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Broadcast and Digital Evolution

The Evolution of Delivering to Any Screen

A Technical Paper prepared for SCTE•ISBE by

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Introduction

Ensuring that content is available and that ads can be placed on any screen is table stakes to content providers and advertisers alike. Now, new questions are surfacing like how to keep the quality standards of broadcast on all devices, how to simultaneously deliver to both broadcast and online destinations, how to reach targeted audiences across platforms, and how to see a holistic reporting view of all content?

Broadcast and digital destinations are no longer separate in the minds of consumers, therefore backend workflows have transformed to seamlessly serve both. The intelligent merging of broadcast and digital technology combines workflows, delivery, and reporting to get content and advertising to any screen.

Advancements in video quality and global delivery are changing the industry at a more rapid pace than ever before. In today's data-heavy world of multi-platform video, profitability and quality assurance are hard-won metrics that must be continually reassessed and updated. Providers of every ilk are contending with the squeeze on both sides of the equation – the need for faster operations, real-time advertising, and lower cost in order to divert more resources into what matters most, the creation or curation of compelling content.

More than ever, video service providers are ruled by three masters. At one corner, there's the fundamental requirement to deliver video at the highest quality, both in picture and playback consistency. At the next corner, dollar signs abound as businesses try to offset ballooning costs of content development and acquisition by streamlining and automating video delivery and commerce workflows. At the third corner is the need to bring learnings from an extremely fragmented media landscape into a holistic view that produces better performance measurements and, ultimately, better commercial performance of every piece of content, be it short-form ad, linear channel, or on-demand.

This paper doesn't intend to encompass all of the changes and challenges of multi-platform delivery. It does, however, aim to highlight some ways in which the convergence of broadcast and digital delivery is – with growing pains – evolving the way that providers deliver and monetize content, and how consumers consume it.

Evolving the Definition of "Quality"

"Broadcast quality" is something that every viewing experience strives for, but in a world where 4K screens are racing towards ubiquity, the hallmark of broadcast quality is its consistency. Paired with the capabilities and image quality of today's devices, as consumers we've really got an embarrassment of riches to choose from. For video service providers, that translates into a desire to connect more meaningfully with viewers at every playback, with repeatable, reliable, more personalized experiences of the highest quality.

Last year, Comcast Technology Solutions published a research paper called *Survive and Thrive: the Changing Environment for Content and Video Providers*. The objective of the survey was to better understand how content and video providers are leveraging online resources and delivery mechanisms, and what they perceive as significant challenges in today's evolving market. Survey respondents listed "discoverability" as the top business challenge they're facing. Maintaining consumer attention in today's market speaks directly to the need for every playback experience to execute flawlessly, lest the viewer go elsewhere. And, depending on the type of program, the consumer might not even have to choose

something else to watch. Instead of watching the newest superhero flick on service A, for example, they can just switch over to service B where they can watch the same movie with less buffering. More and more individuals every year have access to multiple video services, whether served through an online subscription, or over a set-top box or game console – which means that one program might be accessible by one consumer in multiple ways (like a new movie that's just been wide-released for download / streaming). If a show is buffering, lagging, or of otherwise poor quality on service A, but can be watched with reliable quality on service B, it has a definite impact on future viewing decisions. Consistent quality is a huge factor in maintaining audience relationships, especially as more premium services enter the market.

With the accelerating commercial adoption of 4K / UHD / HDR screens, the eventual implementation of the ATSC 3.0 broadcast standard (and the arrival of consumer devices that can take advantage of it), we are seeing [the beginning of] a massive increase in available 4K programming across the entire provider ecosystem. Though clearly a significant improvement in picture quality, the sheer size of ultra-high definition (UHD) video files brings new challenges to storage and delivery. As consumers acquire more of a taste for (and an ability to play) video and audio of increasingly high quality, every touchpoint in the delivery workflow is more heavily taxed by having to compress, store, transcode, and deliver files that are up to four times bigger than those previously handled. That makes for a lot of change that needs to be managed all at once, especially when the premium prices for premium content create premium expectations. It's no wonder that 92% of our respondents in the same survey said that meeting or exceeding broadcast quality and reliability is still important.

IP-based delivery is light-years ahead of where it was just a few years ago, but as more and more consumers develop an appetite for "higher and higher quality" video, the widening data stream continues to push the performance limits of every platform. Advertisers and investors understand the value of reaching a gargantuan audience, but they also – rightly – seek assurances that viewers are getting an experience that supports their brand objectives.

A Unique Path for Every Playback

Delivery to a disparate sea of screens remains a fascinating technical challenge; but the end-point device is not the only thing to solve for. Content providers now have to deliver content, not just to MVPDs, but also directly to consumers -and virtual MVPDs (vMVPD), using a solution that provides broadcast reliability. Business rules and playback rights are not just different from device to device, but quite literally from view to view – and everything needs to be solved for in real time.

So, for a company that aspires to deliver a winning experience anywhere, what does a successful new delivery model look like? Global operators and content providers require cost effective, high-quality methods to acquire, package, distribute, assemble content in order to reach more audiences, manage metadata, and provide more economical options to viewers. There are innovations across management and delivery workflows that can be leveraged:

- Content feeds from all partners can be acquired and aggregated in a more automated, cost-effective way that reduces degradation and time to market.
- A more intelligent multi-CDN architecture can employ predictive analytics for proactive decisioning and smarter routing and caching of content, as well as better performance measurement.
- A carrier-grade cloud infrastructure makes it easier than ever to define sources, upload assets, define policies, and create and deliver OTT streaming services of all types (linear playout, live, VOD, time-shift TV/cloud DVR), directly to viewers in hours instead of months.

- Live media necessitates buffering, error correction and synchronization schemes to overcome the inherent weakness of packet-based IP networks. Virtualized IP networks address this issue with control-layer decoupling from bespoke hardware to optimize the entire network for the demands of video.
- Ad insertion and automated ad commerce tools can be incorporated in order to improve monetization efforts, keep ad-supported content fresh and relevant to viewers, and in turn more valuable to advertisers.
- Metadata needs to be easily normalized and manipulated to SCTE 224 standard, so users can easily and accurate define sources, upload assets, define regional or global distribution policies, and manage the unique permissions and programming schedules for each screen.

A Case Study on Broadcast Market Change

There's so much disruption coming from so many different sources that it's a constant challenge to try and identify the ramifications of change before they impact a viewing experience. It's not just a matter of digital destinations working to meet and exceed broadcast quality. Broadcasters need to provide the level of interactivity and ad insertion capabilities that digital brands offer. Going back just a few years, advertising within a broadcast feed was a relatively straightforward affair. Today, SCTE 35 and SCTE 104 information must be included so that ad insertion at the delivery end-points can occur. And not only occur, but occur at the right point in the video, giving the client a perfect user experience with frame accurate switching.

The service areas of regional broadcast stations are no longer simple, line-in-the-sand maps, as these broadcast constituents' content with content rights and restrictions that don't always line up. Here is an example of an issue we were faced with recently:

We conducted a test with a local television station that was a local affiliate for a national broadcaster. The television station was testing delivery of its content to a national virtual MVPD (vMVPD). We offer a way for organizations like this local station to manage their linear metadata rights, and they wanted to test the product's capability to control the rights restrictions for the station's content. This station normally broadcasts its signal via antenna to a roughly 30-zip code area around a major US city. This station's only blackout scenario happened during a national sporting event, where the territories of two teams overlapped in one subset of their 30-zip code audience area. Traditionally, this television station would black out the telecast of the sporting event to 9 zip codes in the northeastern section of their footprint. As such, their blackout rules had a restriction for these 9 zip codes, which our metadata management tool could easily manage.

Now it was time to share this video feed from the local station with the national vMVPD. When the vMVPD sent out the content during the blackout scenario, the 9 restricted zip codes were blacked out as expected; but roughly 42,000 other zip codes could see the content – essentially the rest of the United States. This was not the desired outcome, because obviously, a local affiliate should not be the station providing major sports content to a national audience.

As a result, this local station now had to get out of the mindset of thinking just about the 30-zip code area and parts of its restrictions to a national perspective. In reality, the blackout restrictions now ought to have been 39,976 zip codes – which includes the 9 restricted codes and the rest of the country. This subtle change in mindset can be rather large and intimidating for a small local television station, but this is just the start of what is required in this new digital/vMVPD ecosystem we have before us.

Additionally, if you are distributing internationally, then country boundary enfourcement is another concern that must be addressed. And although some content providers are addressing this through spreadsheets, emails, and grids, these solutions don't scale and don't statisfy the requirements of the new vMVPDs that don't have large staffs and require machine-to-machine conveyance for their linear rights information.

As Files Inflate, Compression Gets Complicated

For video compression, we're faced with a diversity of codecs serving a diversity of devices and file types, as storage and delivery work to keep up with the capabilities of today's screens. The codecs commonly used today are the result of a rapidly evolving and fragmented market – one full of constituents with different priorities beneath the fundamental stated goals around reliable quality, cost control, and profitability.

MPEG-4 Advanced Video Coding (AVC) has been utilized longer and is more prevalent than most, but it lacks the compression efficiency needed for ultra-high-definition (UHD) programming. Ultimately it will have to give way to codecs that can handle the never-ending quality march uphill – UHD, 4K, HDR, 8K, and whatever comes next. The codecs that are currently in use each have their own unique positives and negatives:

- High Efficiency Video Coding (HEVC), essentially the next-gen MPEG codec, is currently in use by over two billion devices. It solves the challenges presented by UHD, but is shackled to a challenging licensing structure. Complicating the picture are over 1500 HEVC patents in the U.S. across an ocean of companies, turning intellectual property (IP) rights into a potential quagmire.
- AV1, developed by the Alliance for Open Media, is a strong contender but has only been available for a few short years. It is royalty-free and might be an attractive option as the scale of devices deployed increases, but broadcasters largely have embraced HEVC over AV1, somewhat do to the fact that ATSC had to make decisions before AV1 was completely available, so we will see how this changes in the future.
- Essential Video Codec (EVC), otherwise known as MPEG-5, is in development but is essentially an unknown quantity from a licensing standpoint until 2022 at the earliest.
- Versatile Video Coding (VVC) is designed to handle immersive media applications and is essentially the best on paper, showing efficiencies of over 50% above HEVC. It's targeted for completion in Q4 2020. Much is still to be determined with VVC, especially the overall effeiciencies that are gained, depending on tool selection, etc.

The bottom line is that video providers of all stripes have to contend with, and accommodate, compression technologies that are as fragmented as the market itself. As Streaming Media wrote in April 2019, "The market needs a codec that delivers high compression efficiency, reasonable encoder complexity, broad decoder support, and a clear licensing scheme. There are clear questions of scale and the market will need to move to an all-software base, but just as cinematographers now pick digital sensors as they would film stock for different applications, so broadcasters and service providers might one day be able to cherry pick, swap, and replace codecs with automated ease."

You're Only Live Once: Building Redundancies Into Event Planning

Live programming is definitely an area where broadcast and digital are working together to improve experiences across the board. One of the biggest challenges with streaming live events over digital is that,

with so many potential failure points, solving for them all is an expensive proposition that most services don't account for. Backup plans and redundancies are expensive, so they're often victims to cost-cutting initiatives. Broadcast provides that straightforward, low-latency, consistent quality that digital delivery is benchmarked against. When millions of dollars (or more) are on the line, it can be an exceptionally costly corner to cut.

That said, online destinations can provide deeper interactivity that enhances the audience experience; and again, broadcast feeds need to provide advertisers with the same ad insertion capabilities as digital feeds. The best delivery architecture is one that leverages the strengths of broadcast and digital into a seamless multi-platform workflow – piloted by expert event engineers who plan every transmission and quarterback the communication from start to finish. Look at it this way:

- IP-only: lower cost, complex failsafes required, "best efforts" performance.
- Broadcast: more expensive, rock-solid best practices, high availability and reliability.
- Strategic use of both: trusted, cost-effective performance that supports both linear television and cloud experiences.

It's impossible to overstate the value that an experienced team brings to a top-tier live event; not just in overall quality, but also in cost savings. A complex live-streaming event, such as a high-profile awards show, is a great example. There are cameras everywhere: the red carpet and interview areas out front, around the audience, the main stage, backstage, etc.

A well-planned and executed event will map out all redundancy paths, but also will prioritize the use of broadcast signal. For example, the main stage cameras would be captured via broadcast to ensure quality, but lower-quality ancillary feeds could be leveraged to control costs. Satellite and digital captures are then converged into a master control so that the complete program can be compiled, encoded, and distributed across platforms.

The volume of live programming is going through the roof, with media brands of all stripes working to realize – and monetize – experiences that bring viewers closer to a true "front row experience" than ever before. That said, there are no do-overs in live video; so before the world tunes in, it's worth the extra planning to ensure that viewers on any platform get the kind of quality that keeps them in their seats.

"Simulated" Live Events and Virtualized Channels: New Monitization Models that Feels Familiar

The hybridized broadcast / digital model is really a best-of-both worlds architecture that not only bakes in the video quality and process redundancy expected of a major live event, it also opens up opportunities to appeal to viewers in new ways. A program can be created that captures the immediacy and advertising allure of a live event, while also incorporating existing video assets into one seamless program. A live studio audience portion, for instance, could be woven into a playlist with sections of non-live material, encoded and then distributed just like a linear television feed. It's a cost-effective way of producing a special "one night only" event, or a way for a large organization – a coast-to-coast church broadcast, for instance – to maintain a live "feel" with the dependable quality that keeps viewers engaged.

Taking this idea into a 24x7 application results in a "virtualized channel" – a great way to turn existing on-demand assets into an always-on OTT experience that can operate as a standalone destination, or as a live feed that augments the merchandising of VOD content. It can be a particularly attractive way to build or expand niche audiences by compiling a programming schedule of curated content for a particular fan base or demographic. Content providers can extract more value out of their existing content with approaches like these; provided that they've got a system in place to manage content rights and restrictions with alternate content and electronic programming guides that accurately reflect the specific flavor of virtualized channel that's delivered to each screen. Monetization of content also improves – the new linear channel can be provided to multiple vMVPDs, increasing both viewership and revenue from consistent advertising opportunities.

The Evolving Relationship Between Advertisers and Providers

Technology innovations aren't just opening up new opportunities for video advertising; it's changing the way that business is being done, and how providers and advertisers interact.

Programmatic advertising – the ability to automate media purchases based on viewer data – has not only given advertisers a way to improve ad performance at scale, it also provides broadcast and digital providers a more efficient commerce model with which to sell media space at scale. Addressable technology takes this model one step further, using advanced audience analysis and segmentation to focus ad delivery all the way down to the screen level. In other words, two people in one home could be watching the same program on different screens, but see two different ads.

In just the last couple of years, the advertising conversation has moved well past broadcast vs. digital delivery, and into deeper discussions about how to coordinate and optimize campaigns across the spectrum of video destinations, how to automate media commerce from both demand and supply sides more effectively, and how to further personalize experiences. Advertisers rely more heavily than ever on the data that they can get from providers so that each program, each destination, can be viewed holistically in order to more accurately understand how an ad's targeting or creative assets could be changed to improve performance. Innovations are changing industry norms from so many different directions that it has stretched the ability of companies to respond. The question "how do you get your content in front of your customers on the screen they want, when they want it?" is morphing into a much

deeper question, "how do you get your content in front of your customers on the screen they want, when they want it, in a way that makes it more relevant, valuable, and actionable?" There's a lot to figure out, but it's going to be an exciting ride:

- On the delivery side, new destinations and advertising opportunities are showing up regularly. When will providers and advertisers need to be ready to serve ads and content to new connected-home devices? When digital assistants like Alexa, Siri and Google start making purchase suggestions (on content or on anything else), how will that impact workflows?
- On the commerce side, automation and targeting are infusing operations with unprecedented levels of sophistication – and complexity. How much of your work will move towards programmatic and dynamic processes? How can dynamic creative optimization (DCO) be intelligently implemented to tailor ad service based on real-time viewer insights?

On both sides, manual and disparate processes are hampering business, draining time and resources. And they are inherently error-prone. How could we create an environment that brings everyone's work into closer proximity, eliminates redundancies, and enables self-directed service and sophisticated real-time decisioning?

Conclusion

The future for content providers and advertisers is sure to find them working more closely in concert, as the push for more personalized content experiences forces every organization to implement faster ways to manage complexity at scale, and more reliable ways to understand how each viewing experience impacts the viewer.

Abbreviations

AVC	Advanced Video Coding
CDN	Content Delivery Network
DCO	dynamic creative optimization
EVC	Essential Video Codec
DVR	Digital Video Recording
HEVC	High Efficiency Video Coding
MVPD	Multichannel video programming distributor
OTT	Over the top
UHD	Ultra high definition
vMVPD	Virtual multichannel video programming distributor
VOD	Video On Demand
VVC	Versatile Video Coding

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