Transitioning Advertising to IP Video

Technical Strategies for Migrating from QAM to ABR Video Advertising

A Technical Paper prepared for SCTE by

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1. Introduction

Ever since the first cable networks launched in the 1970s, a major trend driving the programming of pay tv providers has been targeting. As more and more channels have launched to target specific interests, viewers have self-segmented. This, combined with the ability of cable networks to segment their networks into ad zones has enabled advertisers to target their ad dollars with increasing precision.

Today, the rise of Internet Protocol television (IPTV) and over-the-top (OTT) video has allowed content to be delivered to a growing array of connected devices. The transition to IPTV and the subsequent development of IP advertising technologies now enables service providers to take their advertising precision (and value) to a new level.

Many multiple system operators (MSOs) are betting on a transition from traditional quadrature amplitude modulation (QAM)-based cable TV to IP video based on adaptive bitrate (ABR) streaming using Internet-based approaches. To do so successfully, cable providers need a strategy that will enable them to gradually transition their legacy set-top box (STB) advertising platforms to the newer adaptive bitrate (ABR) dynamic ad insertion (DAI) systems without disrupting their existing, successful advertising businesses.

This paper provides an overview of how MSOs can prepare for the switch to IP video advertising while continuing to maximize the return on their legacy set-top box platforms.

2. Growth of IP Video

The use of IP and ABR video is increasingly prevalent. The IPTV market was valued at USD 72.24 billion in 2020 and is expected to reach USD 194.21 billion by 2026, at a compound annual growth rate (CAGR) of 17.89% over the forecast period 2021 - 2026.

Parks Research shows that 76 percent of consumers have an OTT service and 22 percent of broadband households have four or more services. As a result, some of the country's largest multichannel video programming distributors (MVPDs) have launched their own IP-based video services. In November 2016, AT&T introduced its DirectTV Now service (now AT&T TV), and Comcast followed suit in September 2017 with Xfinity Streaming service for existing Xfinity customers. In February 2019, Spectrum debuted its TV Essentials service.

One of the benefits of IP video is the ability to target addressable ads. Even today, the addressable ad market is well-established. According to USIM, currently, there are about 54 million MVPD (cable, telco or satellite) households that are linear addressable and 35 million that are ad supported video-on-demand addressable households.

However, the ability to target using traditional video delivery techniques to STBs is limited. Transitioning to ABR-enabled dynamic insertion offers more precise targeting and allows operators to charge more for the ads they deliver. Ultimately, the newer technology will provide benefits that the traditional set-top box can't offer. But as MVPDs build up the number of streaming subscribers to fully leverage this new technology, they need a strategy that allows for a graceful and gradual transition.

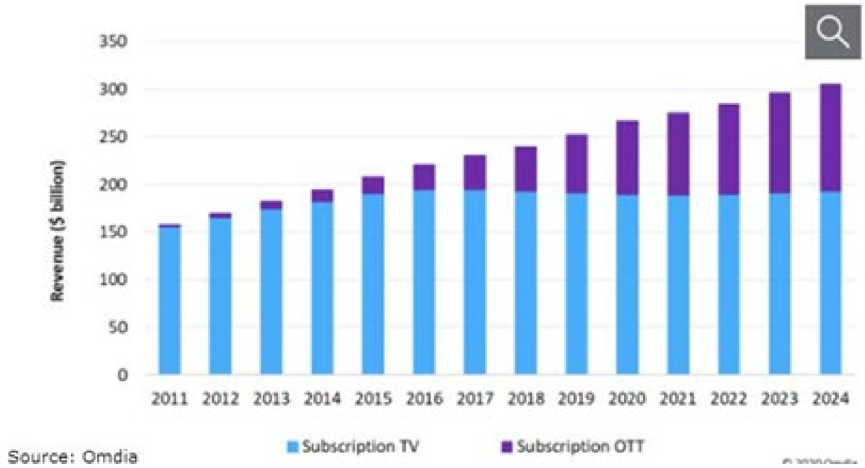

Figure 1 – Subscription TV and OTT Revenue Trajectory, 2011-2024

3. Legacy QAM STB Advertising vs. IP/ABR Advertising

While there are solutions for enabling limited addressable advertising capabilities in traditional STBs, this paper will focus primarily on network-based ad insertion techniques and their evolution as the industry migrates to IP video.

Today the majority of MVPD advertising dollars and subscription revenues come from the traditional set-top box platforms. Using MPEG-2 transport streams, ad servers and splicers, the platform inserts ads in pre-defined ad zones. The ad schedules, which are negotiated and bought, are locked 24 hours in advance. While the legacy STB platform still commands the bulk of the revenue for service providers, it is far from perfect.

For starters, ad zones are defined by geography, which is based on the service provider's access network topology and covers a relatively large area. Negotiating and selling the available ad space is also labor-intensive, involving advertising sales reps working with potential advertisers to fill all the available time slots. Because ad commitments must be locked in at least 24 hours in advance, service providers miss out on potential last-minute ad buys. Finally, the STB solution relies on a number of components that are hardware-based.

Conversely, IP-enabled advertising is a software-driven technology that offers more granularity and flexibility. It is enabled by adaptive bitrate technology that allows service providers to deliver multiple video quality levels within a video stream. Data within each stream is separated into fragments, each containing blocks of video encoded at different bit rates. The varying bit rates enable the media player to choose the appropriate bit rate based on the connection's performance level. The player relies on a manifest, which is essentially a list of available segments. At the simplest level, IP advertising is enabled by customizing this manifest for each stream and either adding or replacing existing segments to introduce ads that can be targeted down to individuals and sessions.

Beyond the technical performance advantages of ABR-enabled IP advertising, there are several significant business advantages. The IP-based technology works across any video device that connects to the internet. Therefore, service providers and their advertisers can reach viewers on whatever platform or device they may be using. Because the technology is fully dynamic, ad decisions can be made in real-time, enabling advertisers to maximize their ad buy and helping service providers capture more last-minute sales. Ad sales can also more easily be automated using targeting criteria and real-time auctions.

The ability to target households, or even individual subscribers, with surgical precision is perhaps the most significant advantage of IP advertising. Addressability can be enabled via individual app and device-level data. Common targeting parameters include device, demographics, time of day/day of the week, content and category, location, etc. Advanced targeting can include content and purchase behavior, household income, product interest, and any other information available through the use of first and third-party data.

The advantage of this investment is obvious: providers can charge much more for addressable ads on IP—studies estimate up to 4-5 times more than for a regular ad. They can target down to the individual user and optimize ad delivery in real-time. This means higher ROI and the ability to capture new, hyper-targeted ad revenue streams.

The business case for making the transition to IP advertising is strong, but the market is still in the early stages. While IP offers better targeting and more dynamic sales models, the majority MVPD subscribers and ad revenue is associated with traditional STB advertising. Operators eventually need a unified solution that can address both markets.

The more immediate question for providers is how to make the switch in steps as they prepare their networks and organizations for the future while getting as much value as possible from their legacy STB platform. IP ad delivery utilizes entirely different technology, sales processes and ad decisioning. Implementing and adapting to these changes will take time, but there are steps that providers can take now and in the near future to prepare.

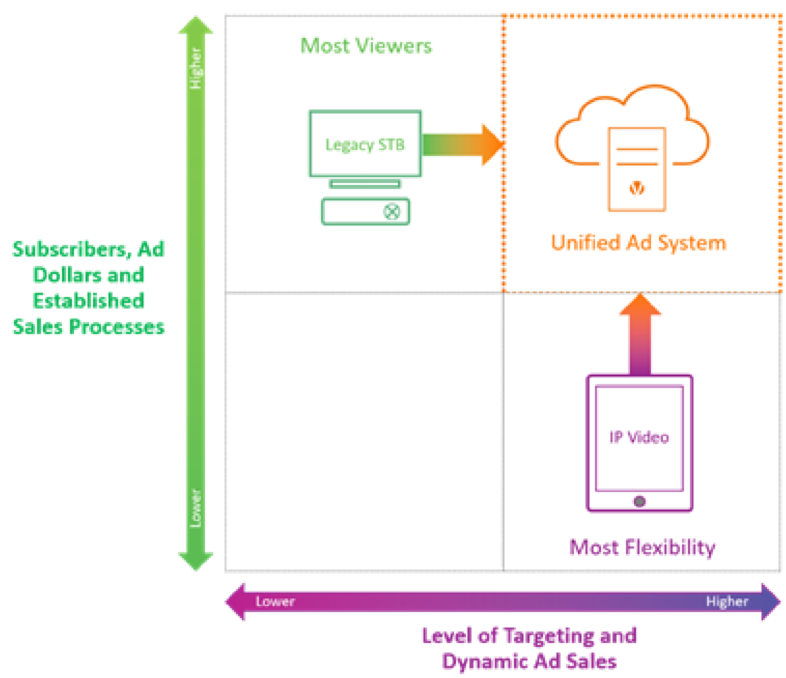

Figure 2 – Creating a Solution that Combines the Strengths of Traditional QAM and IP Advertising

4. Technology Overview

4.1. QAM Advertising

The QAM ad insertion stack consists of the ad insertion server and the splicer. Designed to perform frame-accurate operations on MPEG Transport Streams, the splicer can take an ad stream from the ad insertion server and replace the original bits in a live program stream. The ad insertion server is responsible for preparing and streaming the ads to the splicer, based on schedules published for each channel. The ad breaks are precisely signaled in band via the SCTE 35 standard. The splicer and ad insertion server use the SCTE-30 protocol to coordinate the timing of their activities.

Ad schedules are traditionally generated by a Traffic and Billing system, the function that resides in the ad sales operation and optimizes the placement of advertiser spots within the constraints of the ad buy.

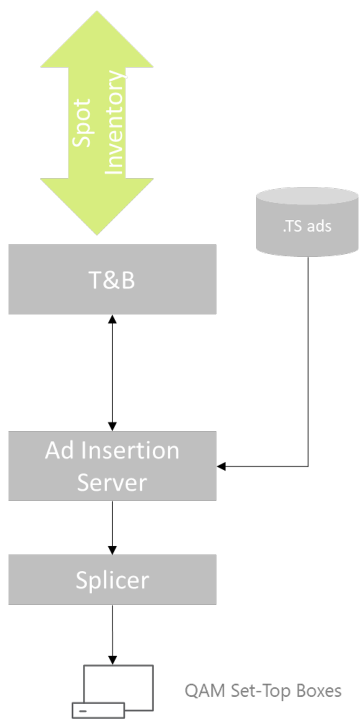

Figure 3 – QAM Advertising Stack

4.2. IP Advertising

There are two main approaches to inserting ads into ABR video, Client-Side Ad Insertion and Server-Side Ad Insertion. Both rely on the content being prepared so that segments align with ad insertion points and the appropriate markers identify the location of the ads. Client-Side Ad Insertions works by having the client call to an ad server to obtain the correct ad. IP ad insertion is increasingly driven by Server-Side Ad Insertion, which will be the focus of this paper.

In IP video using ABR, the video segments are represented in a manifest, which lists the names of all of the segments that represent a live or on demand video stream. Each segment is also represented in multiple bitrates that can be selected based on the client's assessment of network performance and other factors.

In Server-Side Ad Insertion when an ad event is present, the Manifest Manipulator, using VAST or SCTE-130 standards, passes metadata from the client to an Ad Decision Service (ADS) and requests a decision on which ad to insert. The Ad Decision Service (sometimes just referred to as the Ad Server) identifies campaigns that are looking to target that particular client metadata and responds with one more targeted ads. The Manifest Manipulator then customizes the manifest with pointers to the new ad content segments and returns it to the client. Using this new manifest, the client then retrieves a personalized mix of content and advertisements (or other content).

Note that there can be multiple ADSs involved for a single piece of content that can be called depending on the ownership of the ad inventory. While the mechanics of that flow are outside of the scope of this paper, the Manifest Manipulator must be able to support multiple ADSs.

A separate process may be triggered to prepare the ads for delivery, particularly if they are retrieved from third parties dynamically. This may involve transcoding an ad from a mezzanine format into acceptable codec and bitrates or applying standard content profiles to an existing third-party ad.

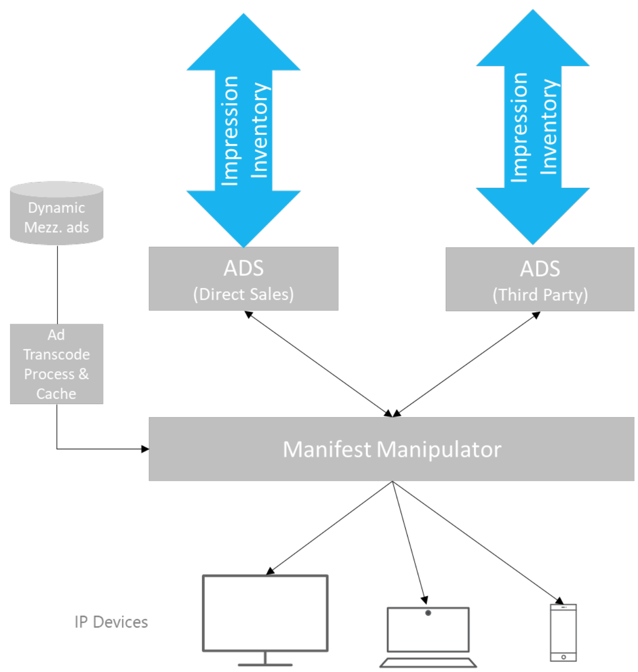

Figure 4 – IP Advertising Stack

4.3. Challenges of the Current Siloed Model

If treated independently, implementation of QAM and IP advertising models results in a siloed architecture, with lack of communication between the two and significant replication of resources. For example:

4.3.1. Separate Ad Decision Infrastructure

The separation of the ADSs for IP ad campaigns and a distinct Traffic and Billing system for scheduled ads limits the ability to generate revenue from the two systems:

- Difficulty in executing campaigns that address both IP devices and QAM STBs
- No opportunity to supplement local scheduled ads with dynamic impression-based ads
- Inability to sell unsold scheduled inventory with dynamic ads

4.3.2. Separate Ad Insertion Systems

The requirement to run and maintain two separate ad insertion systems duplicates operational and capex costs. Both a Server-Side Ad Insertion system based on Manifest Manipulation and a traditional QAM Ad Server and Splicer system need to be procured and maintained.

4.3.1. Parallel Ad and Entertainment Content Preparation

Just as the infrastructure to deliver the ads is replicated, duplicate systems exist to retrieve, process, and deliver entertainment content and ads. The cost of this delivery pipeline grows with the amount of content, the number of ads being targeted and the architecture of the network.

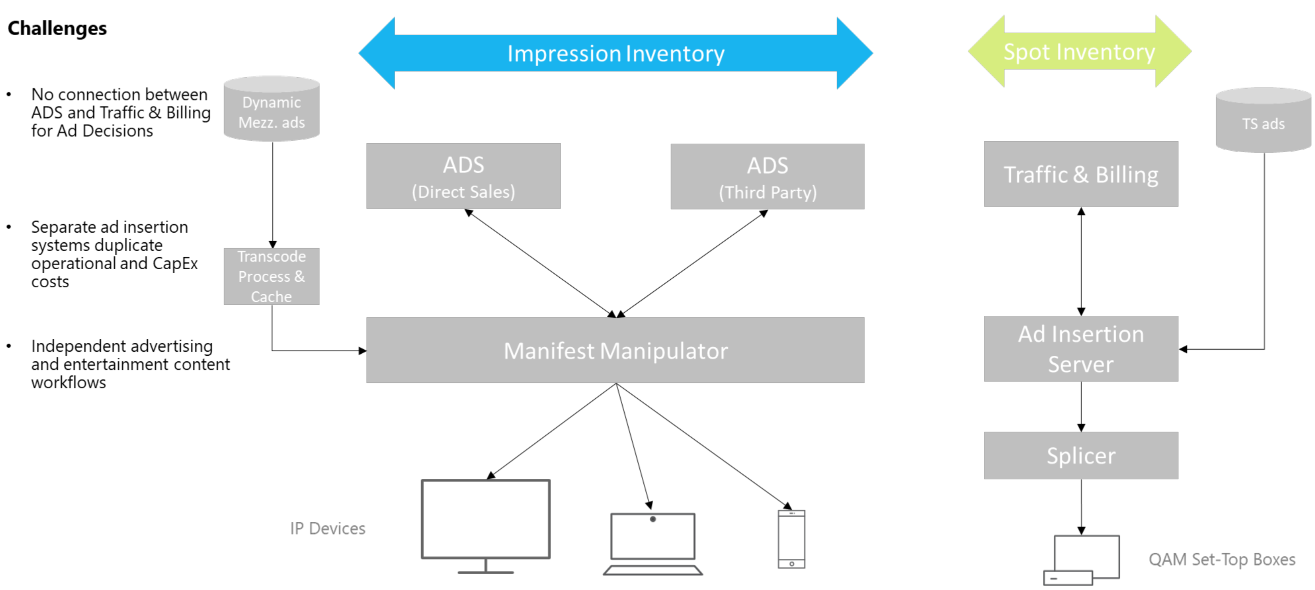

Figure 5 – Parralel IP and QAM Advertising Stacks

5. Business Goals for the Transition to IP

As operators make the transition to IP video and IP advertising, they must consider that traditional QAM video will continue to be delivered for some time and ensure that their existing advertising business is still efficient, profitable, and relevant. At the same time, they must invest in new solutions that leverage the capabilities of IP video, knowing that the number of viewers might remain relatively small for a period of time. This requires trade-offs and a concerted strategy that optimizes the existing business while positioning for the future.

Some of the business goals operators must consider when making this transition include:

5.1. Defend current QAM Advertising Business

As mentioned above, a key goal must be to defend the current advertising business while making the transition to IP video. This includes:

- Maintain existing business processes and ad revenue
    - Ideally the transition should allow for a period of time where existing ad sales, operations and technology can continue to run effectively on the existing QAM network without major changes.
- Extend zone-based ad sales to IP devices (IP Parity)
    - A common first step is to extend the current schedule-based ad sales to IP devices, often referred to as “IP Parity”. This means that ads purchased targeting QAM STBs by Ad Zone will appear on IP devices in that Ad Zone on the same services. This approach allows operators to establish an advertising system for IP devices without interrupting the existing business model. In this way, for a time the same ad sales process can address customers as they move to IP STBs and other IP devices.

5.2. Maximize Revenue

Once an IP advertising process has been established, operators can begin to not only take advantage of the new IP video capabilities but also optimize their legacy QAM advertising solutions to increase revenue. As will be outlined in more detail below, this involves leveraging the strengths of both platforms, beginning to unify some of technologies and enhancing the QAM advertising system to add some of the flexibility and targeting capabilities that are associated with IP advertising. These goals include:

- Monetize unsold ad inventory
    - Removing limitations on QAM ads sales that impose a 24-hour window. Operators can get an immediate revenue boost by making ads targeting QAM STBs more dynamic. Previously unsold inventory can be sold at the last minute, possibly using automated, programmatic techniques
- Enable a mix of scheduled and dynamic ads
    - At the same time, continue to support current ad sales and business processes, so that the system supports a mix of traditional schedule-based ads and dynamic ad placements
- Extend advertising to more channels
    - In many cases there are channels that are properly conditioned for ad insertion but due to low viewership or inadequate ratings data ads are not inserted by operators. The system

should be able to measure the viewing audiences on these channels and, if necessary, aggregate these viewers to make ad insertion on these channels profitable.

- Improve QAM advertising targeting capabilities
    - Leverage changes in the hybrid fiber coax (HFC) network architecture to enable finer-grained targeting of traditional QAM ads at the political precinct or neighborhood level.
- Enable campaigns across QAM and IP footprints
    - While transitioning from QAM to IP video, the solution should allow for operators to execute campaigns that address all device types (though not necessarily with the same targeting precision). This opens up opportunities for new types of campaigns and provides a model that is difficult for other players to offer.

5.3. Improve Operational Efficiency

Addressing a new IP video service that has different technical requirements and capabilities will require new technology and processes. Key to the success of this new advertising initiative will be the ability to optimize the different operational models to find efficiencies. Some of the critical areas include:

- Unify Ad Decisions
    - Eventually the solution should leverage a single "source of truth" for the subscriber data, targeting criteria and the campaigns that are available for execution. This system will incorporate both traditional schedules and dynamic campaigns and address all device types.
- Unify Entertainment/Ad Preparation
    - Great efficiencies can be found in standardizing on one video preparation workflow that can deliver entertainment content with advertising to QAM STBs and IP devices. Standardizing on ABR video formats as the source for both entertainment content and ads can reduce the costs of running two parallel video processing and preparation systems and prepare the operator for the all-IP video future.
- Unify Ad Insertion Systems
    - Similarly, relying on a single system for ad insertion/ad execution represents opportunities for opex and capex reductions versus purchasing and maintaining separate products.
- Transition to Virtualized Solutions
    - All of these migrations can also accelerate the move from hardware-based products to virtualized, software-based solutions that can reduce opex, capex and offer other advantages such as elastic scalability.

5.4. Enable New Business Models

Though not directly tied to the transition to IP video, operators are also looking to capitalize on new business models that leverage their unique knowledge of the end customer and position as owners of the delivery network.

- Insert ads on behalf of Content Partners
    - Cable operators are increasingly applying their ad insertion capabilities beyond the traditional inventory allocations on cable channels. Operators can insert targeted ads on national ad breaks on behalf of programmers and broadcasters on both traditional QAM STBs and IP devices inside and outside of the home. This opens up a new and very large part of the television advertising market.
- Enable Programmatic Sales Through Third Parties

- Operators can supplement their in-house ad sales with third party advertising networks to programmatically sell ad inventory that may previously have gone unsold.

6. Transition Strategy

6.1. Siloed Model

The siloed model represents serious challenges to achieving the business goals set out previously. However, there are some concrete steps operator can take to move their IP video advertising strategy forward.

6.1.1. IP Parity Through Processing of Existing Ad Zones Outputs

A common way to initiate IP advertising through IP parity in this model is to take the existing spliced channels and transcode and package them as separate IP video streams. In this model each ad zone becomes a separate version of the IP channel and is offered only to IP clients in that ad zone. As IP clients service by a CDN different techniques are employed to determine the location of individual clients and map them to existing ad zones. Support for out of home streaming may require additional sophistication. However, the goal of replicating Ad Zones on IP devices can be achieved without major changes to the existing systems.

Pros:

- Defend current QAM advertising business by extending scheduled ads to new IP subscribers
- Requires few changes to existing systems

Cons:

- Maintains dual processes for both QAM and IP video delivery
- Does not take advantage of the dynamic, targeted nature of IP clients
- Requires replicating video processing that may not be practical with large numbers of ad zones

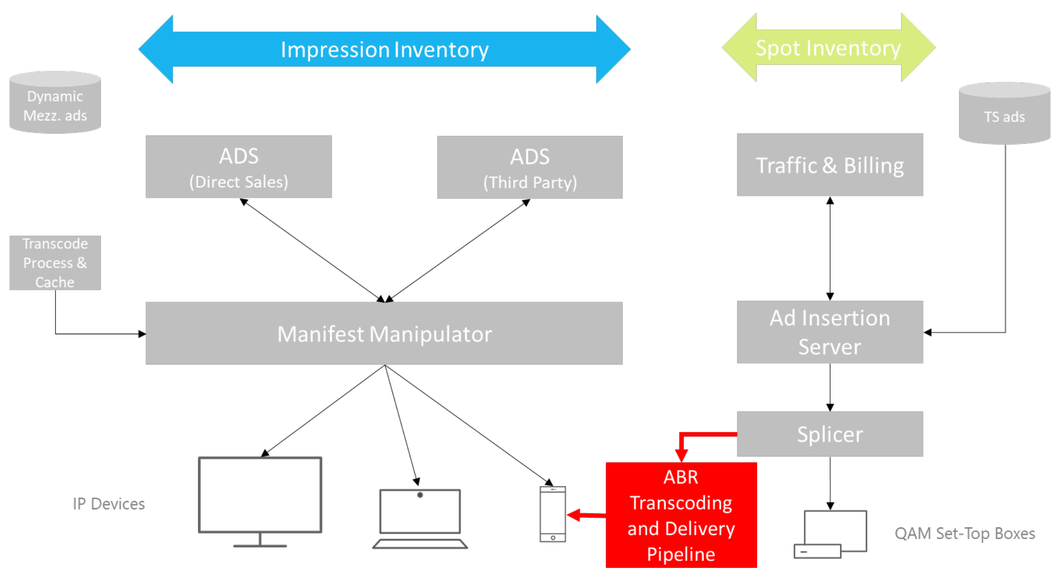

Figure 6 – Achieving IP Parity in a Siloed Model

6.2. Hybrid Model

The next step in the transition is a hybrid model, where both the IP and QAM advertising systems exist side-by-side but start to exhibit coordination and see reduction of redundant processes and components.

Some key steps in this stage are outlined below:

6.2.1. IP Parity Through Integrating Schedules into the ADS

A more sophisticated and efficient model of achieving IP Parity is by ingesting schedules into an ADS (or a component that can act as an ADS for schedule-based ads). The ADS processes the schedules and responds to queries from the Manifest Manipulator with the appropriate ad or ads. This approach has several advantages over the siloes model. First, it requires processing of only one version of each channel into the ABR format regardless of the number of ad zones. Second, it leverages a Manifest Manipulator for the ad insertion, establishing the infrastructure for future IP addressable ad insertion using standards-based protocols and processes. Third, it allows for the use of ABR content for IP ads, again leveraging a standard IP advertising process.

6.2.2. Add Dynamic ADS Integration to Existing Ad Insertion Servers

Just as a process can be established that delivers scheduled-based QAM ads to IP devices, the reverse can be enabled to allow the delivery of dynamic, impression-based ads to legacy ad insertion servers. By adding support for protocols such as VAST or SCTE 130 to the existing Ad Insertion Servers, the Ad Servers can identify ad avails that have not been sold and reach out to an ADS for a real-time (or near real-time) decision to fill the available spot. The ADS responds with ads that are part of campaigns targeting this inventory.

In conjunction with making the ad decision process more dynamic, the ability to collect real-time data from two-way STBs improves visibility and precision in ad measurement, which means that impression-based campaigns can be more dynamically interwoven with scheduled spots to better leverage inventory and increase ad revenue. It also expands the number of channels on which ads can be sold, due to precise viewership information for long-tail channels. This is accomplished by integrating with other elements of the video network, such as SDV servers that already aggregate channel tuning information.

This begins to accomplish the business goals of:

- Allowing unsold inventory on QAM STBs to be sold dynamically near the time of the ad placement
- Support a mix of schedule-based and dynamic impression-based ads on QAM STBs
- Begin to unify the IP and QAM decision systems
- More easily allow for the execution of campaigns across all device types
- Expand the number of channels that can support advertising

6.2.3. Add Support for IP Content to Existing QAM Ad Servers

Independently, or in conjunction with the integration of the Ad Insertion Server to the ADS, a further enhancement adds the ability of the QAM Ad Insertion Server to ingest ads in ABR format and stream them as MPEG-2 Transport Streams to a splicer. To do so, it may leverage the ad preparation process from the IP system, including transcoding and re-packaging.

This capability begins to achieve the business goal of unifying the ad preparation process and increases the universe of ad inventory available to the QAM ad insertion system.

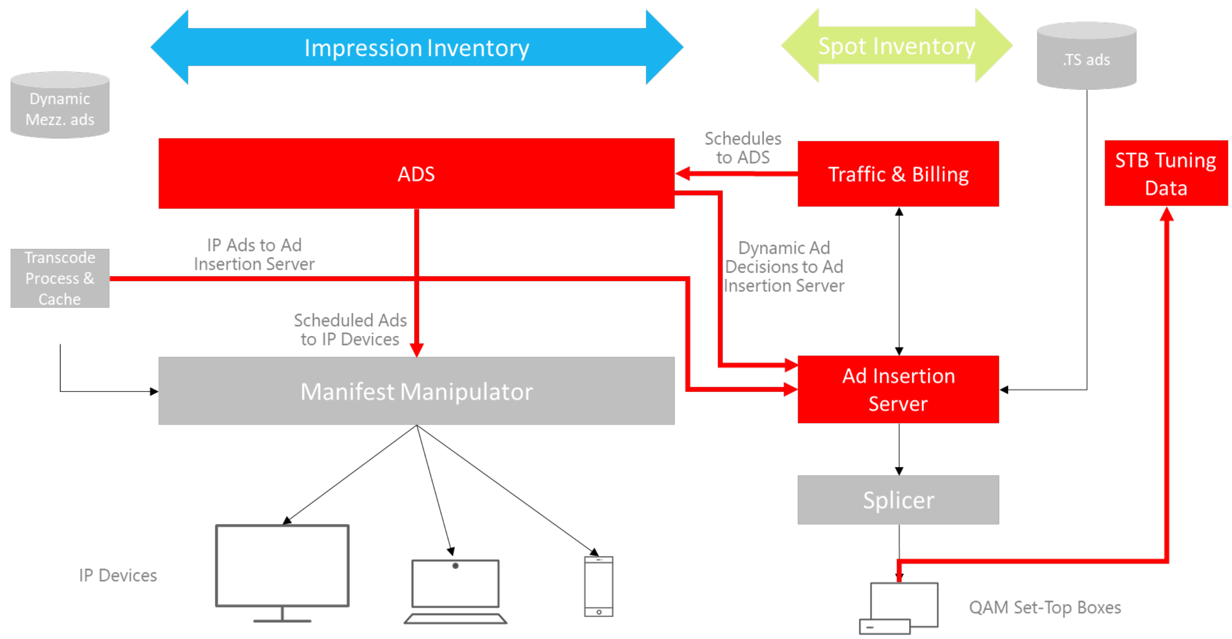

Figure 7 – Summary of Enhancements Possible in the Hybrid Model

6.3. Unified Model

The final model on the path to a full IP video delivery system is a unified model in which the advertising ecosystem has been consolidated into shared systems that support both IP and QAM devices yet fully support the capabilities of IP video advertising.

The characteristics of this model include:

6.3.1. Unified Ad Decisions Through the ADS

The ADS is the central point for all ad decisions, both IP and QAM. Dynamic ad decisions are used for ads delivered to both IP devices and QAM STBs. Scheduled ad sales may still be supported, but the system of record for these ad buys has shifted to the ADS. Note that multiple ADSs are still supported, as advertising inventory may be split between owners, and operators may call out to third party ADSs for decisions on ads sold by other parties in the ecosystem.

6.3.1. Unified Ad Insertion System

The unified model leverages the Manifest Manipulator for ALL ad insertions, using ABR video as the mezzanine format for all ad execution. Based on decisions from the ADS, the Manifest Manipulator generates both personalized manifests that establish a unicast stream to a specific device, but also "channel" manifests that can generate an ABR stream targeted by traditional Ad Zone or any other criteria desired. Similar to the way IP ad content support was added to the Ad Insertion Server in the hybrid model, now the segments that comprise these ABR channels are converted to Transport Streams for delivery over the HFC network to QAM STBs. The result is a common ad execution platform based on virtualized software products, eliminating the need for traditional ad insertion servers and splicers.

6.3.1. Unified Ad and Content Preparation

Because all ad insertion is now done using ABR video as the mezzanine format, content preparation can be consolidated to a single workflow that uniformly processes and delivers video to QAM and IP devices. This step sets the business on a sustainable path of growth by further improving operational efficiency and adding flexibility to continue building the IP video network.

6.3.2. Enhanced Targeting of QAM Ad Insertion

Current Ad Zones offer powerful local targeting capabilities but are relatively broad compared to power of addressable IP advertising and are "hard wired". Changes to the HFC architecture, such as switched digital video (SDV) (including the option of switching all QAM channels) and Distributed Access Architectures (DAA) represent opportunities to develop much more granular targeting for legacy STBs. For example, unique multicasts could be targeted to individual SDV service groups or DAA nodes, greatly enhancing the targeting capability of network-based ad insertion. The composition of the Ad Zone can also be flexible, dynamically assembled from the component service groups or nodes using software configurations.

The unification of content preparation and the efficiency with which channels variants with unique ads can be generated by the manifest manipulator make it relatively easy to generate the large number of targeted channels needed to take advantage of the greater number of smaller Ad Zones.

The unified model addresses the business goals of improving operational efficiency through:

- Unifying ad decisions
- Unifying ad insertion systems
- Unifying ad and entertainment content preparation
- Migrating all systems to virtualized solutions
- Taking advantage of enhanced targeting capabilities enabled by changes to the HFC architecture

Finally, the unified model establishes an advertising system that supports both IP and QAM devices, but is ready to transition to a full IP-only world without requiring any additional changes.

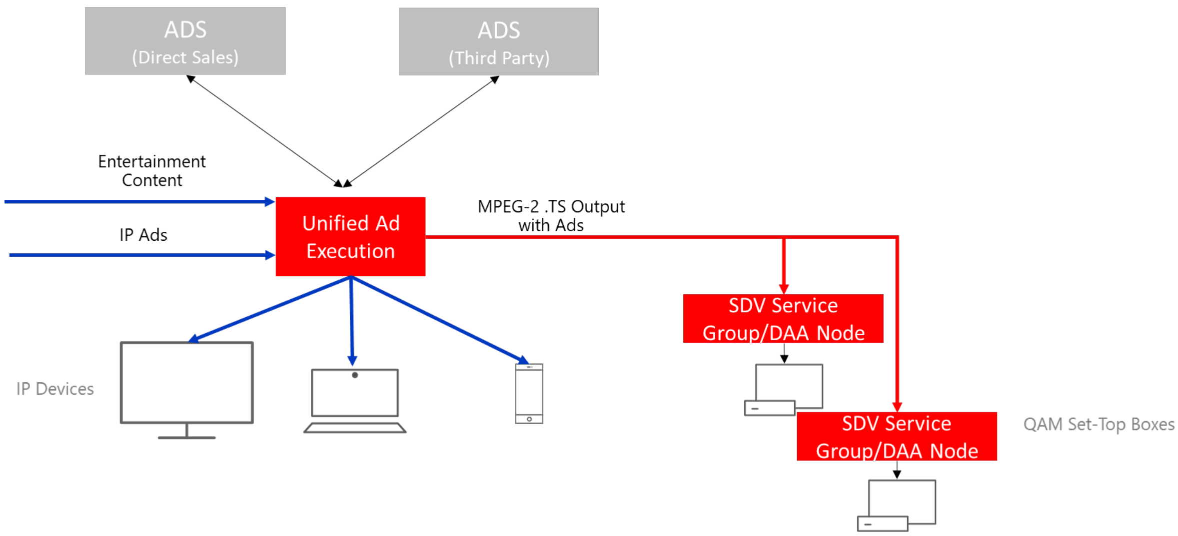

Figure 8 – Summary of Enhancements Possible in the Unified Model

7. Conclusion

As the chart below shows, different models address different business goals. The decision of how fast to proceed must be based on the return on investment, which will be unique for each operator based on factors such as the size of their subscriber base, sophistication of data collection and analytics, the maturity of their existing advertising business and the speed with which they intend to migrate to IP video.

	Transition Strategy						
	Silo	Hybrid			Unfied		All IP
	IP Parity - Xcode Ad Inserted Channels	IP Parity - ADS/Schedule Integration	Add Dynamic ADS Support to Legacy Ad Server	Add Support for IP Ads to Legacy Ad Server	Unified Ad Insertion Platform	Target QAM by SDV Service Groups/DAA Nodes	IP Advertising Platform
Business Goals							
Defend Value of Current Business					X		n/a
Extened QAM Advertising to IP Devices	X	X					
Maximize Revenue							
Improve Legacy Targeting Capabilities						X	n/a
Extend Advertising to More Channels			X		X		X
Leverage Unsold Advertisign			X		X		X
Enable Mix of Scheduled and Dynamic Ads							X
Enable Campaigns Across Both Footprints			X		X		n/a
Operational Efficiency							
Unify Decisions			X		X		X
Unify Content Prep				X	X		X
Unify Ad Insertion					X		X
Transition to Virtualized Solutions					X		X
Enable New Business Models							
Insert Ads on Behalf of Content Providers			X		X		X
Enable Programmatic Advertisng via Third Paries			X		X		X

Table 1 – Comparison of Business Stages in Addressing Business Goals

Abbreviations

ABR	adaptive bitrate
ADS	Ad Decision Service
CAGR	compound annual growth rate
DAA	Distributed Access Architecture
DAI	dynamic ad insertion
IPTV	Internet Protocol television
MSO	multiple system operator
MVPD	multichannel video programming distributor
OTT	over-the-top
QAM	quadrature amplitude modulation
SCTE	Society of Cable Telecommunications Engineers
SDV	switched digital video
STB	set-top box
VAST	Video Ad Serving Template

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VAST specs; https://www.iab.com/guidelines/vast/