

OVER THE TOP

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Fall 2019

## Stream Wars: *The Battle Heats Up*

### Executive Q&A



Remi Beaudouin  
ATEME



Steve Oetegenn  
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Erik Otto  
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Anthony Smith-Chaigneau  
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# Stream Wars (or The Battle of the BehemOTTs)

By: Kurt Michel

As I write this, **Apple** has launched their **ATV+** service in the industry's latest volley to topple **Netflix** for tomorrow's viewer. Next up is **Disney+** on Nov. 12 in the US, to be followed by **NBCUniversal's** Peacock next April, and **HBO Max** in May.

To Netflix' credit, they have spent a lot of time on the streaming mountaintop building their defenses. Their VOD streaming technology and infrastructure is recognized as among the industry's best<sup>1</sup>, their subscriber-acquired data is the envy of everyone in the M&E industry, and they have been investing huge amounts of OPM<sup>2</sup> (\$16B in 2019) on original content<sup>3</sup>. By virtue of their subscriber numbers, they are considered the anchor service of the OTT viewer. But with some of the biggest companies on the planet targeting them, is it enough? Let's walk through some of the coming competitor's relative strengths and weaknesses.

But first, a moment of silence for arguably the first significant casualty of Stream Wars: Playstation VUE, which announced in October that they would shut down operations in January 2020. More on that later.

## Apple

Despite Apple's clear desire to shift to a services business<sup>4</sup>, they continue to focus these services to the Apple device user. Their free-year subscription offer to buyers of Apple hardware sends a clear message that TV+ is being targeted at the Apple device owner. And TV+ lacks an Android or Windows app, even though the persistent Android or Windows viewer can use their browser to view on <https://tv.apple.com/>. My son, a Google Pixel/Windows/Macbook user was not aware of that. So is TV+ meant to bolster Apple hardware sales, or vice-versa? The messages are mixed, and confusing.

Apple's approach to episode availability – drop the first 3 episodes, with a new episode each week – makes sense, given their lack of library depth. Had they dropped entire seasons at once, subscribers could binge all their interesting content during the trial period, never to return. Ironically, data shared by Netflix<sup>5</sup> may have helped them decide on the 3 episode drop in order to “hook” the audience, and keep them coming back weekly. At least with this approach, *if* one of the shows catches a subscriber's interest, there is a chance they will return. And the weekly drop allows show buzz

to be sustained over long periods (a la *Game of Thrones*).

I am not a content critic, but based on my early views and critic's reviews of the Apple TV+ launch shows, they are somewhat hit and miss. But, to use a baseball analogy, the hits are no more than doubles, and I think they really needed a home run or two. My wife and I enjoyed an episode of “The Morning Show,” then tried “See.” We did not make it through that first “See” episode. “For All Mankind” is fun and I think I'm hooked (2 episodes), but I'll enjoy that on my own, since the space genre is not my wife's cup of tea. That means I'll be watching late at night, after she goes to bed, so if it's not engaging, I'll be snoozing. Summing it up, TV+ is clearly not intended to be the anchor service of the OTT viewer. I guess it is aptly named, because it looks like an add-on (+) to whatever a viewer does use as their anchor service. Is it a threat to any existing services? Maybe the other add-ons like HBO Now or Showtime Anytime, but not Netflix, Hulu, or even Prime. Without a deeper library, that is where they will remain.

## Disney

Next up is Disney+. With the Disney, Pixar, Star Wars and Marvel libraries (...and National Geographic) behind them, and new content leveraging those brands, a huge number of people are expected to try it<sup>6</sup> in the first year. The recent free year offer for many Verizon customers<sup>7</sup> only reinforces that.

But what I find most compelling about the Disney+ offer is not so much the service

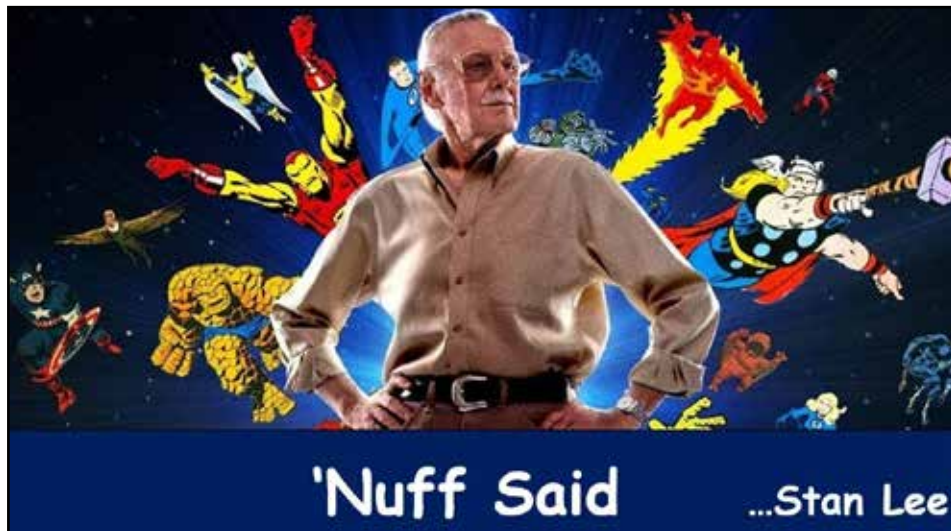


Kurt Michel is Executive VP at Trender Research. He has over 30 years' experience in telecom, datacom, and networking - in development, sales, product management and marketing roles. His marketing leadership experience at Akamai, IneoQuest, and SeaChange gives

him a unique, multi-faceted perspective on the volatile video industry.

itself, but the ability to bundle with Hulu and ESPN+. I believe this will hit Netflix in its Achilles heel. Netflix offers no live or linear programming – only on demand – and their infrastructure is optimized for VOD. Don't get me wrong, I believe on-demand viewing, as measured by minutes viewed, will only continue to grow. But there will always be a need for live and linear, and a true OTT “anchor” service requires that. Since Disney's infrastructure was built from MLBAM's experience in live sports, they have learned how to handle the complexities of live video's demand spikes. I would argue that VOD can easily be handled by a robust live infrastructure, but the converse is not true. If live/linear really does become a requirement for an anchor OTT service, Netflix will need to make significant changes in either their platform, or through M&A.

Of course, maybe I am wrong about the importance of live/linear. Or maybe the Live/Linear services will be met over the emerging





# OTT Fest Launch Is a Huge Success

By: Brian Mahony

ATSC3.0 broadcast infrastructure, with the internet/OTT primarily handling VOD traffic. But I don't think that will happen soon enough, and the battle is raging now.

My bet is on Disney (Disney+/Hulu/ESPN+) for the anchor OTT service winner. But maybe Netflix is OK with that?

### Kurt's Prediction

It will probably take a while – maybe a year – to determine winners, given how the competitors are stacking their subscriber decks with free offers. Due to a recent iPhone upgrade, my entire family can enjoy a free year of Apple TV+. I am also a Verizon Wireless Unlimited customer, so Disney+ will be free for my family for the first year. I would suggest we all ignore the “number of subscribers” or “number of households subscribing,” and wait for the “number of paid subscriptions” stats. In any case, the headlines extracted from active user numbers will keep us entertained through the next year.

In the meantime, it's fun to handicap the players. And I believe the most important weapon in each player's arsenal is their brand. I know Netflix and Hulu have built great brands, because my family sits down to “watch Netflix” or “watch Hulu.” But what exactly do the Netflix and Apple TV+ brands mean, and what are they becoming? In comparison, my household has Amazon Prime, and when looking for a show, we will “check if it's on Amazon.” We do not “watch Prime.” Pay attention to the way people refer to these brands. Ask yourself how many people will ever say “I'm going to watch TV+ tonight?” Our language reveals the difference.

Which brings me back to Playstation VUE. On their soon-to-be-retired home page, it says: *“Watch the best of live streaming TV and On Demand shows on your favorite devices – no PlayStation® console required.”*

So I don't need a Playstation to watch Playstation VUE, and they know they need to tell me that? So why did they name it that???

Branding matters.

I think Disney+ has already won the brand identity battle, because in the consumer's mind, Disney IS entertainment, and their underlying brands only reinforce that. Pixar has never created a bad movie. People notice anything related to Star Wars. And Marvel's brand? As Stan Lee would say – ‘nuff said<sup>8</sup>. □

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Netflix will spend \$15 billion on original content this year. Other OTT giants such as Apple TV+, Amazon Prime, and HBO Max are spending billions more. So it's no surprise that new conferences and communities would emerge to tap into this huge investment of capital. Of course this event would pop up in New York or Los Angeles, right? Nope—Atlanta!

OTT Fest ([www.OTTfest.com](http://www.OTTfest.com)) launched this year in the burgeoning content metropolis of Atlanta. Fittingly, the opening keynote was by Ozzie Areu, CEO of the newly launched Areu Brothers Studios. Ozzie has been methodically building his new media empire, recently acquiring OTT Platform Endavo Media (which itself acquired OTT content aggregator Footprint.TV last year) and, just announced at the show, THEA—a sort of local access platform for a slate of OTT channels. In his keynote chat Ozzie highlighted his studio's strategy which is to focus on long form and short form content—both TV and film—that helps to tell the stories of underserved communities such as women and people of color. This strategy fills a key gap in the industry and is a perfect fit for the Atlanta content community which already includes heavyweights such as Tyler Perry Studios, CNN, and Turner Networks.

Co-founders of OTT Fest are Paul Hamm, Endavo Media CEO, and Kate Atwood, President of THEA; both who now work for Ozzie. Trender Research/OTT Executive is also a partner in this new endeavor and provided about a third of the speakers, including the powerhouse opening panel which consisted of moderator James Norman, CEO of Pilotly; Randy Ahn, Director of the Roku Channel; Jada Leng, Director of Content Strategy for PBS; Maxie Collier, Founder of Super Livestreams; and Stefan Van Engen, SVP of Content Programming at Xumo.

The second day's keynote included an excellent panel made up of leading women in entertainment. Doris Casap, SVP of Film Programming for HBO flew down from New York to anchor this interesting and informative conversation. The other panel members were Tyler Perry Studios' Michelle Sneed, Scripps TV's Cheryle Harrison, Areu Brothers Studios' Kim Leadford, and entertainment industry consultant Angela Northington. The panel was moderated by Mo Ivory, Professor at Georgia State University.

OTT Fest was co-located with A3C, which draws almost 40,000 attendees for its conference/festival across the music, tech, video, and culture landscape. A3C, short for “all three coasts”, started as a hip-hop music festival and like Austin's South by Southwest grew to include cultural and tech components.

OTT Fest's focus on media and entertainment is the third leg of the stool, tapping into both the local community and national (and global) network of up-and-coming content creators and distributors.

In addition to the amazing speaker lineup, sponsors and participating brands included a mix of corporate and entertainment industry brands such



as Delta Airlines, Georgia Power, Netflix, Whistle Sports, Mailchimp, and Tenderfoot.TV.

Next year look for an expanded speaker lineup as well as a pitch contest for new TV pilots and films that will compete to win exclusive production and distribution deals. Anyone interested in speaking or sponsoring next year should contact me at [bmahony@OTTExec.com](mailto:bmahony@OTTExec.com). □



# Balancing Price, Content and Experience Creates Winners and Losers of Streaming Video

By: Michael Jones

Three basic levers determine the success of any streaming service from a consumer perspective – the cost of the subscription, the content included in that subscription, and the quality of the viewing experience. Service providers are constantly trying to balance these levers to create satisfied and loyal subscribers for long-term success. Improving content or the quality of experience (QoE) can grow subscribers or compensate for potential churn from a price increase. Likewise, lowering prices can increase subscribers, as Hulu did in February 2019.

## Price

In 2007, Netflix signed an agreement for the online streaming rights of Starz, providing access to more than 2,500 titles, including recent premium movies from Disney and Sony. Streaming these titles was available, for free, to Netflix DVD subscribers with plans of \$8.99/month and higher. This essentially established the standard pricing structure of streaming services as we continue to know it today, and it did so without taking into consideration the cost of content development and licensing. If a provider increases prices well beyond what exists today, it will impact subscriber count (e.g. historically, Netflix subscription counts have been price sensitive). Otherwise, it will need to consider ad-based VOD (AVOD) options to subsidize its costs.

## Content

The content lever is a difficult one as content owners are now starting to realize the true value of streaming rights (e.g. the cost of streaming rights for *Seinfeld* increased 5X over a 5-year period). According to Netflix, the company spent 85% of its streaming content budget in 2018 on originals, yet Nielsen data shows this content only accounted for 37% of

viewing time. AT&T has been aggressive in licensing content for HBO Max as it has little control over the price lever given existing price structures for pay TV and HBO Now.

## Viewing Experience

QoE can help streaming services differentiate in an increasingly competitive market. Frictionless set-up among devices, easy-to-navigate electronic programming guides and an optimized viewing experience for any given device are examples of how experience can gain new subscribers – and potentially command higher pricing.

Let's look at Netflix to examine these key levers further.

By the time Starz terminated its streaming rights deal, Netflix had the financial strength to license rights directly from content owners, including top films from studios as well as popular television series. Netflix found that many viewers “binged” by watching many episodes of popular TV series in a row, and this meant that these were the most watched content on Netflix. According to Nielsen, the top three programs for Netflix in 2018 were *The Office*, *Friends* and *Grey's Anatomy* – all having more than 200 episodes.

When Netflix started streaming video, it was included for free with its DVD mailing service. By 2011, the price had increased just \$1, to \$9.99 per month. In July 2011, Netflix separated its DVD and streaming services into discrete subscriptions, each priced at \$7.99/month.

At the end of 2011, according to Netflix data from its annual report, the service had 21.6M global subscribers. By the end of 2018, the number had risen to 139.3M. ARPU had actually dropped from \$11.84 (representing customers subscribing to both DVD and streaming services) to \$10.31 per streaming customer. Netflix had kept prices low, relying



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on new subscriptions to grow revenues. In a 2016 survey by Cowen and Company, cost effectiveness was cited by 58% of respondents as a reason to subscribe.

Netflix also offers a very strong QoE. In 2018, the company spent \$1.2B on R&D and has spent the past decade optimizing VOD delivery. The company has pioneered new technologies for streaming, such as the Open Connect distributed CDN, which optimizes cost and performance by hosting content directly in ISP's data centers. Likewise, their Dynamic Optimizer offers extremely efficient compression, minimizing bandwidth costs and increasing resilience to network performance issues. Netflix also works with hardware vendors to qualify products as “Netflix supported”. Finally, Netflix has extensive analytics data for QoE and user behavior.



According to Sandvine, Netflix accounts for 3% of all upstream internet traffic, representing the vast analytics data they collect. This allows them to optimize service quality, provide a strong recommendation engine and gain deep insights for the creation of original content. Netflix built strong subscriber growth by using two of the three levers for a streaming service – increasing content and QoE while keeping pricing relatively flat. Going forward, Netflix is losing some key content for the U.S. market (*The Office*, *Friends* and *Grey's Anatomy* are all moving to competitors) and has no stated plan to lower prices. Its growth will depend on leveraging analytics data to provide tailored content and user experiences, as well as utilizing new international content to expand in international markets.

Today, Netflix has a market cap of \$120B. At the end of 2018, Netflix had 2.7M DVD



subscribers, down from 3.3M in 2017 and 4.0M in 2016. If not for streaming, Netflix would be dying or dead.

### Disney and AT&T Say “Not So Fast!”

Building off of the Starz deal in 2008, Netflix has created a huge amount of shareholder value, as well as a strong User Data Base (UDB) of hundreds of millions of users. Netflix has also built a very strong recommendation engine, a treasure trove of user behavior and QoE data, and a strong glass-to-glass streaming video delivery chain. Netflix does not share the data of, or access to, their subscribers.

Disney, AT&T and others have taken notice. They doubtless realize that Netflix is approaching an inflection point in content ownership, whereby their original content will overtake licensed content as the primary driver of viewership. Netflix is also aggressively building out its global content and subscriber base.

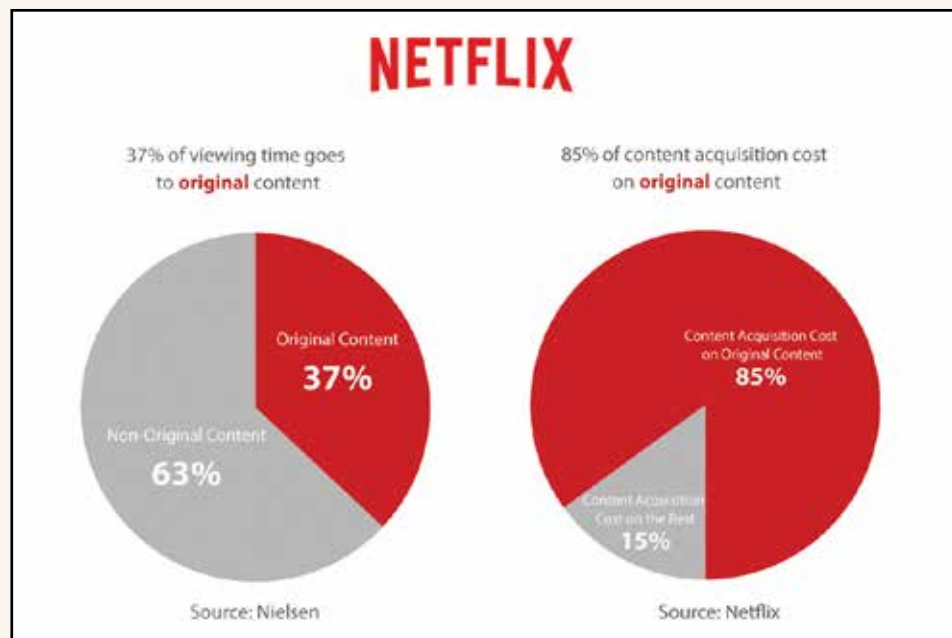
Disney spent \$2.5B to gain a controlling interest in BAMTech, which has become Disney’s streaming technology provider and operator. Disney is also forgoing billions of dollars of content licensing fees – The Wall Street Journal estimates that Disney was receiving \$500M annually just from Netflix for streaming licensing.



Disney is also spending billions to build and market Disney+. Meanwhile, the starting price is \$6.99 per month – and discounts are available to Disney’s D23 fan club members for under \$4 per month. Under CEO Bob Iger’s direction, Disney will lose billions building up Disney+ in order to gain a strategic position in the future of video.

While Disney has top-tier content, including Marvel, Star Wars and Pixar, the Disney+ library is much smaller than that of Netflix, with approximately 500 movies and 7,500 TV episodes at launch; roughly half the size of the Netflix library, according to data from the unofficial Netflix online global search website. To provide a larger library, Disney is bundling Disney+ with ESPN+ and Hulu for \$12.99 per month, a discount of about \$5 based on individual prices.

Despite the consumer-friendly \$6.99 price of Disney+, it is unlikely that Disney will keep that price in the long term. Furthermore, in



2016, Netflix had a global streaming ARPU of \$8.61, offering Disney and other studio content as well as their own originals – which likely represented a better value than Disney+ or the Netflix of today.

Meanwhile, AT&T’s WarnerMedia is building out HBO Max. While pricing has not yet been announced, it is widely believed that pricing will be the same as HBO Now (\$14.99 per month) or, at most, a few dollars more. AT&T does not want to undercut existing HBO Now and HBO pay TV subscribers, so is being aggressive in building out high-demand content to make the service compelling (i.e. using the content lever to build subscriptions). In addition to HBO content such as *Game of Thrones*, *The Sopranos* and *The Wire*, AT&T has spent an estimated \$2B+ to secure the rights to *Big Bang Theory*, *Friends*, and *Two and a Half Men*.

### How to Stand Out in a Glut of Streaming Services?

As the D2C market expands to include Apple+, NBCUniversal Peacock, Discovery/BBC, etc., subscription fatigue is a real threat. Consumers simply will not want to navigate different apps, keep track of what is playing where and not benefit from comprehensive interactive features such as recommendations. Ultimately, disparate D2C service offerings will be a less compelling solution for consumers from a price and convenience standpoint. Technology can make up for this somewhat by leveraging the advantages that streaming has over linear TV. It can offer customized experiences, allowing viewers to choose their desired camera angles and replays, watch multiple streams on the same screen and tailor their viewing experience for their viewing environment and device.

Consumers will have the option to rotate

monthly subscriptions, do without, or find ways to access content for free (e.g. piracy or account sharing). These issues place content and streaming services in a difficult position: content development and licensing is expensive and prices need to support these costs. Also, as Netflix has shown, building a strong connection with the subscriber, and collecting the associated analytics has tremendous value. The value of this data is driving the D2C trend – services will be loath to allow aggregators to control customer data and access.

The easiest and cheapest lever is QoE. In 2018, Netflix’s R&D spending was 10% of its content expenditures. Furthermore, Netflix’s technology not only helps deliver better experiences, but also saves bandwidth, saving money and allowing the service to reach customers who otherwise might not have connections suitable for watching video. This, ultimately, can open up new markets, new customers and new business models. □

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# Will Media's Quest for Scale Ultimately Lead to Extinction?

By: Virginia Juliano

The flurry of media mergers and consolidations over the last 2 years has reinforced the concept that scale is necessary to effectively compete in this new, disrupted entertainment landscape. But while watching *The Day the Dinosaurs Died* (ironically, on Netflix) I had a bit of a revelation that media's rush to get bigger in order to survive may be misguided and even downright dangerous to the future of these behemoths.

*The Day the Dinosaurs Died* describes the fascinating chain of events that occurred after a mega-asteroid hit the earth off the coast of what is now the Yucatan peninsula some 66 million years ago. According to scientists, dinosaurs were the largest "apex predators" of the time. But because of this they were actually the hardest hit by the resulting impact. More on that later.

## Today's Apex Predators

The equivalent apex predators in today's world of media are the horizontally and/or vertically integrated corporations that have been bulking up in order to compete in the streaming wars, as well as the large tech companies that have muscled their way into the space. The sharp-elbowed game of content creation, licensing and distribution (and of course, advertising) between the many players is getting even sharper. In this world, bigger means having more power and leverage to negotiate across multiple fronts and the ability to better defray costs across a large footprint.

AT&T swallowing DirecTV and later Time Warner; Disney gobbling up Fox's assets; Discovery buying Scripps; Facebook, Google and Amazon being so inherently huge for so long; and even Netflix endlessly growing its debt to capture ever more subscribers and high-profile content are just a few examples of the "bigger is better" approach that's been the accepted path to greatness. And let's not forget Viacom reuniting with its CBS brethren, yet continuing to get penalized by the markets for still being too small.

However, size and scale can become a negative, as was ultimately the case in the dinosaur era. It turns out that the majority of dinosaurs did not die directly from the asteroid's impact. Instead, the force of the crash (it was traveling at an estimated forty-five thousand miles per hour) spewed millions of tons of displaced rock, dust and debris miles into the air, producing a thick dust cloud that

rapidly spread across the planet. The cloud blanketed the atmosphere and blocked out all sunshine, which turned the earth cold, halted photosynthesis and destroyed the food supply, leading to a complete collapse of the food chain and mass starvation. The largest beasts who required the greatest amounts of sustenance in order to survive were the hardest hit, and quickly died out.

## Shifting Winds

In our modern media saga, the winds have again been shifting and the apex predators of today may also be the most vulnerable. Activist investors calling for divestiture and new management (in the case of AT&T); increased governmental anti-trust and privacy scrutiny (Facebook, Google); overpayment for lackluster assets (AT&T, Disney); messy cultural fit (AT&T/Time Warner, Viacom/CBS); and investor hyper-sensitivity to small shifts in subscriber numbers and constant skittishness regarding debt load (Netflix) are just some of the hazards that have recently surfaced in the race to scale.

Not to mention that the top-heaviness and bloated infrastructure usually needed to support such large companies generally creates entities that are slow to respond or pivot, which is an increasingly important ability in today's ever-evolving media reality. It also makes them reluctant to take chances on lower-margin areas that don't serve their big balance sheet requirements, even if they do serve an emerging customer need – a classic *Innovator's Dilemma* situation.

Plus, these companies have existed in a bull market for the past decade. The specter of a recession dust cloud could certainly block out the media giants' sunshine and make them more vulnerable than their smaller, more nimble counterparts. When cost-conscious consumers start flexing more control over their entertainment mix, bundle backlash and non-stop subscriber churn could easily dry up the high volume of capital lifeblood needed to sustain their bulk and fuel their required growth.

## Only the Agile Survive

But it's not all doom and



Virginia Juliano is the Founder & CEO of CobbleCord ([www.CobbleCord.com](http://www.CobbleCord.com)), a disruptive startup that helps people cobble together personalized bundles of both free and paid streaming services.

Its patented process uses customer content, device, internet and price preferences to craft a custom list of services for each user, empowering them to get the most from streaming and get rid of cable.

gloom. Let's remember that in prehistoric times, the dinosaurs' extinction heralded some positive developments as well. With those large reptilian predators out of the way, mammals (who were much smaller and required much less food) began to flourish. This, of course, led to our caveman ancestors and the proliferation of the human race.

Similarly, the leaner, more agile players could be better positioned to make the ongoing quick moves needed in today's increasingly complex media terrain – provided they've been built around smart business models and sound financials.

So perhaps ViacomCBS is exactly the size that it should be right now. Maybe it should stand firm and stoutly ignore the constant drumbeat demanding that it get bigger. It's a choice that just might help it avoid becoming too big to sustain itself during the next inevitable famine. □





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# OTT Technology Trends with ATEME

Interview by Kurt Michel with Remi Beaudouin, Chief Strategy Officer, ATEME

*Trender Research's Kurt Michel recently caught up with Remi Beaudouin, Chief Strategy Officer at ATEME to talk about Quality of Experience, core technologies leading the OTT market as well as cloud architecture.*

**Kurt:** Hello Remi. Thank you for taking the time today to share some of your insights with our readership. Could you please share a bit of ATEME's background and its role in the video industry with us?

**Remi:** Hi Kurt, first thank you for giving me the opportunity to let OTT Exec readers learn a bit more about ATEME.

ATEME is a global leader of video compression and delivery solutions. Leveraging a task force of close to 300 people over 20 countries, we serve the leading Content Owners, Broadcasters, Stations, MVPDs (be they traditional or virtual) and OTT pure players. The video industry is a mature market, with its first satellite launch over 30 years ago. Mature does not mean stalled. Actually, quite the opposite. We are facing and experiencing a moving landscape, a management of change with regards to video services and operations. And this is where ATEME comes into play. Based on our tens of thousands of man-years in video coding expertise – the company was founded in 1991 – we help to our customers transform their video delivery as part of their change management process. This can be achieved through various angles:

Some customers' 3rd party Content Deliver Networks deploy our solution to lower the total cost of ownership of video transmission. Based on video expertise, we can achieve high video quality at lower bitrates than other solutions.

As a result, our customers can enjoy scale economies by streaming/transmitting more channels over the same given pipe.

Others standardize on our solution because of the convergence aspect, leading to lower OPEX: we have a unique virtualized software suite to do any input/codec/resolution/package-ing.

Last, but not least, most of our customers – or shall we say partners - leverage our innovation. Engineers comprise three-quarters of our staff. We are involved in all relevant standards activities as well as many research projects.

As a result, we can provide our customers with state-of-the-art video technologies like HEVC/AV1, 4K and all flavors of HDR. This, in turn, provides tremendous differentiation for our customers and reduces their customer's churn.

**Kurt:** What is one of the fundamental changes that you see that OTT technology has enabled in the media and entertainment industry over the last year or two?

**Remi:** One obvious change we have witnessed in the OTT market is the request for improved Quality of Experience. I am not only talking about picture quality, but also latency (obviously), immersive audio, and new ways of watching-like Augmented Reality. These changes are definitely coupled with the mainstream viewership position taken by OTT 4 years ago, when nobody was complaining about long delay on OTT or a me-too approach vs Broadcast. But at that time, the audience ratings were not very high.

Now that OTT is becoming of one the main ways (if not *the* main way for the Z generations) to watch content, the expectation bar has been raised.

If we look forward, another emerging fundamental change is the need for personalized TV, also known as "a la carte". This is almost already the case for the SVOD services based on recommendations and preferences. We see this trend coming for linear services with the emergence of pop-up channels. These channels are not permanent channels, but rather time-limited. Their editorial line is based on outside popular events/trends. For example, if



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there is a royal wedding in the UK, programmers create a channel about Kings & Queens. This channel might last for one month around the event and then disappear. This approach allows vMVPDs to stay closer to the news and social media trends and so engage more with their customers.

**Kurt:** What are some of core technologies that are leading OTT market evolution today, and what role is ATEME playing in enabling the use of those technologies?

**Remi:** There is the classic evolution of the video payload standards: new codecs (like AV1), new resolution (4K), and new packaging formats (CMAF), especially when they enable better services (low latency). This change is happening across the TV Industry.

More noticeable is the adoption of multi-cloud approach. In order to gain flexibility, scalability and cost effectiveness, all ATEME service provider customers have deployed a multi-cloud strategy. Some of them are mixing their on-premise private cloud with off premise clouds, while others mix and use several public clouds. Our value proposition is at the software layer, not in the infrastructure. Our role is to make sure we provide them with an efficient solution that is infrastructure-agnostic so they can leverage the flexibility provided by the multiplicity of the choices.

**Kurt:** Can you comment on the state of AV1 codec adoption in the industry? Is it gaining greater usage? And if so, are there any particular areas of the market that are leading the way?





**Remi:** AV1 is definitely gaining traction year after year, trade show after trade show. As usual, the ramp up takes some time; the ecosystem, especially the decoding devices, need to come to the market. We are getting there. At IBC, we demonstrated an end-to-end AV1 processing chain based on our TITAN solution for encoding and decoding, using Broadcom's BCM72180 AV1 set-top box, in preparation for a new era for OTT services.

Pure OTT players, sometimes called New Media - like Netflix or YouTube - have stated their intentions to support AV1. This obviously is a source of adoption. Traditional service providers now follow the same path.

**Kurt:** You have mentioned hybrid-cloud and multi-cloud architectures as some of the more exciting technical developments available to today's service providers. Can you explain some of the benefits of these architectures, and some of the unique challenges that these architectures present?

**Remi:** Multi-cloud (and I would add hybrid

cloud as well) provides stunning advantages on flexibility, scalability and price. We mentioned time-limited pop-up channels earlier. Only cloud-based headends with all underlying technologies (virtualization, full IP) can enable set up quickly enough so the channel can be monetized over a viable duration. The same goes with VOD workflows: the number of shows vary based on time-of-year. There is a pronounced peak during episodic TV season finals. Having the ability to produce the regular flow on site and then off-load it to the cloud during peaks is key. Last, but not least, providers can lower their operational expenditures with CPU spot instances - not on a single cloud, but on a multiple cloud approach: prices are always better with competition!

**Kurt:** Over the next 3-5 years, what challenges face the OTT industry that ATEME is focused on addressing?

**Remi:** When we look forward, we clearly see network optimization and analytics as the next big things. Booming demand will lead to more

and more OTT services - this is a no-brainer.

We are brainstorming how we can bring more video processing intelligence inside the network so we can optimize the routing and delivery of OTT services. On top of that, there is a clear opportunity to better monetize the content through an improved delivery system that is also customizable. We also discussed personalized TV. What if we could create Kurt's channel bouquet, just for you? You could enjoy your favorite niche content and OTT players could generate additional revenue with targeted advertisements.

**Kurt:** Thanks Remi. I'm especially enthusiastic about "Kurt's Channel". We are seeing a bit of progress there now, so maybe we are exiting the hype cycle and shifting to practical personalization. With the onslaught of content now hitting us, it is becoming increasingly required to combat search fatigue.

Thanks for your time, and I look forward to your future innovations! □



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# Pay-TV Services Decline as OTT Services Continue their Rise

By: Elizabeth Parks

Television industry participants are grappling with the new realities of the US pay-TV industry. Traditional pay-TV providers (MVPDs) have faced continued subscriber losses due to increasing consumer choice from OTT services. Research from Parks Associates finds that the average standalone pay-TV service ARPU (average revenue per user) declined 10% from 2016 to 2018, and consumer-reported monthly spending on pay TV declined from \$84 to \$76.

Self-reported expenditures on non-pay-TV home video entertainment also declined 30% per month over the past seven years, peaking at nearly \$40 in 2014 to slightly over \$20 at the end of 2018, according to the study.

Spending on internet video is the only category to hold steady throughout the time frame, staying at \$8-9 per month since 2014, showing the power of streaming and downloaded content from the internet. Subscription online video is the only growth category for consumer-paid video entertainment beyond pay TV.

Operators, struggling with declining ARPU for standalone pay-TV services, are anxious to leverage this trend. They are taking differing approaches. Some, including Comcast and DISH, are offering subscriptions to third-party OTT video services and are integrating them into their discovery interfaces. Partnering gives operators a chance to serve as content aggregator, a familiar position. Others, including AT&T and DISH, are expanding their competitive reach online and have introduced vMVPD (virtual, i.e. OTT) services.

There is an urgency to change the pattern

of subscriber losses. Consolidation has created large, innovative, integrated companies that impact creation, licensing, and distribution of live channels and content assets. vMVPDs, or pay-TV service providers that offer online versions of traditional cable TV, continue to gain subscribers at a rapid pace.

Subscriptions to vMVPD services have doubled over the last 18 months, making it one of the fastest growing sectors in the TV marketplace. Monthly fees are lower for online pay-TV subscriptions than for traditional pay TV, but providers find lower ARPU preferable to cord-cutting subscriber losses. New online competitors, or virtual MVPDs, have also created a new segment of competition within pay TV with packages of content and features that differ, in some cases significantly, from traditional service offerings.

These trends have a significant impact on broadcasters and cable networks. While the US market includes more licensing customers (pay-TV providers), the pricing pressure for consumer services is forcing increased conflict in carriage negotiations. Such conflicts fuel the interest in continued vertical and horizontal consolidation in order to achieve greater scale, leverage, and control.

New research from Parks Associates finds that the conversion rate from a free trial to a paying subscriber is higher among consumers who trial multiple services. Among users trialing three or more services, almost 80% subscribe to at least one of the services that they tested.

Some OTT providers have expressed concerns that consumers might be churning



*Elizabeth Parks, President of Parks Associates, leads all teams within Parks Associates. She oversees all research and directs the integrated strategic communications plan for Parks Associates; including advertising, public relations, and marketing campaigns. Elizabeth is the key organizer for all of Parks Associates' events, including CONNECTIONS™; and she supports Parks Associates' Business Development Team with prospective client searches, overall support, and maintenance of Parks Associates' databases. Elizabeth joined Parks Associates on a full-time basis in 1998 after graduating from the University of Texas at Austin with a BA in psychology.*

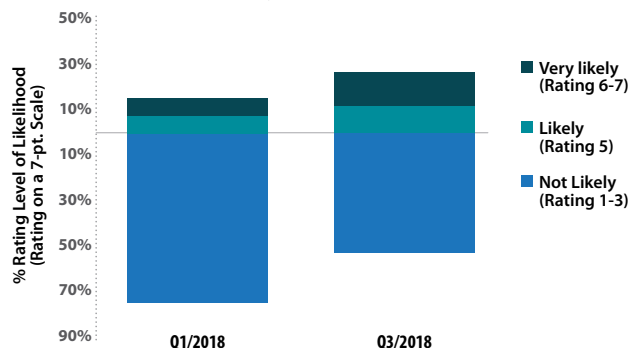
through trials to avoid paying. While some trial abuse likely occurs, the high rate of conversion suggests that most users are actively evaluating for genuine adoption. 58% of US broadband households who trial an OTT video subscription service convert to paying subscribers.

Free trials are an established and effective part of the OTT landscape, but as they become a commoditized offering in an increasingly crowded market, services will experiment with the model to make their service stand out. For example, Sling TV recently began allowing non-subscribers unauthenticated access to limited content, essentially a pre-trial opportunity that encourages viewers to begin an actual trial.

Subscriptions, formerly representing just over half of total online video spending in

**Likelihood to Subscribe to an Online Pay-TV Service (2018)**

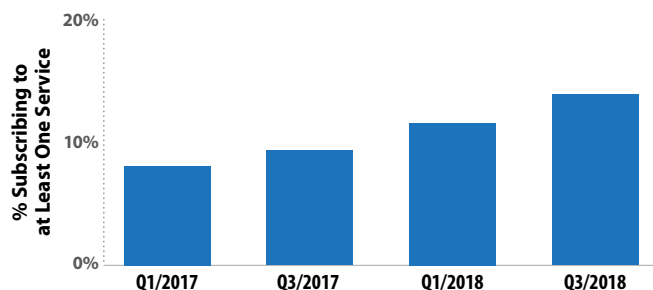
Among US Broadband Households Not Subscribing to Online Pay TV in Specified Groups



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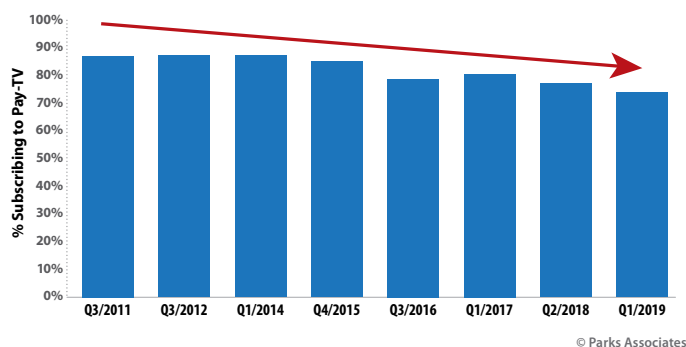
**Overall vMVPD Service Adoption (2017-2018)**

Among US Broadband Households

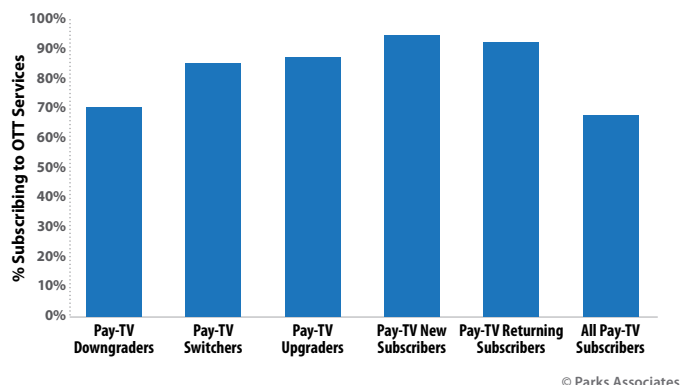


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**Pay-TV Service Subscriptions (2011-2019)**  
Among US Broadband Households



**Uptake of OTT Services by Pay-TV Subscription Groups**  
Among US Pay-TV Service Subscribers



2012, now account for nearly 86% of all internet spending on TV and movies. The new services launching over the next several months are taking different approaches as they enter a crowded OTT market. While the US market is important for Disney, the company will ultimately measure the success of its Disney+ service on a global scale. AT&T likely sees its AT&T TV offering as the evolution of its core pay-TV business rather than as an extension of its vMVPD efforts. Frndly TV

is a niche play, targeting a specific group of consumers with a low price and family-friendly content.

These and other new services due for release, including Apple TV+, will drive consumers to increase spending on internet video and maximize the proportion of spending on subscriptions. The increasing number of new services will also test consumers' tolerance for adding new accounts to their monthly expenditures.

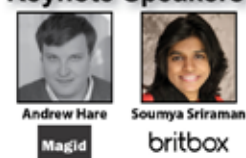
These factors will lead to a spike in the amount of money consumers spend per month, at least in the short term, as new services such as Disney+ and Apple TV+ become available. Tradeoff decisions will come later. To keep consumers spending at this higher level, services will have to consistently deliver volumes of compelling content within an engaging user experience. □

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# Creating Roku Channels: A Few Experience-Based Tips

By: Alejandro Corpeño

Video streaming platforms are now part of the daily video consumption patterns of millions of people in the US and globally. Content providers and networks are aware of this and are racing to bring their offerings to OTT.

Amongst the OTT platforms available today, Roku is one of the top players. They are quickly gaining market share and making their way into households through a wide range of products, from low price sticks to high-end set-top boxes.

With a couple of years' experience developing Roku apps at Iconic, we have some recommendations to share with those planning to adopt this platform.

The first decision is to choose between using Roku's Channel Template or creating a Custom Channel. For brands that want more control of the user experience, design, and other elements of their channel, the Custom Channel is the way to go.

Roku is a mature OTT Application Platform. Roku Channels are Apps, developed on Roku's XML framework called *Scenegraph*. Roku also offers their native library called *Component Controller*, which introduces clear standards to maintain the performance of the channels in their platform, regardless of the target hardware.

All Roku channels should run smoothly on both low and high-end devices, making the development cycle a challenging and iterative process. This process not only includes

software development, but also on-device testing, careful memory management, as well as adaptable UX/UI patterns that adjust to the particular limitations (or extra features) of the hardware your channel will run on.

Roku's Developer portal (<https://developer.roku.com>) clearly states the certification criteria and must-haves that channels should comply with to be certified and published for general availability on the platform. Aside from these specifications, below are some tips that will eventually save you a significant amount of time, money, and frustration:

## 1. Define your monetization model

When setting up your channel, an essential requirement is to specify and choose a monetization model. Don't leave this decision until the end since it will have implications in the development tasks and features that your application should have. The two most common monetization options are:

### • AVOD: Advertising - or Ad-based - Video On Demand

*Roku Advertising Framework (RAF)* implementation is required if you are planning to follow this model. By using RAF, you will be able to measure the traffic and behavior of users while ads are playing. Take into consideration that even though the RAF certification is relatively simple, it is separate from the standard certification process, so make sure you plan enough time for both processes



Alejandro Corpeño, Chief Executive Officer of Iconic is a Fulbright Fellow. He has an MBA in Entrepreneurship & Innovation from Vanderbilt University. His 20+ years of experience on Web + Mobile apps, Scalable Backend Platforms, TV-apps (OTT), AR/VR, design and development give him exceptional industry knowledge.

to take place before your launch date.

### • SVOD: Subscription Video on Demand

For this model, you will need Roku Pay. According to its website, "*Roku Pay is the fast, and simple way to pay on your Roku streaming device.*" Your subscriber/viewer adds the payment information to their Roku account; then they can easily purchase subscriptions, rent or buy movies or TV shows, and purchase Roku device upgrades, offers, and accessories. With Roku Pay, you will not have to worry about developing the payment processing flow or the security considerations around credit card transactions, Roku Pay takes care of all of that for you.

## 2. Pay attention to data integrations for better visibility and positioning in the Roku platform.

Aside from users installing your channel, Roku offers other discoverability tools such as Search and the Roku Channel. For your content to be visible on these other discoverability tools, you need to pay close attention and implement deep links. This will allow your channel to be discovered by users searching on the Roku Channel.

Another integration option that gives your channel better placement on the Roku platform is the Roku Event Dispatcher (RED). This integration option will allow you to fire events when the app launches and track metrics, such as the number of installs, specific errors per device, and how many times an error occurs. It also allows you to prioritize your app's content positioning on the search results by letting Roku know whether a user is authenticated into your channel. If a user is already authenticated into your channel and your channel is listed as an option for viewing on the search results, your channel will be listed above those where





the user is not yet authenticated.

### 3. Develop and test using the lowest range devices

Roku has some of the most popular OTT devices, mainly because of its low-priced options and built-in Roku TVs (OEMs). This is great for market penetration, and also you as a content provider, for it offers a window to millions of viewers. However; the tradeoff is that you need to pay close attention to how your application performs on those low-end devices, which usually have very limited memory and processing power. We learned this the hard way. On our very first app, we started developing and testing on high-end devices only; but when our QA team started performing thorough testing on the full range of devices they discovered it didn't work correctly on the low-end of the spectrum, creating a backlog of bug fixes and performance improvement tasks that needed to be added to our development queue. As a result, we had to deal with unexpected development roadmap adjustments.

Based on this experience, I recommend you develop and test directly on both the low and the high end of the device spectrum from day one. You can code specific rules that apply to low-end devices, making alternative user interaction and design patterns for devices with less processing power. For example, you can code to avoid animations or transitions on devices where they can't run smoothly.

#### Be part of the community

The Roku team is extremely accessible, and you should take advantage of this. You will probably have an assigned Roku Partner Success contact to handle all of the communication between your team and Roku's engineering, certification, and business teams. Additionally, you can find different communication channels with the community on the Roku Developer portal <https://developer.roku.com>

If you get involved in the community, and your channel starts to perform well, you might be invited to one of Roku's Developer

Summit events. My company, Iconic, had the opportunity to attend one of these events. One of our Roku Development Team members was amazed by the number and quality of insights the Roku engineers shared during their talks and workshops. They talked about integration with Google devices as well as other relevant and deeply technical, detailed topics.

We highly recommend you enlist and participate in the community. You will be able to meet and interact with those you've spoken with through slack or email in their official capacity; but through the community, the interaction will be more personal and casual.

In summary, we have found that Roku's team is truly focused on bringing a top-quality experience to the users, and understand the importance of the developer community in realizing that mission. They genuinely care about their developer community and their channel partner business relationships. Good Luck! □



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# Metadata is the Answer – and the Problem

By: Janet Greco

New dynamic user interfaces and recommendations can be the difference between winning and losing in the OTT space, but managing the backbone of consumer-focused search and recommendation is a big challenge for incumbent broadcasters and content providers. The opportunity for operators will be huge once they get their metadata management practices right.

## Data Driven TV. Sounds great, doesn't it?

While OTT streaming services enjoy interrogating their data lakes with fancy dashboards, accurate audience metrics and extensive analytic capabilities, traditional broadcasters and pay TV platforms are having a tougher time of it. They face competition from the likes of Netflix, Facebook, Fortnite and everything else that vies for the attention of consumers these days.

"The role of data for operators is really very important," says Jacques-Edouard Guillemot, SVP at Nagra, speaking at IBC 2019, who set out the issues succinctly. "They have built their entire infrastructures and business processes around data. Yet when we look at operators, they have legacy systems that for some of them are 30 years old. All departments should

be able to use data in a meaningful way. But the biggest issue for our customers is that their organization is very siloed. How do you break those silos? And how do you make data available for everyone that needs it?"

While it is true that "data-driven" is the mantra of the day, the beating heart of the TV business revolves around proper metadata management in a way that "fixes" the multiple data silos within legacy operators.

## Legacy innovations still in play

If the transition from paper to electronic marked the initial disruptive force in TV metadata delivery practices, the new "AI"-driven techniques for automating metadata extraction are set to be the second wave.

Artificial Intelligence (AI) is the term we often use when we really mean Machine Learning (ML) and a host of other technologies that are still at the early stages of development and deployment. These new technologies are driving a new wave of disruption in content navigation and search, enabling metadata to be automatically extracted. ML enables computer systems to learn based upon ongoing data that is provided. After a while the learning becomes more refined. AI, on the other hand is when a computer appears to learn, think and solve problems on its own. Both generate metadata *but also require* metadata to work. Beyond the AI/ML buzz, new metadata extraction technologies also include computer vision, speech to text, automatic translation, etc, and all are on-course to bring transformative benefits to the TV business.

The need for accurate TV content metadata to drive program discovery has been increasing as the number of channels and services has steadily grown. But audiences' easy access to program information has actually decreased as we have gained more TV viewing options. As with the printed "grid" formats that preceded them, digital Electronic Program Guides (EPGs) introduced in the mid 90s made it a bit harder to access program information, because you had to click into the listing to view the description.

Driving all these guides was the business-to-business exchange of TV metadata consisting of time, title and a program description. The first disruption in TV listings distribution took place in the early 90s with the advent of "electronic delivery" services. These intermediaries, which came to be known as



*Janet Greco is an independent consultant with expertise in enterprise TV metadata management helping TV businesses take a more holistic view of their data operations and helping them*

*solve problems around disparate workflows and data sets. She founded the first disruptive pan-European TV metadata aggregation service, Infomedia S.A. in 1991. Her company: [www.broadcastprojects.com](http://www.broadcastprojects.com)*

TV metadata aggregators, provided a modern conduit for channels to deliver their schedules to the wide number of publications, later websites and EPGs, in an efficient manner.

What broadcasters needed at that time was someone who could sort out their TV schedule (TV metadata) distribution problems so that consumers could discover their programs. This became necessary as TV was deregulated and trans-frontier satellite broadcasting began. At that time the delivery of this information was done mainly by snail mail and fax.

Programming and schedule data began to flow freely from broadcasters to aggregators. In this way, TV metadata aggregators became the necessary cog in the wheel to get linear TV data to publishers of magazines and guides, because of all the multiple formats (paper, faxes, spreadsheets, Word and text documents).

From paper to electronic, there has hardly been any further innovation for almost 30 years. Today, descriptive TV metadata is still acquired in multiple formats, aggregated and normalized. It is then delivered to anyone who needs to populate an EPG guide, including the now/next Service Information feeds (DVB-SI and PSIP in the US) which channel providers were originally meant to generate on their own.

## AI and Machine Learning: New Forces in TV Metadata Extraction

We are now in the midst of a second wave of disruption. A good example of this disruption can be seen at the annual workshop for developers working on metadata and artificial intelligence, hosted by the European Broadcasting Union (EBU), Europe's representative body for public service media. The topic of media information management is part of the EBU's strategic program on production. It aims to help members enhance



**Jean-Fran ois Cr mer, Director, Clients Service & Operations, EMEA at TiVo, working with the incoming TV schedules from European broadcasters at Infomedia S.A. in Luxembourg, c. 1992.**

and enrich their media by integrating their data (descriptive and technical but also subtitles) from commissioning to distribution.

The EBU Metadata Developer Network focuses specifically on how AI is being used to automatically extract metadata from video. It is a diverse community of academic and industry specialists working in AI, and machine learning experts from public and commercial broadcasters as well as start-ups. It provides a showcase for a variety of projects and operates under a highly collaborative atmosphere, sharing expertise and best practices.

AI can solve specific problems, like using facial recognition to speed up editing processes, enabling new forms of creativity in production, or automating the creation of subtitles and translations. Another use case is sentiment analysis, a technology already in deployment that can be very complementary for optimization and personalization of the user experience. Ultimately it means pointing the technology at the entire libraries of video content. But by what mechanism will that data make its way back to the indexed content asset?

“AI will not save the day for those who never managed data properly. Being able to attach AI generated metadata to an asset is key to everything. This is where everything begins and ends. This is particularly true and easier to manage in a semantic data framework including bringing together data from silos”, says Jean-Pierre Evain, Principal Project Manager at the EBU, in charge of the EBU Strategic Programme on Media Information Management and AI.

### Data Lakes and Data Puddles

The quality of descriptive TV program information sits at the heart of a TV business. It is fundamental to the user experience, content discovery and recommendation. It is also central to AI and ML. When you have accurate data, you also stand the best chance of leveraging it. Interpreting that data based on context, categories and more granular characteristics has the best chance of success when it is meaningful and well-managed *in the first place*.

Across the industry, TV metadata sits in fragmented silos in legacy systems with no easy way to de-duplicate the data or fix the disjointed workflows that often result in time-consuming manual interventions. You could call them data puddles instead of data lakes. As many dedicated systems have been used to manage different aspects of the TV operation, the use of multiple “unique IDs” within the same organization came into play as well. These legacy systems are no joke to sort out.

### So what concrete actions can be taken?

First, prioritization. Face facts and commit to getting metadata systems working in



harmony to arrive at a single “meta-truth” across the enterprise. With their messy data puddles across the organization, legacy players won’t be able to keep up. In the scheme of things, SVOD and the new D2C services will be the least of their problems.

Second, be objective. Conduct a thorough review across the enterprise and assess metadata requirements per department. Bringing an objective outsider in to conduct interviews with internal stakeholders is an excellent way to break down barriers to new systems and strategic ways that support long-term business goals.

Third, approach AI technologies with meticulous attention to the devil in the details. One thing that stands out in all the demos I’ve seen is the fact that these systems must be meticulously trained by people! Make sure there’s a clear plan so that any extracted metadata actually ends up back with the content asset, catalogued under one unique and persistent identifier. One excellent use case to consider is archive optimization, using ML, that can identify duplicate assets, assisting humans in cleaning up content libraries and the associated data more quickly.

Fourth, simplify. Use technology that simply gets the job done. Merging disparate sets of metadata can be accomplished with ordinary data analysis and management tools capable of surfacing duplicates and centralizing the multiple “unique IDs” that exist in different silos. Data can then be viewed in one single location in order to make decisions about how to edit, store, and manage this data (including editorial rules) and, where necessary, repopulate the original legacy systems that must be retained.

There is no quick fix for metadata management practices neglected in the past. During those earlier times when content owners and broadcasters began handing over their data to metadata aggregators, we arrived at a situation where aggregators now hold the keys to the kingdom, with their extensive and coherent data sets.

Ironically, today these data sets are licensed back to the companies who in turn need them to drive their guide and recommendation services. But here’s the thing... those companies need data - their *own* data - for their own productions and the content for which they’ve acquired the rights. This same data must seamlessly tie into a host of other operations across the enterprise (ad targeting, CRM, analytics, etc). It would be a mistake to again entrust third parties to sort out metadata issues when in reality the housekeeping must be done internally first.

“With AI comes a lot more metadata that the business needs. The problem is how to store, access and use that extra data to keep the customer happy,” said Willem Andries Nel, Technical Delivery Manager at Multichoice in South Africa. “A single ID would be helpful, but the underlying problem is that legacy systems will not go away overnight. We need a single data store where all the existing data and IDs are linked. This single storage would then contain all the extra AI data that the business knows we need. And then there is the problem of how to use metadata to entice Gen Z customers.”

New technologies will perform best when they have the best foundational data regarding the TV content, so that people can ultimately find it. Automated metadata extraction technologies will certainly be a help, once the foundation is laid, but they are not the total solution. The consumer has an almighty problem of choice, and those choices are not just about TV anymore. If it is too difficult to find content that is relevant and relatable, chances are they can more easily find something else to switch their attention to.

It’s not a question of managing churn, but being able to pre-empt it, so the only way to do that is generate engagement with your content and propose content in an intelligent and effective way. The trick is to find breakout tools that can help get this clean-up job done. Let’s finally clean up those sloppy data puddles and move on. □



# Making Existing Codecs Work Better

## MPEG-5 Part 2 LCEVC and its “game-changing potential” for video delivery

By: Guido Meardi

One of the great issues to confront the broadcast industry over the last few years has been how to improve the efficiency of video delivery without imposing significant extra financial or technical burdens on content creators. With ever-increasing demand for higher resolutions and more immersive content, the debate has increasingly revolved around improving the performance of video compression technologies.

Since 2003 when AVC/H.264 emerged, there has been solid progress in the development of new video codecs that have typically delivered a nearly 50% improvement in efficiency (delivering the same quality at half the bitrate). However, each generation has come at the cost of a substantial increase in computational complexity, on the order of 6x-10x. This rising complexity has two important implications. Firstly, it directly corresponds to the time taken to encode content, and therefore the cost of running the server infrastructure needed. Secondly, for live encoding, where, by definition, encoding must be real-time, operators are often forced to disable the advanced features of codecs, reducing their benefits and compromising the potential bandwidth savings.

The MPEG (Moving Pictures Experts Group) standards organization has not only been investing time in developing next-generation codecs such as VVC, but also in improving existing coding technologies’ performance. This will allow broadcasters

to expand their capabilities without tearing up or duplicating their existing distribution workflows. The result of this performance improvement activity is **MPEG-5 Part 2 Low Complexity Enhancement Video Coding (LCEVC)**.

The standard comprises a codec-agnostic extension to enhance other codecs. Deployable via software upgrade, LCEVC significantly increases compression efficiency for workflows using existing codecs such as AVC/H.264, HEVC, VP9, AV1 and – in the future – EVC and VVC.

According to MPEG, the new standard specifies “a data stream structure defined by two component streams – a base stream decodable by a hardware decoder, and an enhancement stream suitable for software processing implementation with sustainable power consumption. The enhancement stream will provide new features such as compression capability extension to existing codecs, and lower encoding and decoding complexity, for on-demand and live streaming applications.”

One immediate example application of LCEVC is the standard’s ability to achieve H.265/HEVC-like coding efficiency with H.264/AVC. It is possible to realize the desired efficiency while maintaining an overall encode/decode complexity that is lower than that of the existing AVC encoders. Similarly, for operators using HEVC, they will readily be able to achieve coding efficiencies similar to future generations (e.g. VVC) while at the same time



notably reducing processing requirements and costs.

Since LCEVC is independent of the underlying codec, this process is also applicable to future codec generations such as VVC. Moreover, because this standard reduces the underlying codec’s overall complexity, newer and more processing-intensive codecs may potentially be rolled out at an earlier stage.

LCEVC enables the advanced tools of the underlying codec to be employed, reducing the complexity for next-generation codecs like VVC, and resulting in substantial cost reduction and improved usage feasibility in live environments. This lower complexity is highlighted by the charts in figure 1.

The charts in figure 2 show detailed analysis of the efficiency benefits of applying LCEVC enhancement to both AVC/H.264 and HEVC encoding workflows.

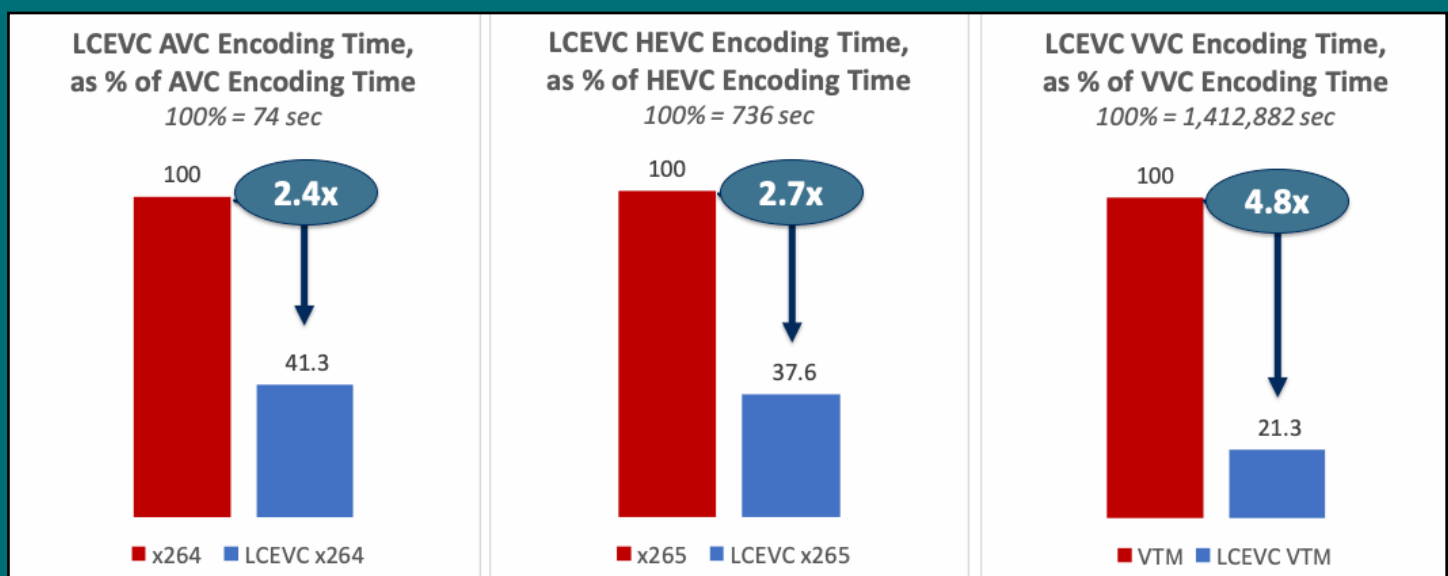


Figure 1

## Reducing cost and complexity

At V-Nova, we recently released the third generation of our video distribution enhancement technologies, P+ (formerly PERSEUS Plus), which incorporates the industry's first optimized implementations for encoding and decoding MPEG-5 Part 2 (LCEVC). Demonstrated at IBC 2019 in Amsterdam, P+ users will be able to achieve the same or better quality at up to 50% lower bitrates than using the enhanced codec natively, and up to 5x lower computational complexity, significantly reducing encoding operating costs.

With P+ and other LCEVC-compliant technologies, content creators and providers now have a pathway to enhance and streamline their video workflows without waiting for standard codec rollouts that could be months or years away. Another strong point is that P+ can be deployed in multiple ways: as a containerized transcoding microservice; as an SDK for x86 (Linux, Windows), ARM (Android, iOS), FPGA and HMTL5 scripted decoding; pre-integrated into a number of open-source options; and directly from V-Nova's Platform in AWS.

It is already apparent from recent trial deployments – a number of them with major-name operators – that LCEVC's ability to deliver higher quality at lower bitrates resonates strongly with both on-demand and live streaming service providers. Simply put, better quality results in reduced churn and longer viewing times, improving monetization potential. Acceptable quality at lower bitrates improves a provider's reach across bandwidth-limited, lower quality or congested networks.

As TV sizes grow and internet bandwidth improves, viewer expectations rise accordingly - to the extent that even minuscule amounts of latency or a quality reduction can cause viewer switch-off, never mind the appearance of the dreaded wheel of buffering. Consumers don't care about the complexities of 4K and HDR; they will simply demand the quality they have come to expect from HD. LCEVC offers broadcasters a way to meet these expectations without presenting huge financial or technological hurdles to their existing operations.

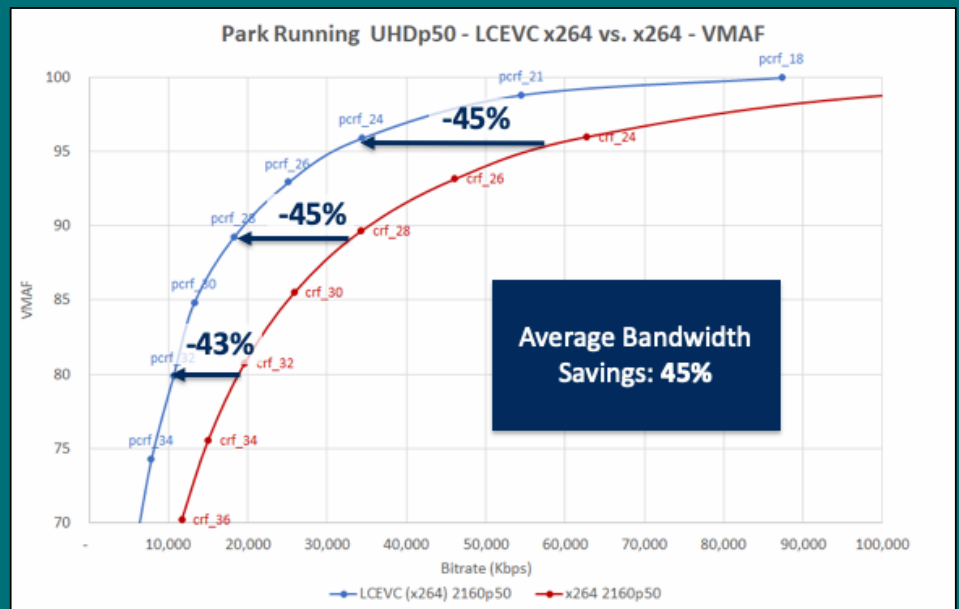


Figure 2: Bitrate savings for equivalent quality when using AVC/H.264 enhanced with LCEVC.

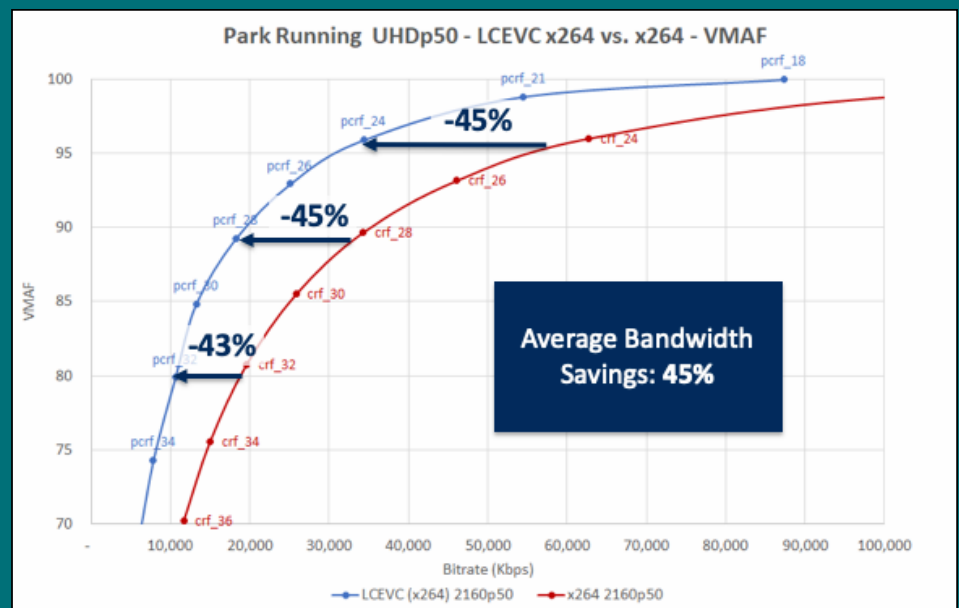


Figure 3: Bitrate savings for equivalent quality when using HEVC enhanced with LCEVC.

If you are thinking about enhancing, cost-reducing, and/or future-proofing your video distribution in these unpredictable times,

LCEVC should be high on your list of technologies to investigate. □

OVER THE TOP

# VIDEO Magazine

Executive

For more information on submitting an article or advertising in OTT Executive Magazine:

Nichole Janowsky, Editor:  
[njanowsky@ottexec.com](mailto:njanowsky@ottexec.com)

# The Evolution of Verimatrix

Interview by Kurt Michel with Steve Oetegenn, President & Chief Operating Officer at Verimatrix

**Steve Oetegenn, President and Chief Operating Officer at Verimatrix shared his knowledge and experience regarding security and protection within the OTT marketplace with Trender Research's Kurt Michel.**

**Kurt:** Hello Steve, I appreciate having the opportunity to speak with you today. It has clearly been a very busy year for you, with many changes beginning late last year with your announcement that you were being acquired by Inside Secure. Walk us through the highlights since the merger?

**Steve:** Since the initial announcement, we have fully merged the two companies and have completed the operational integration – all within four months.

You'll see that we also re-branded the company to better reflect our broader company vision of enabling and securing the connected future. After thoughtful consideration and some market validation, we decided to keep the Verimatrix name while retaining the look and feel from the Inside Secure logo and its tagline, "Driving trust." In fact, the dashes and dots in our logo spell out TRUST in Morse code.

We feel this best captures the synergies between the organizations. While both companies bring a focus in security and

analytics, our expanded areas of expertise and target audiences are quite complementary. The Inside Secure assets enable Verimatrix to offer new solutions to our existing customers and reinforce our security heritage in additional markets at an accelerated pace. And Verimatrix brings new dimensions of business value to Inside Secure's product portfolio in end markets that are fast shifting towards software and cloud-based security and analytics solutions.

Together, we enable success through trusted business insights and friendly security.

**Kurt:** Tell me a bit about the new Verimatrix. A year ago, you were recognized across the industry as a leading Conditional Access/DRM provider. What new areas are you focused on, and how has your incumbent customer base received the "new" Verimatrix?

**Steve:** Yes, by design Verimatrix was vertically focused on the media and entertainment market. Now, with the combined technology and talent, we are able to offer enhanced solutions across multiple markets to help customers address new security challenge and business needs. This has shifted our strategy to a more horizontal approach to the market, where we can



Steve Oetegenn became President and Chief Operating Officer at Verimatrix in 2019 once the merger with Inside Secure was completed. He brings a wide range of experience in international business, having launched numerous high tech products to the global marketplace. Steve has specialized in Digital Security and Anti-Piracy since 1998, working with Government agencies, Global Banks, Fortune 500 companies and Major Hollywood studios. Prior to joining Verimatrix, he was COO of MediaSec Technologies LLC as well as COO of Argus Systems Group.

apply our digital security and analytics technology and expertise to a broader set of industries.

We have over 1,200 customers in 113 countries and protect more than 2 billion devices – and counting. While our security is not visible to end users, in the past week, you've probably used at least one of our security solutions on your device or from a service, and you didn't even realize it. For example, if you accessed Visa payments on your mobile phone, or streamed from a leading on-line video service, you used our security. Our innovative technology is continually relied upon by users of the world's most common online services and connected devices.

In addition, with continued high-profile security breaches, it becomes more important to not only secure and anonymize personally identifiable information, but also use analytics that can help optimize a company's services – in a secure fashion.

To that end, we are continually releasing new features and also improving the accuracy and efficiency within our Analytics solutions. In the past year, we mainly focused on further improving the data granularity, accuracy and efficiency of our product. For example, with the latest version, we can provide our customers with insights on session quality and growth rates, capacity utilization and root cause analysis, to name few.

**Kurt:** I know it is still early in the merger, but can you tell us a bit about how that is going?





**Steve:** We are very pleased to find that our existing customers have been positive about the merger, as we can offer them more comprehensive solutions across their enterprises and have additional expertise to keep leading the pace of innovation.

Because we have earned the trust of our customers, they really view us as a reliable business partner. They are looking to us to help them gain and maintain market leadership as the transition to OTT video continues.

We feel now is really an opportune time for service providers to question whether they should build yet another on-prem system, with its CAPEX and OPEX consequences, or perhaps choose a virtualized cloud instance.

We are seeing a number of our customers shifting to cloud-based security systems while outsourcing the expertise and maintenance to us. This enables them to focus on service differentiation and customer care, which is their core competency.

**Kurt:** Can you speak a bit about the capabilities and benefits the new Verimatrix brings to the pay-tv market and the media and entertainment industry overall?

**Steve:** We are really excited to bring new and more comprehensive solutions to this industry, where video service operators and content providers can benefit from multiple offerings. For instance, the former Inside Secure's end-device security technology has been integrated with our server-side Multi-DRM offering, which expands the protection profile for OTT video delivery.

We also demonstrated frictionless TV Everywhere Authentication at IBC, which features our Strong Authentication and TV Authentication (nTitleMe) solutions. Together, these solutions provide an additional layer of security, while making it easy for subscribers to access third-party applications from a managed or operator application.

We've also received positive industry response to our ProtectMyApp Code Protection service, as service providers understand the need to secure their mobile apps just as much as the content itself. For video apps in particular, it is common for attackers to "repackage" an app to remove advertisements. The motivation is not financial in this case, as it aims to allow users to watch videos without being interrupted. For app publishers, when the advertisements go, so does their revenue stream.

ProtectMyApp is a "send it and secure



it" subscription service that secures application code within minutes through a simple web interface. Verimatrix is the first in the industry to offer cost-effective, yet time-tested mobile app security to any developer.

Without a doubt, it is more difficult to make security easy to use than to make security more secure.

**Kurt:** I noticed on your web site that you are now focused on a number of markets beyond digital content – like IoT and automotive. It makes me think about the opportunities and threats in a world of autonomous vehicles and internet everywhere. Can you talk a bit about the future – looking 3-5 years out?

**Steve:** With our horizontal approach, we are really about securing and analyzing data in any form across multiple industries including automotive, financial services, internet of things, mobile app security, telecom and of course media and entertainment. The biggest change over this time period is how we deliver our solutions and create value for our customers.

As more services and transactions occur "in the cloud," the more they will need higher levels of security to stay ahead of hackers. Offering comprehensive security as a service is not only more cost-effective, but also more responsive to security threats. Cloud-based security can outperform traditional security approaches in critical ways:

1. Threats are identified and systems are updated more quickly because of better real-time monitoring and forecasting,

2. Set-up costs are low, and development is done on the latest version without any upgrade hassles,

3. Likewise, the subscription approach is cost-effective and flexible: pay-for-success security services make it easier for providers to experiment with new offerings.

Take automotive. Autonomous vehicles will actually become autonomous, which requires a much higher emphasis on security. Imagine if someone could remotely take control of your car while it is in motion. We are able to ensure that all types of applications are protected, and all services are secure. Furthermore, through the use of analytics and predictive monitoring, we are able to identify patterns that enable us to intercept potential breaches as they unfold.

**Kurt:** Steve, it looks like Verimatrix has really broadened its view, evolving in a way that makes a lot of sense. I'm looking forward to a bright future where companies like yours continue protecting us from the dark actors in our connected world. Thanks for sharing with us. □

# Beyond TV: The Promise of Delay-Free Live Video

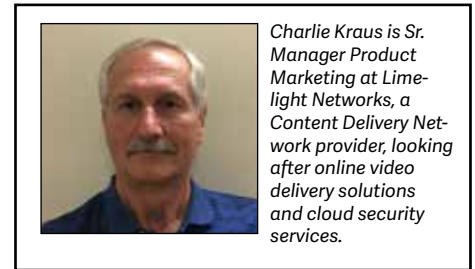
By: Charlie Kraus

Numerous video trends, reports, and internet traffic growth forecasts all point in the same clear direction – increasing online video traffic and viewing times. According to Cisco’s Visual Networking Index, live video accounts for 5 percent of internet video traffic, and is forecasted to grow to 17 percent by 2022.

What will be the key drivers in the increase in live streaming? Limelight Network’s State of Online Video 2019 report revealed a couple of key insights into viewer behavior that hint at the way live streaming will evolve over the next few years. The most popular live content today is news, sports and eSports events, with 58 percent of people globally saying they would stream more sports online if it was not delayed from the broadcast. And for the first time, smartphones surpassed computers as the primary device used for online viewing globally. This mobile-first shift will have broad implications for OTT delivery, allowing new business and monetization models that are not possible with traditional broadcast video.

Coinciding with smartphones now being the primary online video viewing device, several new live streaming delivery technologies are becoming available that can lower online streaming latency, offering a range of reduced latencies well below the typical 45 to 60+ seconds of current HLS and DASH stream delivery. Latency refers to the delay between when a camera captures an

event, and the presentation of that event on the viewer’s screen. To meet the immediate live streaming online sports requirement, traditional broadcast’s 5 to 8 seconds is a guide. Both of today’s pervasive HLS and DASH chunked HTTP streaming formats can be configured to use small size data chunks that result in delivery latency of around 6 seconds. This would enable viewers to engage in event commentary with friends watching online streams or traditional broadcasts, and display live game statistics for both audiences, supporting a more interactive social experience. Taking this concept further, OTT services could expand the capabilities of their platforms to support viewer community creation (e.g. a friend group) and “group viewing” of live sports events, concerts, or movies together, along with real time group communication. Beyond tweaking HLS and DASH streaming formats, two other technologies that can deliver low latency streams are: low latency mode CMAF (Common Media Application Format) and WebRTC (Web Real Time Communication). Both are in the early proof-of-concept testing and deployment. CMAF’s goal is OTT video delivery simplification, and it offers options to bring latency as low as 2 seconds. CMAF has a very good chance of becoming a popular choice for large scale online video delivery because it is delivered as HLS and DASH formats, leveraging the current robust and massive global CDN capacity to



*Charlie Kraus is Sr. Manager Product Marketing at Limelight Networks, a Content Delivery Network provider, looking after online video delivery solutions and cloud security services.*

deliver this traffic.

WebRTC can reduce latency even further, to sub-seconds. With the ultra-low latency provided by these technologies, new business models are enabled. The very low latency presents an opportunity to offer live event viewers the capability to select multiple camera angles on screen. Some early WebRTC proof-of-concept tests involve live online auctions. Today, it is common for live auctions to include remote bidders via telephone conference along with the live attendees, but the remotes lack a real-time video feed. The sub-second latency of WebRTC enables remote participants to watch the auction via a live video stream, leveling the playing field for remote participants. So far the results are encouraging, both for the fast realtime latency, and video quality.

A related – and lucrative – application, from a technology standpoint, is online gambling. Unlike live auctions, there are no actual players at the gambling tables. The tables are usually staged in large warehouses with a live dealer and attendants, with web cameras streaming live video from the tables. Remote players participate via an app displaying the table action and facilitates making bets. Again, WebRTC provides the sub-second latency streams that make this possible. Casinos are enthusiastic about the opportunity to expand to an instantaneous worldwide player base. Beyond the video complexities, online gambling presents a “perfect storm” of challenges: huge sums of money, personal data, and more cash transactions per minute than some of the world’s largest banks. To address this, a suite of cyber-security measures needs to be in place, such as encryption of all communications, tight access control of online players, and especially, robust Web Application Firewall (WAF) protection of all web transaction applications.

Along with mobile-first video consumption come the expectations for true mobile-first experiences. Consider that half of all searches



on Google are done on mobile devices. For us, this means every aspect of live video interactive application design must consider the user; screen design optimized for the smaller real estate and easy navigation that does not require pinching and expanding to read and interact. If your service is ad-supported, careful consideration to where ads are placed in relation to the video content is critically important for viewer engagement maximization. The State of Online Video report also revealed that global audiences generally accept online video advertising when ads are presented before the video, the content is free, or if the ads can be skipped.

#### Summary

It is now crucial for live streams to be playable on any device, and iOnline video is viewed on a broad range of internet connected devices all over the world, and mobile connections are often subject to changes in bandwidth and latency that can cause video to stall and rebuffer when network conditions change during playback. Technologies available from Content Delivery Networks (CDNs) providers can address these challenges. CDNs can simplify live stream distribution by automatically packaging video in the correct



Online auction.

format for each of the many viewing devices. They can also accept a single high-quality stream which can be transcoded to the multiple bitrates required for Adaptive bitrate (ABR) delivery. This ensures the streams can be easily and efficiently delivered at the highest quality to as many viewers as possible. And of course,

latency must be reduced to enable newer applications like real-time online gaming and auctions to flourish. With these technologies, online video will evolve far beyond the TV application. □

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*Enhance your Brand, Grow your Pipeline, Build your Business*



# Data is Crucial in Today's Evolving New-Media Environment

By: Jim O'Neill

It's going to be a busy year.

In the U.S., there are nearly a dozen major services expected to launch starting with AppleTV+ Nov. 1, Disney+ later in the month, AT&T's multiple HBO and Warner Media iterations, NBCUniversal's Peacock AVOD service and the billion-dollar baby founded by Jeffrey Katzenberg and helmed by Meg Whitman, Quibi. And that number, of course, doesn't consider the broadcasters and content owners and creators looking to go direct-to-consumer (D2C), nor the offerings from smaller niche players who see their own bright futures in D2C.

Netflix just announced its Q3 earnings, adding 6.77 million customers (about 600,000 in the U.S.), with Amazon and Hulu both saying they're adding subscribers as well. Competition for eyeballs is growing fiercer.

Who's watching all of this content? And who'll be watching in the future? What devices? What kind of content? How do you position your service to win?

These are questions that will be critical to OTT services as they enter — or continue their navigation through — the evolving media landscape. There's so much data available.

In Brightcove's most recent Quarterly Global Video Index, published in late September, we took a deep dive into hundreds

of millions of data points from our media customers in Q2 to sharpen the focus on a snapshot of the industry, specifically on how content is consumed.

We looked at 1) how content is consumed on mobile devices, 2) the trends in how time watched for content of different lengths on all devices (smartphones, computers, tablets and connected TVs) were developing, and 3) how the battle between iOS and Android is shaking out.

## Time watched on devices

The global content-delivery environment has adjusted to consumer adoption of streaming video. It's common, today, to find live sports, freshly minted movies, episodic TV, live events and news streaming over-the-top to any device, anywhere.

And, consumers have adopted a form of "screen democracy," where the screen nearest at hand is the one they'll watch on, regardless of the content length.

For instance, ultra-long-form video (ULF) — content that's 41 minutes or longer (think movies, documentaries, events, and live sports) made up the lion's share of time watched on every device, often by a significant margin. Seventy percent of time watched on connected and smart TVs was ULF video.

But nearly two-thirds (66%) of time



Jim O'Neill is principal analyst at Brightcove and editor of Videomind, an industry blog. He has worked in the online video industry for more than a decade and, prior to Brightcove, was principal analyst at Ooyala, an analyst with Parks Associates and editor of FierceOnlineVideo and FierceIPTV. He's based in Boone, North Carolina.

watched on tablets also was ULF video, as was 52% of time watched on smartphones and 42% of time watched on desktop computers. Those shares were essentially flat from the numbers a year ago, indicating the full adoption of the viewing tendencies.

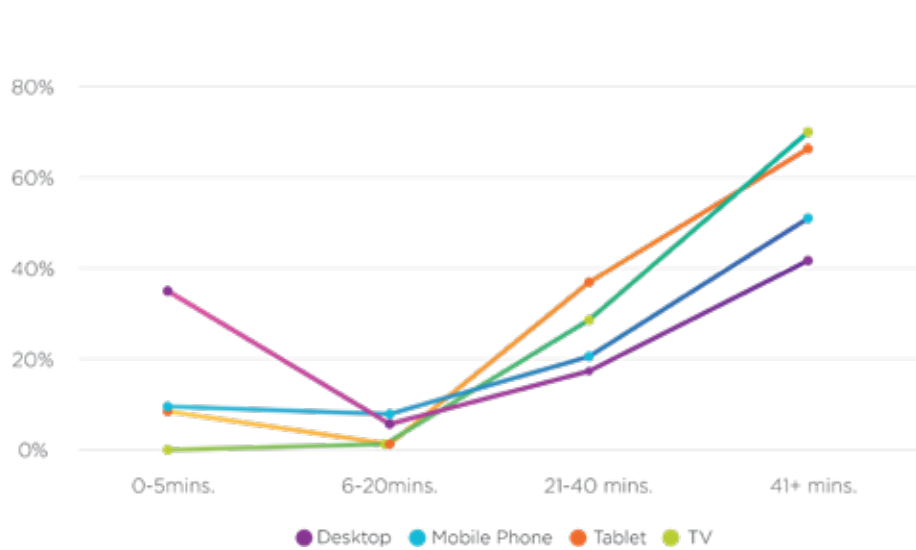
It wasn't just ULF. Long-form video (content from 21-40 minutes long, think hour-long dramas and the like), saw the second-highest share of time watched on every device but desktop computers. On smartphones 31% of time watched was long-form (up from 29% a year ago), the highest percentage for all devices. Connected and smart TVs followed at 27%, and tablets were at 24%. Long-form time watched on desktop computers was the lowest measured, just 16%.

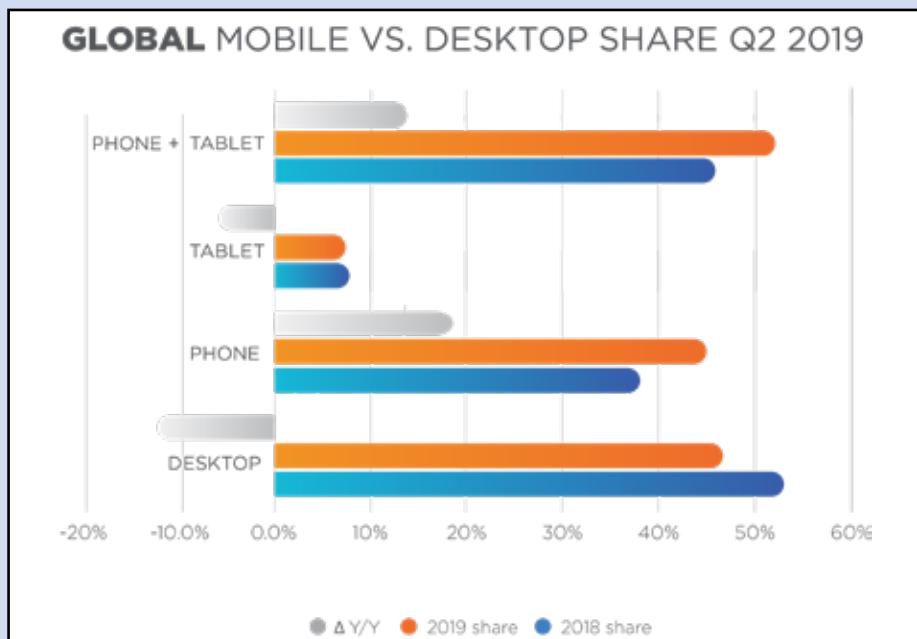
Of course, short-form video (0-5 minutes long, think news stories, sports highlights, trailers for movies, and the like), make up the largest single category of video by a very-large margin. As a result, they make up the largest number of videos watched on devices other than connected or smart TVs.

Smartphones once were looked at as THE USUAL device for "grazing" short-form video. But, that's changing. Better screens, increased availability of premium and live content, and a shift in overall viewer behavior has pushed desktop computers into the leadership position as far as time watched for short-form. In Q2, short-form content made up 35% of time watched on computers, up from 31% a year earlier. On smartphones and tablets, time watched for short-form didn't break into double digits. Connected and smart TVs? ... less than 1%.

While all video forms saw increased views Y/Y, the growth in long- and ultra-long-form video views outpaced that of short- and medium-form. Again, that's likely due to more premium content, especially sports, coming over the top.

SHARE OF TIME WATCHED BY DEVICE AND VIDEO LENGTH Q2 2019





#### The steady growth of mobile

Smartphones have become ubiquitous, not just in mature markets like North America and Western Europe, where penetration is 104% and 122% respectively, but also in emerging markets. Smartphone penetration in APAC (not including China and India) is at 114%, the Middle East is 112%, Latin America is 102%, India is 85% (and rising quickly), and penetration in Africa is at 81%.

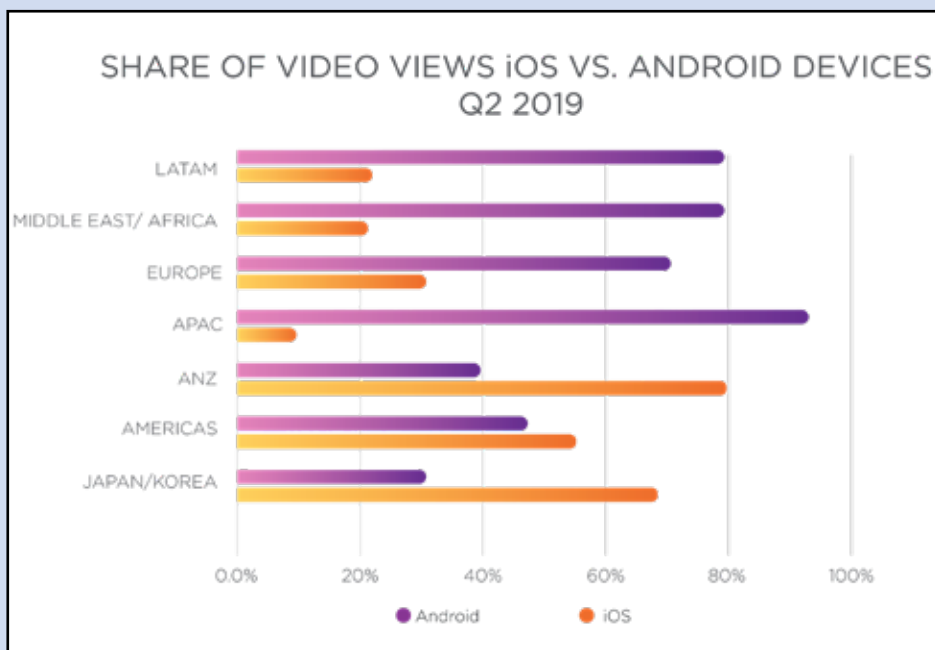
The impact on video viewing has been pronounced.

In Q2, we found that video views on mobile devices outpaced those on computers, 53% to 47%, a flip from a year ago. Year/year, smartphone video starts in Q2 2019 increased by double digits in every region but North

America. Middle East/Africa saw a 43% increase, Latin America was up 27%, Japan/Korea 26%, Europe 24%, Australia/New Zealand 17%, and APAC 11%. In APAC, video starts on smartphones topped 84%; in Japan/Korea share was 58% and in Middle East/Africa, share was 57%.

Smartphones saw growth in excess of 62% in the number of video views for medium-form, long-form and ultra-long-form content in the quarter, compared to a year earlier. It was the biggest gain by any device for those forms, and it even saw a respectable increase of 44% for short-form videos.

Clearly, smartphones have become a primary screen for consumers around the world.



(You can see more regional data by downloading Brightcove's Quarterly Global Video Index)

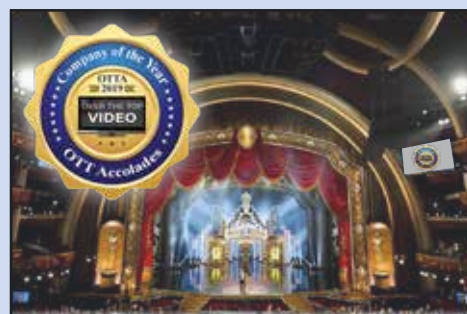
#### iOS or Android?

iOS — once the undisputed operating system of choice around the globe — is being pushed aside by the Android OS. iOS maintains a tenuous hold in only three of seven regions globally (North America, Australia/New Zealand and Japan/Korea) and has seen its share decline everywhere but in Japan/Korea. In Q2 2018, just 49% of video starts on smartphones were on Android-based phones. In 2019, that share increased to 58%.

Much of the change is being driven by the flood of inexpensive Android-based phones from China coming into the market. Emerging markets like APAC and LatAm (78%) are the biggest users of Android devices by share.

#### The bottom line

Today's video viewer is more demanding than any other in history. They want to be able to watch any content, on any device at any time. That "inflexible flexibility" can be a tough hurdle for media companies to clear. But, using data, the job is a lot easier. □



### 2020 Over-the-Top Video Accolades

*Announcing the 2020 OTT Accolades (OTTAs), an awards program to honor the people, products, and companies that are driving the over-the-top video industry forward.*

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# Get ready for the Cognitive TV Era

By: Gideon Gilboa

The pace of change in the television industry has seen players across the broadcasting ecosystem fundamentally rethinking their strategies. Technology providers worldwide are taking a fresh look at what watching TV really means to consumers today, and what the future of TV will look like. We at Kaltura believe that this relentless pace of change is set to continue. Vendors and service providers alike will need to get data-savvy and agile, in order to understand and prepare for the third generation of TV experiences – the era of Cognitive TV.

The media and entertainment industry constantly evolves to feed consumers' ever-growing appetite for more compelling experiences. And the TV marketplace is no different. The ongoing shift in audience preferences and viewing habits, alongside the feverish technology innovation required to meet consumers' expectations, are propelling the TV industry far beyond the static "one size fits all" offering towards more interactive and personalized experiences. Cloud TV, as today's dominant TV service delivery backbone is increasingly known, modernizes the entire TV service infrastructure and transforms TV service capability. It does this by combining the robustness and scalability of familiar pay-TV alongside the agility and the speed of online OTT (over-the-top), making

Cloud TV the true best of breed delivery platform, now set to replace traditional TV distribution paradigms. Moreover, Cloud TV has forever changed the consumer viewing experience as we know it.

## When data meets TV

Although it might be too early to determine the precise shape of the entertainment experiences that will emerge in the future, what we know for sure is that those experiences will be data-driven. The symbiosis of data and entertainment is still in its infancy, but the potential of the bond between the two is transformational, marking the beginning of a new epoch in our industry: the era of Cognitive TV.

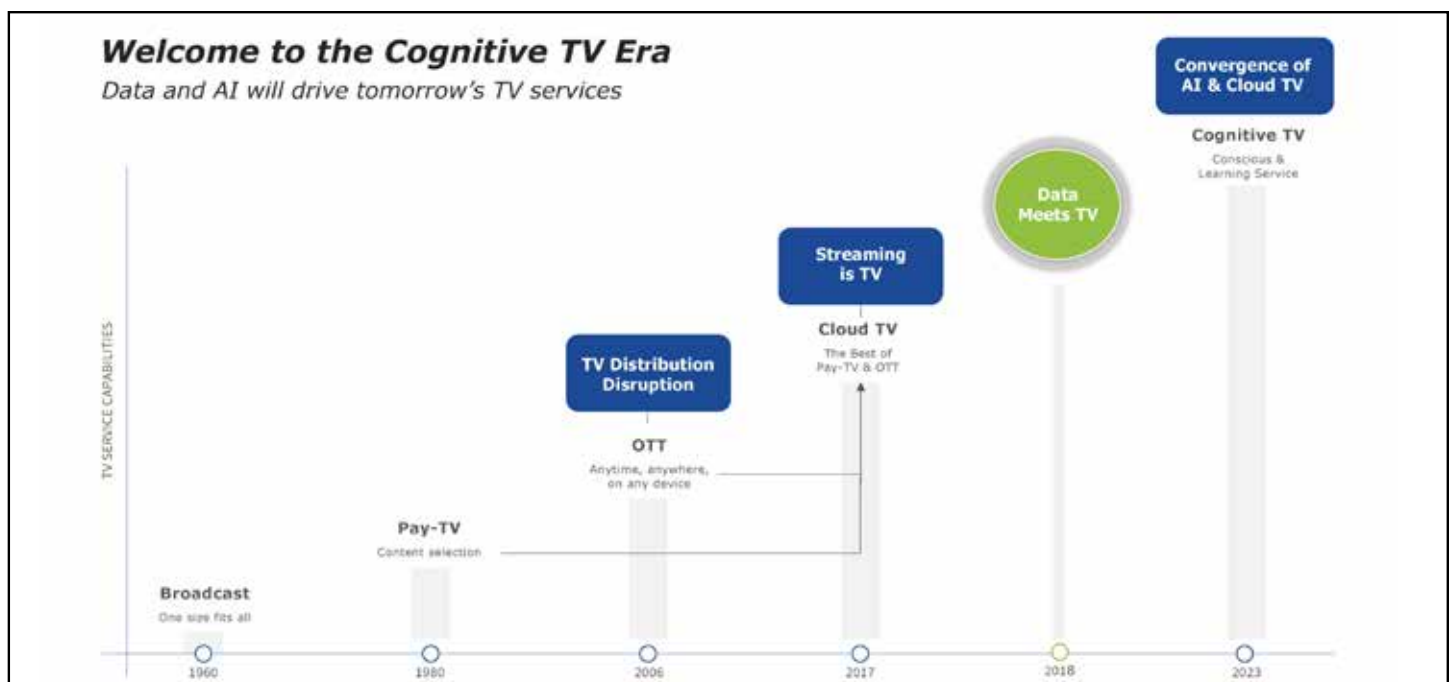
As streaming becomes 'the new TV' and digital-first channels become the primary audience engagement outlet, the amount of data that is created rises exponentially. Mobile and digital assistants, fueled by artificial intelligence (AI), are further catalyzing this shift in content consumption habits. To tap the near-unlimited service and commercial capabilities which this new TV era will bring us, the entire TV infrastructure will need to be interoperable with external systems like voice and proximity detection and will need to have the ability for real-time experimentation.



Gideon Gilboa is Senior Vice President of Product and Marketing for Media and Telecom at Kaltura. Prior to joining Kaltura in 2017, he held various research, product marketing, product strategy and product management leadership positions in the video technology unit of Cisco, and its predecessor NDS which he joined in 2011. During this time, Gideon led the service provider video product marketing team driving go-to-market strategy, marketing, innovation and sales enablement for a \$1bn video portfolio. Throughout his career, Gideon has played a key role in developing and introducing new video products to the industry including the world's first DVR/PVR, as well as DRM, addressable advertising solutions and some of the industry's first OTT systems.

## A day in the Cognitive TV Era

As we enter the Cognitive TV epoch, the infusion of AI into Cloud TV revolutionizes both consumers' and service providers' worlds. Envision coming home after a long work day and having your TV interact with you by identifying/recognizing the mobile device in your pocket, offering you the opportunity to continue watching your favorite show where you left off, or the news program you typically tune in to at that time of a day.





In the Cognitive TV age, TV is no longer about a multiscreen experience, but rather an omniscreeen, personalized experience. Devices will become aware of each other, based on proximity, and of the context of their usage, creating truly immersive cross-platform experiences. In addition to the adoption of Natural UI, the notion of using natural human interaction such as voice as the primary user interface instead of a complex UI which we have today, we can expect mobile devices to serve as new content discovery and interactive experiences platforms, complementing the TV watching experience.

#### **Adding the intelligence layer to the TV service**

Through smarter, more efficient data processing and real time analysis, service providers will be able to finally deliver meaningful personalization. To achieve this, an additional layer of TV service intelligence needs to be created, relying on cognitive technologies and machine learning (ML).

This will allow providers to generate actionable insights for better understanding and prediction of user behavior, essential to expand market share and extend viewer engagement with the service. Coupled with deep learning, those insights will enable a new generation of learning-capable TV services; these will essentially reflect subscribers' viewing habits and preferences. The entire user experience will become 'predictive.' Viewers will be presented with tailored content offerings, as the service's UX adapts based on real-time experiments, anticipating what the viewer would like to watch next.

Building platforms that can harness the

power of AI and aggregate data from multiple sources is vital to make Cognitive TV a reality. Not only do users get TV experiences with real meaning and inherent appeal, service providers gain the opportunity to mine a rich new seam of monetization possibilities.

Operators will be able to balance consumers' expectations with business goals via adaptive advertising. By taking smart and dynamic ad insertion to the next level, viewers can be served with fewer - but truly relevant - ads. Ad payload adapts in real-time based on user engagement, selecting the most appropriate ad format based on the user, the device he or she is using, the content and most importantly, context and the viewer's engagement level.

#### **Taming the data: benefits for operators and viewers alike**

In the highly competitive TV services marketplace, taming the enormous amounts of data will help operators to mitigate churn and strengthen brand loyalty. ML algorithms will automatically generate user segments that will identify if a subscriber is likely to drop off of the service, or migrate to a lower tier subscription. Attractive content and promotional offers can be automatically generated to help galvanize the relationship with the subscriber via the most appropriate communication channel at the optimal time. Moreover, through predictive commerce the system will have the ability to identify and offer the best content packages, and provide service providers with insight on how to market those packages. Eventually, this will enable further business model flexibility and personalization, empowering service

providers to create individualized TV packages on-the-fly, in place of today's pre-defined content bundles. Finally, in the upcoming era of Cognitive TV, the entire video plane becomes contextual. Content-aware encoding and transcoding will allow more cost-effective video processing, storage and distribution, while implementation of ML mechanisms will deliver real-time user experience optimization. Key QoE parameters such as startup time are dramatically enhanced by predicting what the viewer will likely watch next and pre-fetching that content in advance, and then delivering the best-possible quality in accordance to the user's connectivity and device. The whole experience as a viewer is elevated.

Many of the limitations on how users interact with their TV service today are removed with the advent of Cognitive TV; hitherto disparate content silos are harmonized, and viewers interact conversationally with their TV services. Search and recommendation are, at last, finely tuned and meaningful to each user and to groups of users for shared TV experiences. The power and accuracy of curation is dramatically improved: the huge volume of seemingly random, untargeted content we see today is pared down to only what's relevant to the particular viewer(s) in a particular context.

Driving us toward the Cognitive TV era is the convergence of Cloud TV and AI. As this era unfolds, it will be telling to see what measures operators will take to stay ahead of the curve. Taming oceans of data will be key to delivering Cognitive TV's third generation, highly personalized entertainment experiences which viewers are expecting. The act of watching TV will be redefined. □



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# 5 Tips from the Production Room: How to Live Stream Like a Pro

By: Carlos Rojas

Today's streaming technologies can help you deliver your sporting event with broadcast quality – even if you aren't a major broadcaster with a big budget. However, there's more to live sports streaming than buying the latest camera and encoder. Here are 5 tips to help you stream live sports like a pro.

## #1 Encode the live stream for reliability and quality

Many mainstream sporting event broadcasters transmit the camera signals from the venue to an offsite encoding facility served by a satellite or fiber connection. This setup comes with high-quality transmission facilities that can be used to create a geo-redundant architecture for maximum resiliency – but this quality comes with a cost.

Ingest flexibility is a major advantage of streaming live events and can open new possibilities for cost optimization without sacrificing signal quality. Even large broadcasters are starting to take advantage of these new technologies. But you should understand the risks and balance them against your need for fault tolerance. Here are some things to consider:

- **Onsite encoding** eliminates transmission costs by encoding the production at the venue itself, using existing internet bandwidth. Laptop to server-based options allow you to stream directly from the event site. However, an onsite appliance creates a single point

of failure due to the single egress circuit and device being used for distribution, so depending on the event, you may want to build redundancy into the onsite infrastructure.

- **RTMP's** lower cost of packetized transport allows for greater event volume coverage with respectable picture quality. A rate of 3.5 Mbps delivers an acceptable HD picture resolution, and a personal hotspot or the venue WiFi may have the available bandwidth to transport the stream for distribution. However, compared to the robustness of satellite, fiber, forward error correction, or TCP/IP handshakes, RTMP is subject to packet loss that could impact the end-user experience.

You can still achieve broadcast quality, optimize costs, and build resiliency and reliability without procuring satellite and fiber facilities. Encoders that use commodity hardware such as a laptop or server will keep costs low. Look for providers that can provision with resiliency both on location and in the cloud. And ensure they can be managed remotely by your live events team.

## #2 Decorate the live feed to optimize monetization

You can deliver a broadcast-quality streaming experience as your event goes to ad break by using server-side ad insertion (SSAI) technology. SSAI enables broadcast-quality ad viewing experiences by equalizing audio and



Carlos Rojas is the Director of Live Event Operations for the Verizon Media Platform. Carlos has been with the company for the last 9 years, merging legacy broadcast technologies with OTT delivery

platforms to manage and stream more than 45,000 live events annually. He has a strong operations background, professionally skilled in broadcast engineering including, all forms of live productions and transmission technologies in both legacy and IP based workflows.

video quality between ads and the live event content.

SCTE-35 is the key to making SSAI work. SCTE-35 signals are written into the manifest and used to trigger ads. Broadcasters typically make code changes to their automation playout system to keep their streamed ad calls and playback in sync with their traditional broadcast or have control personnel manually insert SCTE-35 markers for autonomous commercial breaks. When done without SCTE-35, the stream uses an API call to add a marker.

As you "decorate" the live stream for ad breaks, these markers become a part of the VOD asset and can be used to extend the economic value of the sporting event, enabling you to dynamically change out ads for VOD viewers. This is helpful because many of the ads and promos that you run during a live event are not the same ads you want to run if you offer the program as a VOD. You may also want to adjust the time of the breaks since viewers of a VOD program are less tolerant of longer ad breaks.

Look for a streaming platform that provides you with the flexibility to dynamically change the markers to suit your needs. Also, look for a streaming platform that uses an SCTE-35 detector, so if the stream already has the markers, you can use SSAI, your campaign or your program content if you haven't sold the inventory. You don't have to take ads that are the original broadcast. Use the time to promote yourself, your product, your event, or the series.

## #3 Estimate your live stream audience – and double it

Regardless of your event, the majority of live event viewers join within minutes of the



event starting. So your live event infrastructure must scale up quickly - in minutes, or even seconds. For most first-time rights holders, estimating peak viewers is extremely challenging. Despite your best efforts to model viewership, things can change dramatically.

Expected audience size also comes into play when working with your content delivery network (CDN) partner(s). For large events, your CDN(s) will want your viewership estimate so they can make capacity reservations and add any special configurations. This will increase the odds that your content will be available in the right regions during the crucial events -such as game start and after halftime. Here are some factors that can help you estimate your audience:

- **Historical Metrics:** Viewership numbers from a past event are a good starting point to estimate upcoming live and VOD sessions.
- **Client Forecast:** A combination of historical data, as well as client internal numbers (whether through marketing or advertisement), helps set an anticipated forecast.
- **Significance of Event:** Events such as a championship game or a rival matchup are more apt to garnish higher viewership, especially within the region of each team.
- **Time of Broadcast:** Weekend games can easily command a 50-100% increase in viewership. Games broadcast in the evening in a particular region may lose 25-50% of the audience depending on the time zone impact.

• **Geographical Coverage:** Is it distributed, highly concentrated, or perhaps a combination of both? Work with your CDN, so they are prepared to scale in the appropriate regions.

Cost structures for streaming service providers can vary considerably. If audience size is an unknown variable, look for a provider offering a variable rate structure with the freedom to scale. Also, look at whether the provider locks you into a minimum or tiered rate structure.

#### #4 Scale your live stream session management

Coupling high-quality ads with OTT's 1:1 targeting makes for a high-quality viewing experience. If your live sport has geographical restrictions, you'll also need 1:1 session management to manage blackouts. Both of these important live streaming functions are supported by the manifest server in your streaming platform or service.

However, for live sporting events, it is essential that the manifest services are designed to scale. Without the proper headroom, overburdened manifest servers can become a



point of failure in your streaming workflow and leave customers staring at a blank screen.

Putting your manifest servers in the cloud with options for scalability can work, but it can be difficult to get this right. Live sports viewers tend to show up in large numbers all at once. More will join when they see a tweet or notification that their home team is making an epic comeback against a competitive rival.

As explained in point 3, streaming services can help you absorb the risk of under-provisioning and the cost of over-provisioning. Look for a service that has a proven track record of not only scaling delivery but also for scaling manifest infrastructure for live events.

#### #5 Prepare your live stream for the worst

Live events rarely start and end on time. Being prepared for this unpredictability means thinking through all the possible scenarios and having a backup plan that keeps your audience informed and engaged during delays or programming glitches.

Backup programming can extend viewer engagement when geo-blocking is needed or when weather issues take a turn for the worse. Longer form content such as related sports highlights, athlete documentaries, and recent news video are good options. Having these ready to go can maximize viewership during and after the delay.

Slates (a still or animated looping image) keep audiences informed for a variety of scenarios. Create slates in advance so that they are well designed. Include a selection of graphics, background audio, and music that reinforces your brand identity. Consider creating the following slates to start:

- **Pre-event** slates to alert the audience that the stream is about to begin

- **Post-event** slates alerting viewers that the program has concluded

- **Inappropriate** content cover-ups during the broadcast

- **Event not available** in your area slate for geo-blocking restrictions

- **Delay** slates for technical or weather issues

Look for streaming services that can help you prepare for these situations and can quickly insert alternative programming or slates as needed. Be sure the provider can top up a full-screen graphic, properly alert your audience of the event status, and switch to a different live feed if the primary feed is delayed or canceled without updating a URL. A service that can quickly handle any of these situations helps ensure you don't lose viewers.

#### Bringing it all together

Live event operators know that a successful live event doesn't happen by chance. Experienced specialists work together in advance to prepare for any last-minute changes or technical challenges. In these moments, creating a seamless viewing experience is more art than science, as talent and experience come together to resolve any challenge. With the right planning and preparation, you too can build and deliver an edge-of-your-seat experience for your next live sporting event! □



# Video Monitoring in an OTT World with Mediaproxy

Interview by Kurt Michel with Erik Otto, CEO of Mediaproxy

*Erik Otto, CEO of Mediaproxy, shared his perspective on how monitoring, analytics and measurement are changing and evolving to keep up with the ever-changing OTT landscape.*

**Kurt:** Hello Erik, thanks for taking the time to speak with us today. Could you tell us a bit about Mediaproxy? When you started, and what problems you were born to address?

**Erik:** Mediaproxy was founded in 2001. Since then, the technology for regulatory compliance and the broadcast market as a whole has changed considerably. When we started out, a lot of broadcasters were still using VHS tape to record off-air broadcasts for logging purposes. We helped pioneer the move into digital file-based systems to log transmissions, so I suppose that was a primary area Mediaproxy was created to address. Later we augmented the core logging product by expanding into monitoring and analysis. From the initial proxy logger, we have developed a comprehensive range of functions, allowing our system to be used across a facility for near-line archiving, in addition to automated quality assurance and monitoring applications. In the more than 18 years, we've been involved in compliance technology and over 15,000 channels have adopted our systems, which I think makes us the most experienced company in the field.

**Kurt:** How has online video and OTT streaming changed the game for your traditional broadcast customers, and how have you responded to those needs?

**Erik:** Broadcasting has become a hybrid; where conventional linear distribution over terrestrial, satellite and cable sits alongside OTT streaming platforms. Most of our customers are still what would be thought of as traditional broadcasters, with linear transmission at the core of their operations. But OTT is increasingly supplementing those activities, through catch-up and other on-demand services. Perhaps the biggest change that OTT has brought compared to linear TV is the possibility of targeted advertising. The key to this will be getting viewers to 'log on' so there is a better opportunity to identify the demographics of those watching and then track their behaviors, such as preferences and viewing habits. To allow broadcasters to do this, Mediaproxy has developed a suite of tools that sit alongside our quality assurance features. These are based on an advanced model of 'outgoing and return' monitoring that utilizes our Monwall interactive multiviewer. This creates a new but familiar way for broadcasters to analyze and monitor hundreds and thousands of profiles in real-time.

**Kurt:** There are a number of Analytics, Measurement and Monitoring companies in the industry – and I still get the sense that there is



*Erik Otto, CEO of Mediaproxy, began his career in media after studying applied engineering far too long ago. He's had an extensive career working in audio engineering, television broadcast, computer graphics, digital film and high-end computing. Erik has also founded XDT Pty Ltd, which develops the fast data transfer solution Catapult. The software-based solution enables media companies to efficiently utilize internet and VPN connections via its UDP accelerated transfer protocol.*

confusion, because there are so many things that fall under that umbrella. Some companies focus on operational measurement (Can the viewer see the video, and is it good?), some focus on behavioral measurement (what did the viewer watch, when did they abandon?), others key in on standards compliance (did the ad play, and at the appropriate loudness?), and I fear I am only touching the surface. When we start thinking about analyzing how these different types of measurements affect the others, the complexity dramatically increases. Where are you focused today, and do you think the industry will converge to a "comprehensive" solution that can monitor all of these dimensions and provide true insights to service providers?

**Erik:** Monitoring and logging technologies were already diversifying and developing rapidly as linear television evolved, particularly into the digital age, but that has increased with the advent of OTT and streaming. The speed at which OTT entered the market caused a lot of vendors to release products very quickly. These were based on rudimentary feedback early on and have been carried forward and extended, with the result being they have become extremely fragmented. There is still an attitude that remains from the days when hardware devices were the norm, that a specialized standalone unit was the best solution to a specific problem. Advances in software have allowed systems to be more comprehensive and provide a range of functions and features. While an in-house monitoring system might tend to concentrate on the technical aspects of the program such as loudness, captions, audio-video characteristics and so on, it is also well-positioned to check the validity of the program





content. This comes about through integration with As-Run Logs and being able to reconcile SCTE triggers and compare captions with transcripts, as well as other procedures. Essentially, if we can detect a problem, whether it is technical or operational, we will do that and raise the appropriate alarms. Our LogServer product already provides features for technical tasks such as compliance checking and archive logging plus the behavioral measurement you mention. It is in a unique position to do all this because it can be installed as a probe at any point in the production and transmission chain, with full access to all metadata.

**Kurt:** For a niche-caster – someone who has a very specific market segment that they want to super-serve - what would you suggest they do to make sure their content is being delivered to viewers with the appropriate quality? Is there a cost-effective way to do that?

**Erik:** The problems involved in distributing programs are a little different for the kind of specialized broadcaster you describe from those experienced by traditional linear and streaming services. There are two critical aspects involved in monitoring any distribution process. One is to ensure that content is delivered at the correct quality according to the relevant national standards. The other is to make sure programs get through the CDN (content distribution network) in the right format versions to the various devices and platforms available to the audience. Mediaproxy has

developed its logging and monitoring systems to address both these problems. We provide real-time monitoring of the output program, so the broadcaster can be confident that what is being sent is correct in terms of both content and compliance. We also allow different profiles to be monitored in the cloud. This makes for a very affordable way of ensuring the distributed streams are constantly available. In addition, we have a software-based real-time content matching feature to guarantee that the right content is going to the right place at the scheduled time.

**Kurt:** At this year's IBC show, I saw 8k popping up around the show floor, and improvements in color spectrum and High-Dynamic-Range (HDR) technologies, as well as advanced compression techniques. What advances did you see in the industry that helps you plan your roadmap over the next 3-5 years?

**Erik:** My personal opinion is that HDR will have the biggest impact on consumers. The general public can see the improvements offered by a wider color space, but they tend not to be as aware of resolution. One thing that will drive the awareness and eventual adoption of HDR is when it is widely available on smartphones, tablets and desktop operating systems. Once HDR is common to those environments and platforms, the higher resolutions will follow. From the Mediaproxy perspective, we are an engineering-led company that is always at

the forefront of the next wave of technology and the tools needed for it. Right now, the sheer scale involved in distributing programs and other video - with multiple channels going to multiple platforms and devices - is in danger of overwhelming broadcasters and service providers. What has to happen is a move away from having technical operators looking at hundreds of 'pictures' as they are transmitted. Exception-based monitoring will not only make it possible to lower operational costs, but it will be the only way to deal with the myriad sources involved in broadcasting today.

**Kurt:** Erik, thanks for your perspectives. I'm sure there are many readers who look forward to the day when cloud-deployed software handles the "heavy lift" monitoring of the vast amount of content being delivered – and quickly flags the exceptions that require manual intervention. Without these tools, I don't think we would ever have found the cure for "buffer rage". □



# How Software Encoder Computing Efficiency Impacts Service Quality

By: Mark Donnigan

The video encoding function is the most visible part of any video distribution pipeline or streaming workflow, and yet it's often the least understood. Executives responsible for operating video services have long since outsourced the role and function of video encoding to specialists, and for a good reason. The knowledge and scientific background required for the video encoding discipline is highly specific and not so common.

For years, the operational process of converting a video signal into a digital bitstream was performed by purpose-built hardware boxes called video encoders. Though every video encoder vendor could tell you why their product was superior, typically, most were limited in their ability to be customized beyond the features or performance they shipped with. This meant that when a new technology standard launched, the encoders to be upgraded had to be taken offline so internal boards could be replaced and new parts added. In other cases, entirely new encoders had to be purchased as there was no suitable upgrade path with the existing technology. Such was the case when the industry moved from the original MPEG2 digital codec standard to AVC (H.264).

### Software ate the hardware

Marc Andreessen (the co-founder of Netscape and a16z, the famed venture capital firm with investments in Foursquare, Skype, Twitter, box, Lyft, Airbnb, and a seemingly never-ending list of startup disruptors)

penned an article for the Wall Street Journal in 2011 titled "Why Software Is Eating The World." (<https://a16z.com/2011/08/20/why-software-is-eating-the-world/>).

In his article Andreessen wrote, "Six decades into the computer revolution, four decades since the invention of the microprocessor, and two decades into the rise of the modern Internet, all of the technology required to transform industries through software finally works and can be widely delivered at global scale."

For video engineers, software-based video encoders have almost fully subsumed video encoding hardware. With software applications freed from purpose-built hardware, and most able to run on ubiquitous computing platforms like x86 in virtual environments, "software is eating the world" is not a contentious statement. But what does this really mean for a technology or video operations executive? Let's take a look.

Computer software is the bedrock of the largest and most valuable companies in the world, and the role of software has become equally vital for video distributors. This is good news because software is flexible in ways that hardware cannot be. For example, software is able to scale without requiring a linear increase in physical space and utilities like power, unlike hardware. And software can be moved between systems and even entire data-centers in near real-time to meet capacity overruns or temporary surges. Software is much more flexible than hardware. But where is the Achilles heel of software?



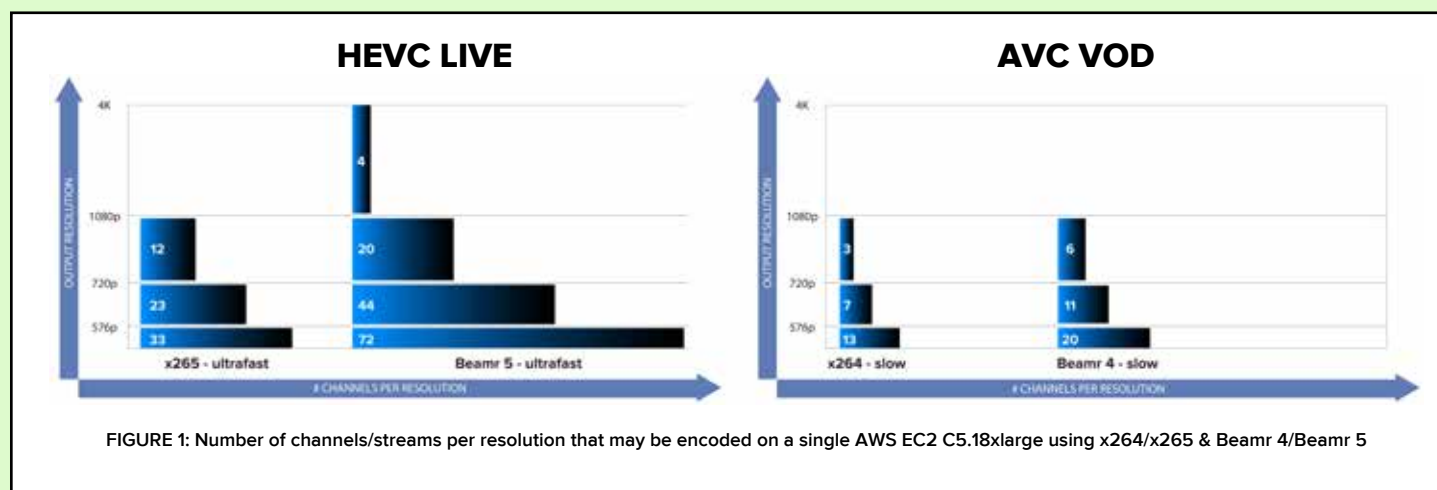
Mark Donnigan is Vice President of Marketing for Beamr, a video encoding technology software company. Mark has been a part of building several trailblazing companies in the video industry including the OTT VOD pioneer, VUDU. As an industry figure he participates actively in various consortiums, traveling and speaking on the future of entertainment services and video technology.

### The next frontier is software computing performance

There are three pillars that every video encoding engineer must address as they develop and operate their encoding systems. They are bitrate efficiency, quality preservation, and computing performance. When developing a video encoding solution, it's well known that you can optimize a codec implementation or video encoder for two but almost never three of the pillars.

To achieve bitrate efficiency while maintaining video quality, resource-intensive tools are required, which leads to slow operational speed or a significant increase in CPU overhead. Likewise, for a live encoding application, where the encoder must operate at high speed to reach 60 frames-per-second (FPS), a compromise in bitrate efficiency and/or absolute quality is often required.

Commercial video encoding development teams are improving their performance





attributes regularly. But even still, codec complexity is outpacing bitrate efficiency advancements, and this is creating the need for video encoder performance optimization. Traditionally, this is not an area that video encoding practitioners and image scientists have needed to be concerned with, but that is no longer the case, as we shall soon see.

Figure 1 illustrates the advantages of a software encoding implementation, which - when all attributes are normalized such as FPS and objective quality scores - is able to do twice as much work. In this example, the open-source encoders x264 and x265 were compared to Beamr's AVC and HEVC encoders, Beamr 4 and Beamr 5. A few things immediately stand out. First, for services needing to encode live 4K it is possible with Beamr 5 but not with x265. In fact, Beamr 5 is able to encode not one but four individual streams on a single AWS EC2 C5.18xlarge. This is a clear demonstration of how codec performance directly translates into a quality of service and cost benefit as a result of fewer machines being needed, and less complex encoding frameworks needing to be built.

#### Video encoding compute resources cost real money

Opex must be considered carefully by every video distributor; only now, the competitive playing field has moved beyond the winner being the service who can drive the lowest cost of operations. Suppose entertainment experiences, like live 4K streaming, cannot be delivered reliably as a result of a mismatch between the encoder and the expectation of the consumer. In this case, the cost benefit from using an unoptimized software-based video encoder would be lost as a result of the service not being competitive with a most basic requirement, reliable 4K streaming at broadcast quality.

Consider that because of performance limitations due to how the open-source encoder x265 utilizes its compute cores, it is not possible to encode a live 4Kp60 video stream on a single machine. The capacity to encode a single stream or full ABR stack on a single machine is essential to maximize encoding quality and ensure a service that is free from unnecessary complexity and visual artifacts.

This doesn't mean that live 4K encoding in software isn't possible. But it does mean that to deliver the quality of video experience consumers expect, video distributors will need to evaluate commercial solutions which have been performance optimized for high core counts and multi-threaded processors such as those available from Intel and AMD. Video distributors wanting to use software for their flexibility and virtualization options will encounter overly complicated engineering hurdles unless they select encoding engines where multi-processor scaling is native to the very architecture of the solution.

In testing, we found that the open-source encoder x265 running on a single AWS EC2 C.18xlarge instance was able to output barely 30 FPS when running in 'ultrafast' mode, which is required for real-time operation. As the standard frame rate for live content, especially sports, is 60 FPS, it's easy to see that 30 FPS does not meet the technical requirements for broadcast-quality streaming.

#### Things to think about concerning computing efficiency and performance:

1. Stop chasing the next more advanced codec without considering first the complexity/efficiency quotient. Dave Ronca, who led the encoding team at Netflix for ten years and recently left to join Facebook in a similar capacity, recently published an excellent short article on the subject of codec complexity titled, "Encoder Complexity Hits the Wall." (<https://www.linkedin.com/pulse/encoder-complexity-hits-wall-david-ronca/>) Though it's tempting to think this is only an issue for video streamers with tens or hundreds of millions of subscribers, the same tradeoff considerations must be considered regardless of the size of your operations. Remember that a 30% net bitrate savings for a 480p profile that is only 1 Mbps will return a 300 Kbps bandwidth savings. While a 30% savings at 1080p which is often encoded closer to 3.5 Mbps will give more than triple the return, almost 1 Mbps of savings. The point is, we must carefully and methodically consider where we are spending our compute resources to be sure that we are getting the maximum compute ROI possible.

2. Recognize that structural issues relating to the design of a standard, or codec implementation, matters. The advantage of a commercial software solution is that it was generally built by a team that held in balance the requirements of bitrate efficiency, quality, and compute performance. This is in stark contrast to most open-source projects where contributors all have separate and individual priorities and agendas. This is precisely why the architecture of x264 and x265 are unable to scale like a commercial solution can.

3. Insist that your internal teams and consultants conduct performance benchmarking on all software solutions being evaluated. The three vectors to measure are absolute speed (in FPS), individual stream density when FPS is held constant, and the total number of channels that can be created on a single server using a nominal ABR stack such as 4K, 1080p, 720p, 480p, and 360p. Of course, it will be essential that both encoders produce comparable video quality throughout all tests.

If software has eaten the video encoding function, then compute performance is the oxygen needed to meet consumer expectations in order to thrive and win against an increasingly competitive and crowded direct-to-consumer marketplace. With so much upheaval in the distribution model and go-to-market business plans for streaming entertainment video services, it may be tempting to push down the selection of new, more efficient software video encoders. After all, this likely isn't the only "burning" issue. But, by forfeiting this work, it could have a genuine impact on a service's competitiveness and ability to scale to meet future entertainment service requirements. So the next time your technical team plans a shoot-out, make sure to ask what their test plan is for benchmarking compute efficiency. □



*"Software is eating the world."*



# Making TV Voice Discovery Child Friendly

By: Charlie Bonfield

## Voice discovery is here to stay

Due to the rising popularity of virtual assistants like Amazon's Alexa, Apple's Siri, and Google Assistant, the modern consumer has grown accustomed to using their voice while interacting with electronic devices.

Today, the consumer has the freedom to move around the home achieving tasks that would otherwise require "hands-on" human interaction, such as typing a query into a search engine or changing a music playlist.

In addition to making these tasks simpler, the use of voice could provide additional contextual information about the speaker (age, gender, sentiment, etc.) that may then be further used to enhance that user's experience.

However, a fundamental question remains. How can entertainment aggregation companies like TiVo make sure that the content delivered to families across the globe is safe for children?

## Content Discovery Tools/Parental Controls

To begin answering this question, consider how TV viewing habits have changed over the years.

In the days when knobs were used to switch between TV channels, there were very few options available and content was generally family-friendly.

That changed quickly. As cable companies came on the scene and wanted to deliver more content to drive up their subscription and advertising revenues, consumers started to see more choices, available right at their fingertips. And with these choices came more options for

types of content – action, adventure, comedy and drama galore. A lot of these choices weren't necessarily as wholesome as pre-cable TV shows once were.

Today, however, the widespread adoption of voice-enabled devices has removed even more guard-rails on content proliferation and discovery when they may, in fact, still be needed to match the rise in mature content.

Since an individual's voice offers a wealth of information about them implicitly, we can use it to elegantly solve this problem.

## A High-Level Overview of Our Work

In our research at TiVo, we showcase ways to enhance personalization by extracting anonymous demographic information about voice remote users to ensure the appropriate content is shown to the right members of the home.

Let's dive in a little deeper.

To develop this capability, we first extracted and gathered non-personal acoustic features from audio samples through one of our non-US deployments. Next, we folded in our own proprietary metadata, specialized to the offered content. This component is crucial for inferring the relevance of content to the speaker/viewer. In the scope of our research, this was limited to age-based relevance. The third step was to utilize what we had gleaned in real-time to optimize natural-language understanding and backend search. In doing so, we closed the loop of enhanced entertainment discovery by matching a user to a collection of relevant



Charlie Bonfield is a data scientist with TiVo. In September 2019, Charlie was awarded the IET Young Professional Award at IBC in Amsterdam for the tech paper, 'Leveraging Acoustic Information for Enhanced Personalization in the Entertainment Domain', which he co-authored with his colleague, Manik Malhotra, a senior engineer in software development at TiVo.

content - in the absence of explicit user identification.

Plainly stated, we used the quality of the requester's voice to determine their age, and used that information to present age-appropriate content.

## What Makes This Challenging

It is worth highlighting some of the known challenges faced with voice recognition tech in the entertainment space:



- Utterances in the household domain often only contain between 0.5 and 1.5 seconds of audio.
- Audio is often far from clean (environment - background noise due to television, other household members speaking, etc.).
- Voice recognition needs to be quick and able to scale without adding perceptible latency to our existing service.
- To differentiate between voices from each demographic, our research at TiVo led us to estimate the following quantities:
  - Pitch: how high/low someone's voice is.
  - Intensity: how loud/quiet someone speaks.
  - Speech rate: how quickly a person speaks, how often they pause.
  - Date/Time: not acoustic features, but useful in biasing prediction for times where children are unlikely to be awake and/or making requests.


Text features: We wanted to highlight that text features were not, in fact, significant for prediction – this worked in our favor because we wanted to generate a prediction concurrently with voice-to-text, but parents searching for content for their children is a very common use case and transcription errors only served to degrade our models.

**Machine Learning, or Teaching the System to Make the Right Choices**

Metadata Tagging: How Content Metadata Makes a Difference

Example: "The Breadwinner" vs. "Breadwinners"

"The Breadwinner"	"Breadwinners"
	
<b>Ratings:</b> <ul style="list-style-type: none"> <li>["PG13", "G", "PG", "Tous"]</li> </ul>	<b>Ratings:</b> <ul style="list-style-type: none"> <li>["G", "6+", "T", "G", "TV7"]</li> </ul>
<b>Genres:</b> <ul style="list-style-type: none"> <li>["Drama", "War", "Animation"]</li> </ul>	<b>Genres:</b> <ul style="list-style-type: none"> <li>["Animation", "Comedy", "Children", "Animated Comedy"]</li> </ul>
<b>Class:</b> <ul style="list-style-type: none"> <li>Unknown</li> </ul>	<b>Class:</b> <ul style="list-style-type: none"> <li>Kids</li> </ul>

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We utilized an ensemble approach with a combination of linear and nonlinear classifiers on the first level of the ensemble and gradient boosting on the second level.

On the first level, we choose to perform one vs. all classification for adult men, women, and children; thereby trivially providing us with gender classification.

For our specific business considerations, correctly identifying children as children instead of adults was of the utmost importance. As such, our requirements were tied to that performance metric.

Speed was also vital and we clocked the median response time to be around 100ms.

When clustering the different voices, our primary source of confusion was between women and children, likely due to overlap in estimated values of fundamental frequency. Since all of the information we fed into our models was acoustic, the confusion is understandable if you consider how similar voices of women and children can sound. However, there was enough separation in the space spanned by our demographic groups to meet our objective; the punchline being that we were able to attain 90% precision in identifying children from audio.

Although we had the ability to infer demographic information about users from audio alone, a great deal of effort went on behind the scenes to generate augmented metadata to further the extent of our work.

Our process for metadata tagging was as follows:

- We assigned “adult” and “child” friendly labels to all genres that we had on hand. Those that did not fall into either bucket particularly well were designated as “unknown” (essentially defined by exclusion).
- We used term frequency-inverse document frequency (tf-idf) weighting in order to generate composite scores for the content genres.
- We augmented the resulting scores (derived from genres) using ratings information – the ratings could push the scores in either direction.

The net result was a set of class labels and associated scores which could then be utilized later in the context of natural-language understanding (NLU).

### The Right Metadata and Breadwinner

As a demonstrative example of the utility of our augmented metadata, consider the dilemma that we would be in if a user were to make a request for “Breadwinner”.

After stemming and stop word removal, “Breadwinner” would return two assets – “The Breadwinner” and “Breadwinners” Although both are animated, “The Breadwinner” centers around a young Afghan woman living in the Taliban regime who disguises

herself as a boy to support her family after her father is wrongfully imprisoned. Whereas “Breadwinners” is a children’s show about a pair of ducks who fly around their home planet of Pondgea delivering bread.

The combination of the “war” genre and ratings are sufficient to earn “The Breadwinner” an “unknown” classification (and rightfully so), while the same fields reinforce the “child” classification for “Breadwinners.”

And so, for each asset in the catalog, we have an age rating (“adult”, “child”, “unknown”) that mirrors our demographics and an associated score that can be leveraged by the NLU.

### How can machines better understand children?

With information extracted from audio and metadata specialized to our problem, we turned our focus to improving how our system understands children.

Prior to the development phase, we conducted a case study using a subset of the utterances that we used to train our models for child detection. The goal of the study was to better understand how children interact with a voice search system in the entertainment domain using audio from the field.

In our study, we found that:

- Children rarely correct their pronunciation or rate of speaking, often times yelling or mumbling and expecting the system to understand them.
- Children do not always remember longer phrases and/or have the ability to reconstruct them completely. Shows like “Transformers: Robots in Disguise” or “Mickey and the Roadster Racers” are often too much for a child to say on their own. As a result, they will often make noises that sound like the words in the titles in an attempt to get the system to understand them.
- In general, it is difficult to align intention/expectation with what is returned to a child in voice search. Children will often play with the system or make nebulous requests.

With those observations in mind, we made the following adjustments when it came time to create the child-optimized NLU:

- Phonetic variance: corrects for situations where a child says parts of their request correctly but not others (direct string comparison).
- Normal variance: handles missing words (solved via a fuzzy chunker that can be programmed to be more tolerant of missing words/phrases when comparing with known words/phrases).
- We also added implicit bias into the scoring function that we use for entity selection. Essentially, we introduced an additional conditional penalty motivated by the fact that our existing system was biased towards adults.



As input, the function took demographic information derived from the raw audio (child or adult flag), the entity type, and normalized age relevance (output from our procedure detailed earlier).

- The optimal function introduced high penalties when we determined a child was requesting adult-appropriate content, but very little penalty in the reverse case.

### Opportunities to extend voice personalization

Moving forward, there are two particular areas of interest for extending our work on voice personalization:

- We are in the process of validating the performance of our work across multiple languages. As with all language models, when the fundamental units of speech change (phonemes), it is not always clear how well a language model will generalize.
- More generally, we wish to further enhance personalization by working to go even a step further and identify individual users (but still preserving their anonymity) within a household implicitly. For many households, the age/gender demographic may do a fairly good job at bucketing views and assigning users to profiles; however, it is not inconceivable to attempt to differentiate amongst users of the same demographic within a household.

At Tivo, we are in the business of bringing safe and enjoyable viewing experiences to every household we serve, and look forward to leveraging continued voice technology research to meet that goal. □



# Nagra's Perspective on OTT's Continuing Challenges

Interview by Kurt Michel with Anthony Smith-Chaigneau, Senior Director Product Marketing at NAGRA

*Kurt Michel, Trender Research's EVP, sat down with Anthony Smith-Chaigneau, Senior Director Product Marketing at NAGRA. Anthony shared his views on the trends and challenges that face the OTT market.*

**Kurt:** Hello Anthony. Thanks for taking the time to speak with us today. Can you tell us a little about NAGRA, the kinds of customers they serve, and your role there?

**Anthony:** NAGRA is the digital TV division of the Kudelski Group. For more than 25 years, our engineering and technology expertise combined with our focus on end users has allowed us to work with the world's leading service providers and content owners to protect and grow their businesses in the ever-evolving pay-TV industry.

Throughout our history, we have focused on staying ahead of the curve when it comes to the constantly changing landscape of the digital television business; starting in content protection and moving into interactive TV and a variety of other verticals like watermarking and anti-piracy. That led to enterprise grade solutions for OTT that are both pre-integrated but malleable and bespoke.

As we moved further away from broadcast-ing and into the OTT era, we were quick to offer our more traditional broadcast customers the ability to enter the world of IP by providing

one of the first TV Everywhere solutions on the market. As "all IP" has progressed, we consult with our customers and prospects about what is clearly the post-OTT era. This means that we now have to concentrate on the 'business of TV' not the 'technology of TV' with AI-driven pay-TV analytics and active content monetization tools and services. Of course, we continue to keep abreast of the challenges of content and service piracy that undoubtedly remains a business challenge in the new, fully-connected world.

My role in the company as a product marketer is to ensure that we are informing our customers and the market of the capabilities of the company, the products and new technologies that we have recognized as essential for future business and integrated into our portfolio, and understand what will matter to them both now, and in the future.

**Kurt:** Specific to the OTT Video Market, what are some of the trends that NAGRA is seeing in the industry? Has anything emerged at IBC 2019?

**Anthony:** We recently published the results of the 2019 Pay-TV Innovation Forum, a research program we launched with UK consultancy MTM a few years ago. As a first trend, this year's findings revealed growing executive sentiment regarding the impact of stand-alone OTT services and the ability for pay-TV pro-



Anthony Smith-Chaigneau is the Senior Director Product Marketing for NAGRA's pay-TV and OTT Solutions unit. He is recognized as a leading evangelist for advanced-service television technologies, having held several senior management roles in leading digital TV companies since 1999, including the DVB consortium, where he was heavily involved in international-standardization efforts across the world including ATSC, and CableLabs.

viders to evolve into super-aggregators to deliver smart content aggregation. We know OTT viewing has become a mainstream behavior in many pay-TV markets globally. As an example, Netflix has grown its paying subscriber base from 124 million in June 2018 to 152 million in June 2019. In addition, the launch of new direct-to-consumer (D2C) services from Disney, WarnerMedia, NBCUniversal and other providers (with anticipated launch dates later this year or in early 2020) is likely to stimulate further disruption in the market.

The opening for a super aggregator is there, and pay-TV providers are well-positioned to take on this role. This is why we are seeing the pay-TV industry increasingly embracing OTT disruption to deliver exactly what the consumer wants, when they want it and on whatever device they choose. Once upon a time the mobile experience was an afterthought, but now the ability to adapt the big TV experience to the mobile experience while on the move has shifted from a "nice to have" to a "must have" for providers.

The second trend we have observed is the increased importance and value in live sports OTT streaming. The increasing availability of high-quality broadband and the growth in multi-platform and device viewing has led to a proliferation of new sports OTT services - including a new generation of sports OTT aggregators, and D2C services offered by leagues, clubs and broadcasters. In fact, six of the top ten global sports leagues and federations by revenue - notably those in the U.S. market - have launched premium OTT services to drive additional engagement and revenues from their most loyal fans.

Last but not least, there is an increased need for scalable service protection - protecting



content is no longer enough. The entire service of an operator needs to be taken into account, with technology that goes beyond traditional conditional access systems (CAS) and Digital Rights Management (DRM) systems to ensure operators are armed to overcome the many threats levied against their services – whether direct threats to content, as well as broader threats at the service level from vast armies of zombie IoT devices. And, as consumers continue to drop their ‘big bundle’ pay-TV subscriptions, high-quality pirated services might become even more prevalent as an even cheaper alternative to low-cost streaming services. Anti-piracy services and forensic watermarking also need to be a part of that approach.

As viewing behaviors continue to evolve, more ‘Netflix-like’ pirate OTT services are expected to increase in availability, offering large on-demand content libraries and combining them with live news and sports. As IP-based content distribution costs continue to fall, monetizing pirated content via OTT channels is becoming an increasingly profitable business for pirates who do not have to face the full cost of content production. Given this, pirate services are increasingly likely to offer high-quality, professional-grade experiences that effectively compete with legitimate services.

**Kurt:** What do you see as the key remaining challenges you have identified in the OTT video market that must be addressed?

**Anthony:** The industry is going through significant change, and with this change comes a number of challenges. In conjunction with smart aggregation and content and service protection that I already mentioned, there remain significant OTT-era hurdles around increasing business performance and monetization, and improving viewer engagement.

The evolution of business models and smart aggregation to meet consumer demand is needed, but the path to accomplish this is not clear for most. To adapt to the changing landscape, industry executives expect traditional pay-TV packages to be radically re-structured in the next decade. For success, the new landscape must include a new generation of super-aggregator offerings that I outlined earlier, as well as a range of other changes, including fewer linear channels and a more flexible and diverse range of prices and packages. Success depends on the ability to anticipate the market’s rapidly changing conditions and embracing a new aggregation model that combines the best of pay-TV with the best of OTT streaming.

When it comes to business performance and monetization, using data in an efficient way has always been a challenge. However, with an AI-driven business performance platform, such as NAGRA Insight, companies can access and leverage the right data to drive acquisition, reduce churn, and monetize content to optimize

business performance. The right data available in real-time provides the opportunity for actionable analytics which results in the ability to upsell by targeting current and potential customers who are most likely to convert with relevant content and services. This is particularly important as providers experiment with new ways of pricing and packaging content and seek to find the best combinations for each customer.

**Kurt:** What is NAGRA doing to help its customers meet these challenges?

**Anthony:** With the OpenTV Suite, we’re enabling providers to leverage a next-generation OVP solution to deliver a super-aggregated viewing experience for a broad variety of consumer device ecosystems, including Android TV. Should a customer wish to go down the Google path, we are able to rapidly marry the TV Business Service Platform to the features and services of Android TV to create a very compelling service. And as with any service, the Operator needs to know what is happening within their business; so we have additional products that drive the business logic towards a more active content monetization and content management focus with the ability to make changes to UI-UX content and business rules on the fly.

As I mentioned before, we have a very unique AI-driven pay TV platform solution, NAGRA Insight. This platform provides recommendations on business actions to help operators make better strategic decisions, drive their business more effectively and improve their bottom line. For example, NAGRA Insight can predict the individual behavior of TV viewers, such as their propensity to churn, to purchase a package or to consume specific content. It’s an invaluable tool to optimize business performance and address specific business challenges.

As I outlined in an earlier question, content piracy and service protection will continue to be seen as a considerable challenge. This is why we extended our security solutions to address (at scale) any content distribution channel or evolving user experience offering, in the context of new aggregation and monetization challenges. NAGRA cloud.SSP offers an advanced and modular software-as-a-service (SaaS) security services platform that comprehensively addresses all dimensions of content and service protection for the connected world. The unified broadband and broadcast security client, NAGRA Connect, and the Conax Contego security platform are elements of this comprehensive solution.

In parallel, we have ramped up our anti-piracy service to help our customers take a holistic, pragmatic and value-driven approach to managing piracy risks. Watermarking and anti-piracy services are a key part of our scalable

service protection approach and are designed to stop piracy at the source by marking content and by disrupting or blocking access to pirate services.

**Kurt:** Do you have any examples of customers who are having success?

**Anthony:** With a solid history in pay-TV, we can proudly say that we have more than 500 service and content providers around the world using our solutions to help secure more than \$90 billion in revenue, while delivering video content to more than 300 million devices.

At IBC we announced that Vodafone has deployed our cloud-hosted and cloud-operated Security Services Platform, NAGRA cloud.SSP, to help protect Vodafone TV (VTV) services across a large number of operating companies including those in Spain, Portugal, Greece, Italy and Romania. As part of the deployment, the NAGRA Connect client and player complement the end-to-end security solution to enable comprehensive security for VTV across set-top boxes, web browsers, open devices and connected TVs.

NAGRA cloud.SSP was also selected to secure streaming content and support a multi-DRM solution for Wynk, a subsidiary of Bharti Airtel Limited, India’s largest integrated telecom services provider. This latest win marks the first deployment of the cloud.SSP for an OTT pure play service in India.

We also deployed a range of solutions worldwide; Euskaltel in Spain is a full TV Everywhere service that has plans for a nationwide deployment. Linknet in Indonesia is another example. These are both very strong Android deployments.

Montecable, the leading cable operator in Uruguay, deployed our cloud-based turnkey OTT solution, Conax GO Live, to enable new features for their pay-TV service, including Android TV support and video-on-demand (VOD). HD PLUS is the first operator to deploy NAGRA’s TVkey Cloud on its satellite platform. With TVkey, they can activate consumers right from the smart TV app store, similar to the OTT app experience, and deliver the best of Internet and TV experiences. In addition, we have delivered many other turnkey OTT projects in both Europe and LATAM.

These are just a few of the many examples of clients who are experiencing success using our technology, expertise and services.

**Kurt:** Anthony, thanks for walking us through NAGRA’s story, and what you see as the challenges the industry continues to face. You touched on a lot of issues - Security, Piracy, showverload (too much content on too many services) and the need for aggregators among them. There is certainly a lot to keep our eyes on in this rapidly evolving market! □



# Leveraging Emerging Technology to Drive the Media Industry Forward

By: Hillary Henderson

Digital brands across the news and entertainment landscape are all vying for consumer attention. And the truth is, there is no one-size-fits-all solution to drive audience engagement and brand revenue. With technologies like Augmented Reality (AR) and Artificial Intelligence (AI) at their fingertips, how can publishers decide which platforms are worth investing in and when to invest?

### Bring Stories to Life with Immersive Tech

With an influx of different forms of digital entertainment like streaming video and podcasts, solely text-based digital and print news have lost their appeal to mainstream consumer audiences. Even the New York Times and the Wall Street Journal have had to adjust their monetization strategies for digital content, to account for print numbers continuing to decline. How can these legacy brands entice readers and keep text-based engagement alive? Implementing immersive technology to deliver dynamic and interactive storytelling is key.

AR technology can be used to bolster print media stories, literally bringing the text to life. Relying on the ubiquity of smartphones, publishers can add video content to print media stories by having readers simply hold their phone in front of the physical newspaper or magazine.

For example, Sports Illustrated immersed readers in the treacherous climb up Mount Everest for its Capturing Everest issue of the print magazine. Readers could use their phones to unlock 360 degree video clips and virtually join the trek. Building on its success, Sports Illustrated has added video content to its annual College Football Preview and Swimsuit issues. By incorporating more creative storytelling across digital and print mediums, national publishers can deliver traditionally static news content in a more interactive way, and in turn, increase audience engagement, ad revenue and brand loyalty.

### Create More Personalized Experiences with AI

In addition to creating dynamic news stories with AR, publishers can leverage Artificial Intelligence (AI) to create highly relevant and personal digital media experiences at scale. In particular, publishers with large, unstructured video content libraries have an incredibly difficult time identifying the best video to

compliment written stories. With AI, publishers can analyze specific elements of video content automatically and then embed customized, engaging video playlists into digital news articles.

For example, suppose a national publisher has excellent brand recognition and organic site-traffic, but cannot keep audiences on its platform for an extended period of time. AI technology will help illuminate which specific elements of video best entertain audiences - whether it's pranks or celebrity interviews - and then create unique, video playlists to embed into relevant articles for each individual reader. This level of personalization and increased audience engagement allows publishers to charge more per ad-spot and ultimately drive the bottom line for business.

Similarly, AI helps broadcasters quickly identify relevant video content to streamline the production of video clips for breaking news across digital news and social platforms. Coupling huge libraries of archived footage automatically categorized with geographic and weather data, producers can curate breaking news updates such as natural disasters, and recommend it to viewers.

AI technology can also serve as a headline optimizer for individual stories, driving more traffic to news sites through improving SEO. Forbes, for example, created a proprietary AI tool, Bertie, which gives contributors headline recommendations based on the sentiment of their articles and suggests images to accompany written content too. In the future, publishers may use this technology to experiment with creating and disseminating unique headlines that will encourage individual readers to engage with specific content.

### Add Convenience and Broaden Offerings with Voice

In today's on-demand economy, consumers expect entertainment at their fingertips, all the time. With voice technology, publications can streamline the content discovery process for consumers, delivering information directly and within seconds. For example, investing in voice technology allows local news providers to disseminate public safety and weather updates in real-time. With nearly 120 million smart-speaker devices active in United States households, these devices can automatically share pertinent and potentially life-saving



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*and OTT solutions across mobile, web, and TV-connected devices. She forges partnerships with video ecosystem partners to create value, drive revenue, and reduce audience churn for media and entertainment clients. Before its acquisition by IBM in 2015, Hillary was a longtime member of the Clearleap team, having been involved with the company's product development since 2009. Hillary leverages her previous experiences in product management at The Weather Channel and COX Digital Media Group to advance IBM Cloud Video's innovative technology platform.*

information with local audiences.

Voice technology can also help publishers diversify their business models and engage with new audiences. NPR, for example, recently turned its broadcast morning news show into a separate, more digestible podcast called Up First, which can be accessed on smart speakers.

For even more niche publications—think food outlets like Tasty or AllRecipes—voice technology can help create engaging and educational experiences. Publishers can distribute cooking instructions via smart speakers, timed specifically with certain steps within a recipe. During this process, these publishers can distribute other related content and ads to sustain engagement.

AR, AI and voice technologies will all play a crucial role in transforming the way stories are told and experienced. But it is important that publishers don't just throw everything in the kitchen sink. With a tailored and varied approach to implementing these technologies, publishers will create engaging, personal and seamless entertainment for today's always-on audiences. □







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