue:	$ 336,000

SVOD Accomplishments:

- SVOD can easily piggyback on a MOD launch. It uses the same streaming infrastructure. Therefore MOD sites are likely candidates for SVOD services.
- The revenue per subscriber is fixed and therefore not subject to changing viewing trends.
- Billing is easy for SVOD in that it is a subscription package, as we have today.
- Studio rights have been secured by some providers.

SVOD Hurdles:

- SVOD is not yet deployed and take rates are not yet well defined.

Bandwidth implications for a pay-once, view-often service are not yet understood and may require more video streams and RF bandwidth to support the viewing tendencies.

Interactive Advertising (IAD)

Interactive Advertising has been used for years for PC based applications. Since local and national broadcast advertising revenue is a major part of programming today, the use of advertising in on demand and interactive television services are of obvious interest.

There are many approaches to interactive and targeted advertising, as well as how these interact with broadcast programming. Many of these approaches remain vendor or service specific today, but the bottom line is that the consumer impact, implementation, and revenue modeling for advertising in an interactive environment is not yet understood. It may be that each advertiser continues to pay for broadcast 'spots' while paying a per-use fee for interactive spots. Targeted spots may command a higher fee. Much of the success of advertising will depend on the interaction and delivery capabilities, which are being agressively developed by companies like SeaChange International.

Since no firm revenue model yet exists, we will instead look at some of the parameters that will be used in building such a model:

1. Broadcast advertisement cost per 1000 views (used per number of cable subscribers)
2. Target advertisement cost
3. Number of potential interactive views (used per number of digital cable subscribers)
4. Number of actual interactive advertisement users per ad
5. Advertiser payment per minute of interactive advertisement use
6. Number of participating advertisers and programmers

There are many other factors that can be included in this model; however, most of the additional inputs are unique to various solutions that are being developed. Although the business models are still being tested as solutions are enhanced and built, it is clear that interactive advertising will be a part of digital networks, both through standard interactive applications, and on demand video applications.

Interactive Advertising Accomplishments:

- Basic Interactive Advertising can be supported through existing VOD infrastructures, using a unique IAD application service.
- Helps justify cost of VOD system for additional revenue in the successful local advertising space.

Interactive Advertising Hurdles:

- IAD Presentation, traffic and billing parameters, and set-top based handoff between interactive, target, and broadcast advertisements are still being worked.
- Interactive IAD client/servers need to be developed, along with supporting traffic and billing systems (that support all of the new parameters for traffic management on VOD servers and advertiser payments).
- Programming rights issues need to be addressed.

After-Broadcast Programming On-Demand

After-broadcast programming (ABP) uses the VOD servers to also support real time recording of broadcast programs. These programs would then be available for viewing on demand after their scheduled broadcast time. This service is sometimes confused with a Time Delay product, which only postpones the broadcast play-out in a broadcast mode.

There have been several attempts at broadcast replay of programming. Most recently, Tivo and Replay are also offering personal video recorders (PVR) that offer similar services to subscribers that pre-plan their broadcast program recording. There is likely to be a market for after broadcast programming both in the subscriber set-top or television directly as well as from a video server, or in some combination of the two.

Since a ABP video server based service does not yet exist, we will make some assumptions for our revenue model. Since eventually, subscribers will have both PVR and video server based ABP access, we will assume that an average household will use the server based after broadcast program access once weekly. We will also assume a $1.99 price per replay.

Total Homes Passed:	200,000	
Total Subscribers:	140,000	(70%)
Digital Subscribers:	56,000	(40%)

Buys Per Month:	4
Average Cost Per Program:	$ 1.99
Monthly Revenue:	$ 445,760

ABP Accomplishments:

- Enables a new method for watching TV – truly what you want when you want it as it relates to available programming
- Enhances the PVR market to offer subscribers the ability to plan program recordings as well as watch them for a per program fee if recording was not planned.
- Billing interface is similar to Movies on Demand billing.

ABP Hurdles:

- Server based ABP buy rates are still relatively unknown.
- Network integration work, including MPEG compatibility of digital signals from various satellite and encoder sources is a significant issue. Some MPEG sources do not include critical data like I-frames for performing fast forward and rewind functions.
- Real-time encoding and MPEG import capabilities are in their infancy in servers. Mostly, asset management and scheduling integration efforts are required.
- Licensing rights for both programming and advertisements are undefined and undeveloped for server based ABP solutions.
- Bandwidth impacts of this service are not modeled.
- Storing all possible content on video servers will take a significant amount of automation and disk storage. The trade off between storage & management costs and revenue potential will need to be weighed.

News or Weather on Demand

In addition to the functionality of the ABP service, there is also opportunity for pay-per-view or subscription based services for special interest programming. It is likely that we will see Video on Demand (or non-video based interactive applications) services for target audiences, such as News on Demand or Weather on Demand. With such

a service, a subscriber could watch previously aired news services on demand and potentially tailor their news delivery order towards their interests. Likewise, for a Weather on Demand service, a subscriber could search for weather conditions and receive updates and recent videos at the click of a remote.

Modeling for such a service is somewhat challenging. Since these services could be offered in many ways, we will assume a fixed subscription fee with a 20% take rate.

Total Homes Passed:	200,000	
Total Subscribers:	140,000	(70%)
Digital Subscribers:	56,000	(40%)
Svc. Subscribers:	11,200	(20%)

Per Subscriber Revenue:	$ 5.00
Monthly Revenue:	$ 56,000

NOD, WOD Accomplishments:

- As with SVOD, subscription based services are easy to implement for billing purposes.
- The revenue per subscriber is fixed and therefore not subject to changing viewing trends.
- Television-based weather updates is a highly desired service. Providing this convenience with interactivity can be a very compelling application.

NOD, WOD Hurdles:

- Business model is fairly unproven for TV based services, although much research has been done (and is likely to continue).
- Content updates can be an issue, especially for a broadcast video service like News on Demand. Management of the constantly changing content can be impacting.
- The revenue for these types of services may not warrant heavy video (bandwidth) use. A service such as Weather on Demand may be very successful as a graphics-only application that requires little bandwidth impact and can use existing internet site caching for content updates.

E-Commerce, Internet Applications, Food Purchase Applications

These applications are commonly non-video based and can easily utilize the same underlying delivery technology. Once an internet-on-TV application exists, it becomes fairly easy to launch HTML or XML applications (depending on the browser support) that are managed locally.

Many Internet-on-Cable applications are also targeting the set-top layering and application interoperability problem described in the first section of this paper. This makes the thought of an internet browser middle-ware product appealing to operators. Issues remain, however, as to the real standardization of set-top interfaces to avoid the potential of a proprietary solution dominating the middle-ware marketplace.

Total Homes Passed:	200,000	
Total Subscribers:	140,000	(70%)
Digital Subscribers:	56,000	(40%)
IOC Subscribers:	16,800	(30%)

Per Subscriber Revenue:	$ 20.00
Monthly Revenue:	$ 336,000

The business model for Internet-on-Cable applications is complex. As with Video on Demand, a middle-ware product enables many applications, and therefore one is justified to spread the cost across many services. However, as with Movies on Demand, one application must exist to kick start the deployment and have a viable stand-

alone business model.

A monthly internet access fee of approximately $20 per subscriber is likely for Internet-on-Cable. Other add-on applications are likely charged externally. For example, a Pizza store would pay on-going fees to the operator to have an on-line, marketed application. Fullfillment is done outside of the cable billing system in that the payment is made upon delivery, directly to the store employee. Likewise, fullfillment for most e-commerce applications is handled directly with the vendor in question. This leaves a reliable, constant revenue stream with the operator without any subscriber billing requirements.

Internet-on-Cable Accomplishments and Benefits:

- Many times, Internet middle-ware platforms also add application interoperability software, addressing one of the major issues within set-top box software.
- Internet access easily enables electronic commerce applications.
- Internet middle-ware easily enables local applications such as Pizza buying or local news bulletins.
- Interactive Offering (also called walled garden) applications can use an existing Video on Demand system to do local on demand streaming integrated with HTML applications.
- Having cable modem and Internet-on-Cable back-end interoperability would be very positive.

Internet-on-Cable Hurdles:

- Cost vs. revenue factors are still being determined.
- Affect on the infrastructure is being tested and is not yet well understood.
- It is not known if EPG vendors will be willing to be a 'subset' application as opposed to the middle-ware itself (this would affect non-EPG vendors only).
- Video on Demand interoperability work is still in progress.
- Having internet or walled garden sites specifically tailored towards television viewing remains a general issue.
- Subscriber-specific applications require billing workarounds since most billing systems are designed for Pay Per View billing only.

IN SUMMARY

Revenue Summary

First, let's look at the various revenue models, both on a revenue-per-subscriber and on a revenue-per-system basis. It is easy to note that the key factors are the anticipated take rates and digital penetration numbers. *The purpose of this paper is not to anticipate these, but instead to point out the revenue possibilities and to offer some suggestions as to what factors go into the various calculations.* These hypothetical numbers and listings of accomplishments and outstanding issues will hopefully enable discussions of what is ahead and where we are.

Service	Per-Subscriber Monthly Revenue Est.	Per-System Monthly Revenue Est.
MOD	$ 12.75	$ 714,000
SVOD	$ 15.00	$ 336,000
ABP	$ 7.96	$ 445,760
WOD	$ 5.00	$ 56,000
IOC	$ 20.00	$ 336,000

Figure 5. Potential Revenue Estimates for Interactive and On-Demand Services

Another issue that arises in looking at these new revenue potentials, is what the maximum actually is of what a typical subscriber will buy. This all the more justifies applications like interactive and target advertising, in that the revenue comes from non-subscriber sources.

Technical Summary

We have certainly come a long way in the field of Video on Demand. The technology has gone from the perception of having only expensive trials to being one of todays most viable new businesses. This has been accomplished through the deployment of standard digital infrastructures, and the completion of Video on Demand platforms into these infrastructures. The primary VOD components (video servers, SRM, server management, streaming management, asset management) are complete, low component costs justify the VOD business, and early deployments are under way.

There is no doubt that Movies on Demand business has been the jump-start for Video on Demand. Enhancements and technical hurdles remain mainly in the areas of advanced billing/subscriber management, encryption techniques, and application interoperability. At the same time, we continue to see improvements to component performance, density, fault tolerance, and cost. Various issues exits for new VOD applications, including the impacts on back-end services, bandwidth, and storage. Such services are likely to begin in trial phases to quantify these impacts.

As we begin to see more wide scaled deployments of the basic Video on Demand infrastructure, new services will certainly emerge as add-on applications since their costs will be lessened by the initial investment and as we continue to strive to maximize our digital network investments.