streaming media [SM]

THE BUSINESS & TECHNOLOGY OF ONLINE VIDEO

european edition

101

COMPANIES LIGHTING UP THE ONLINE VIDEO INDUSTRY

Table of
contents

FEATURES

COLUMNS

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Streaming Forum Gets Smarter

At the 2017 CES in Las Vegas, the most impressive—or at least most intimidating—display was Amazon's giant Echo speaker-shaped meeting room. Far away from the aisles of TVs, iPhone cases, and Bluetooth speakers that cluttered the Las Vegas Convention Center, the 12-foot-tall cylinder dominated the hallway outside the exhibit hall dedicated to C Space, the part of CES dedicated to "creative communications, brand marketing, advertising, digital publishing, social networking, and entertainment."

In other words, the place to go to see the future of media and content. And if Amazon's Echo—the central feature of which is Alexa, the company's digital personal assistant—dominated C Space, the artificial intelligence (AI) that makes Alexa (and Siri and Cortana) possible has dominated discussions about the future of over-the-top (OTT) video ever since. AI and machine learning are changing the way video is created and consumed. From camera tracking and graphics to analytics and recommendation to monitoring social media sentiment, no segment of the video creation and delivery chain is untouched, and that's as thrilling (and, some would argue, scary) as stepping into a giant Echo in Vegas.

The spotlight has been shone on the scary side recently, with a slew of articles like "Something Is Wrong on the Internet" (go2sm.com/medium) highlighting how YouTube's algorithms push kids from harmless nursery rhyme videos to clips showing popular characters like Peppa Pig in disturbing scenarios. It's the logical extension of the "you may also like" recommendations found on every OTT service, but the fact that it's targeted at toddlers and accelerated by autoplay should make all of us reckon with how computers are dictating what we see and hear.

Of course, AI and machine learning aren't inherently nefarious, and forward-thinking creatives and technologists are using those technologies to build better products and services in every field, from healthcare to manufacturing, and OTT is no exception. That's why we've chosen to highlight AI, machine learning, and neural networks and their impact on online video at the 2018 Streaming Forum in London, where we'll focus on "building smarter OTT services."

We're putting together a programme that offers insights into all the ways AI is impacting OTT—helping publishers maximise their QoS and QoE by deploying AI-based analytics in the network, increase their revenue by microtargeting advertising, decrease customer churn by making sure viewers receive a steady stream of content they love, and delight consumers by tailoring user interfaces for specific devices and types of content.

Not every session at Streaming Forum will address AI, because machines and networks are (for now, at least) only as smart as the people who design them. We've got one of the smartest people in the OTT business, Sky's principal streaming architect Jeff Webb, kicking things off with a keynote called "Streaming in the Land of Containers." Webb will offer a look inside Sky's live-streaming platform, which is moving toward a containerised, microservices architecture that he says features self-healing capability and end-to-end automation. The 2018 rollout of the OTT version of Sky Q is one of the most anticipated developments in streaming video, and Webb's talk will offer a rare chance to look under the bonnet of an OTT service at (or near) launch.

You can also expect sessions that will help you get smarter about encoding and transcoding, VR and 360° video, delivery and distribution, content protection and DRM, and live event and live linear streaming. Find out more about the 2018 Streaming Forum, which will be held alongside BVE at London's ExCel on 27 February, at streaming-forum.com.

Eric Schumacher-Rasmussen (erics@streamingmedia.com) is editor of *Streaming Media*, as well as conference chair of Streaming Forum.
Comments? Email us at letters@streamingmedia.com, or check the masthead for other ways to contact us.

Blackmagic Video Assist 4K adds professional monitoring, scopes, and HD and Ultra HD recording to any camera!

Now it's easy to add professional monitoring and scopes, along with HD and Ultra HD recording to any SDI or HDMI camera! Blackmagic Video Assist 4K has a large super bright 7 inch monitor so you can see your shot clearly, making it easier to frame and get perfect focus! Featuring two high speed SD card recorders that save HD and Ultra HD video as 10-bit 4:2:2 ProRes or DNxHD files, you get superior quality than what most cameras can record.

On Set Monitor with Professional Scopes
The super bright 7 inch screen is bigger than the tiny displays found on most cameras! You get video monitoring and a highly accurate vector scope, RGB parade, waveform monitor, and histogram. With support for up to six 3D LUTs, focus assist, exposure tools with false color overlays and more, you'll always get perfect looking shots!

Non-Stop HD and Ultra HD Recording
Now you can bypass the lossy compression used on most DSLR and video cameras! With 2 high speed UHS-II recorders that use commonly available SD cards, you'll never miss a shot because when one card is full, recording automatically continues onto the next! You get 10-bit 4:2:2 ProRes or DNxHD files that work with all editing software.

High Quality Audio Recording
Get better quality sound recording than your camera! Blackmagic Video Assist 4K features two mini XLR inputs with 48V of phantom power and an extremely low noise floor of -128dBV so you can attach professional microphones. Audio is embedded in the same file with the video, so you don't have to worry about syncing separate files!

Broadcast Quality Connections
Blackmagic Video Assist 4K includes HDMI and 6G-SDI inputs so you can record from virtually any camera or DSLR. The HDMI and SDI video outputs let you view shots on larger screens or even projectors! You also get a built in speaker, headphone jack, LANC, 12V power and two LP-E6 battery slots for non stop power!

Blackmagic Video Assist 4K
€765*

Learn more at www.blackmagicdesign.com/nl

Buzzword Bingo

View From the Edge

By Dom Robinson

W e're hitting an interesting time for innovation in streaming media, with a number of technologies being touted around the market that seem to produce video content that only machines can benefit from.

When folks started humorously noting that to watch 4K you need to sit closer than 8' away from a 10' diameter display, we all laughed a little, but still started working out how to mention 4K in our marketing to ensure that we didn't seem inferior to our peers and competitors.

When 8K came along, we started to think about justifying TV sets for our trade show booth displays that would cost as much as the home that any consumer might put them in.

With AR and VR, we are always referring to the shortcomings as "limitations of today's iteration, but boy won't it be immersive when that technology catches up."

And with HDR, we are all upgrading our workflows and pipelines to support colour ranges that exceed human perception or at least are far beyond the eyes of the average consumer.

But rather than get into a bun-fight with the religious over each of these (which I am sure will be fun in the proper setting!), let's look ahead and see if we can seed a few new ideas into the market. It's quite simple, really. All we need to do is select a bunch of current buzzwords, write them on bits of paper, and draw them out of a hat.

Here are the buzzwords: AI, big data, deep learning, tensor flow, autonomous, containerised, microservice, low latency, high scale, hybrid cloud, ultra, dynamic, range, carrier, OTT, X, lossless, low bandwidth, high security, sensory, IoT, blockchain, DRM, GPU compression, software-defined, and 5G. (Don't understand some of the acronyms? That's a feature, not a bug!)

From these, I am going to create three new products for 2018. You will notice that the ubiquitous term "edge" is not among the choices. In fact, I am going to include that with each.

You can see the results in the photo, right.

Then I asked my colleagues at id3as to pick one row each and give me a 50-word product definition:

First out of the box is the 0.9 release of Tensor-Flow GPU Microservice. The product will be re-leased through Kickstarter (raising more than any previous Kickstarter project) at a random date (to be determined by a roll of the dice) next year.

TensorFlow GPU Microservice

Using the power of our high-density GPU units, we will create a low-maintenance and remote TensorFlow-based intelligence that will be there when you need it the most—paying for the decisions only when you want them. Introducing AI to your business workflows has never been this easy.

The Edge release will of course follow and be suited to IoT and MEC environments.

Software-Defined Containerised IoT

Redefining IoT to mean "Intelligence of Things," we will take the concept of hardware out of the IT equation, relegating the need for silicon to the past. In fact, we aim to ensure this product redefines IT to Information Software (IS), and, likewise, IoT will become Intelligence of Software (IoS). You will be able to scale down
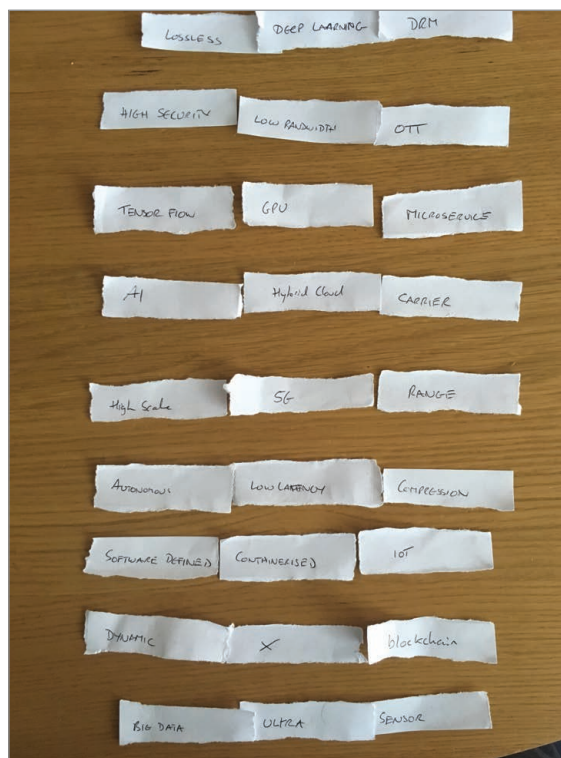
Buzzword Bingo: the streaming industry's hottest new parlour game?

your platform to non-existent at will, protecting your investors while occupying your competition in a faux war they cannot ever win.

The Edge release will be completely intangible.

Lossless Deep Learning DRM

Bringing together data mining at scale with blockchain to preserve all the transactional logging relating to a file's use, we will offer a DRM like no other. It will endlessly increase the data payload that the content will need to carry to be usable. This will increase the friction (network distribution will become increasingly more expensive and less efficient), meaning that pirates will be disincentivised to rebroadcast the content even if they share security keys or otherwise manage to redistribute the content. After merely a few copies, the files will be guaranteed to be so large and full of transactional logging in-formation, they will be too expensive and time-consuming to transfer efficiently over even the largest multi-terabit submarine cables.

The Edge release will be available as a browser plugin and guaranteed to cripple even the most advanced supercomputers.

We will be offering all the IPr to the MPEG-LA for oversight and seeking to get the ITU to ratify the APIs as standards.

I'm looking forward to seeing what other Buzzword Bingo results readers come up within the comments on the online version of this article.

Dom Robinson (dom@id3as.co.uk) is co-founder, director, and creative firestarter at id3as.
Comments? Email us at letters@europe.streamingmedia.com, or check the masthead for other ways to contact us.

Tips for a Better Facebook Live Experience

The Video Doctor

By Robert Reinhardt

C lients who produce live events frequently ask me to also provide alternate feeds to Facebook Live and occasionally to YouTube Live. Typically, my implementation has the initial outbound stream from the live venue published to a streaming server that pushes the stream from the server to a specific Facebook destination such as a timeline, group, event, or page. Here's a short list of some of the questions/issues I consider when prepping to stream in a social media context.

Creative Solutions for Multiple Live Feeds

If you only require a single live feed for your Facebook audience, native apps will be the most efficient solution. Facebook Live has some great features, and there are free alternatives such as Open Broadcaster Software, available at obsproject.com.

When my clients want to push a live stream to multiple outlets but we have limited outbound bandwidth at the event venue, I use Wowza Streaming Engine (WSE) to handle all the routing of live streams. Many of my clients have existing Real-Time Messaging Protocol (RTMP) ingest workflows that utilise WSE. Adding a stream target for Facebook Live allows you to automatically publish specific stream IDs to a Facebook Live destination. In my onsite workflow, the output from my camera or video mixer feeds to an RTMP-based H.264 hardware encoder such as the Teradek Cube, AJA HELO, or similar device. This device then pushes the live stream to a WSE server instance. This server can provide a direct stream to my client's web or mobile apps, as well as handle the output to Facebook Live. With the server as the go-between, I only need enough bandwidth to route one stream to the server, which has more than enough bandwidth allocation to route SD and HD streams to multiple locations.

Quality Control Options

I test the available bandwidth at the venue as much as possible to determine the highest bitrate and quality I can push to Facebook Live. One handy feature of Facebook's native publishing tools is that you can enable HD Upload in your user or application settings of the mobile app. HD Upload automatically replaces the recorded live stream on Facebook with a higher-quality version stored locally on your device. This version is uploaded after you end the live stream and post to the page. All of the viewer commentary and feedback is kept intact during the swap.

You can accomplish similar results with third-party publishing tools by removing the archived Facebook version of the live event and posting your own edit from locally recorded sources, but you'll lose the commentary from the original live stream recorded by Facebook.

Ensuring Proper Security Measures

Unless you are the regular administrator for a Facebook destination, you will need to arrange access with your client. Do not ask for their own private credentials for their Facebook account. A far more secure route is to have them add your Facebook account to their page, group, or event settings, and provide posting privileges. Later, your client can remove your access.

Avoiding Accidental Copyright Infringement

Some events I've worked on have played copyrighted music over the PA system during breaks, introductions to speakers, or awards ceremonies. While you probably can stream uninterrupted to Facebook during the live event, it's likely that Facebook's automation systems will detect the copyrighted music in the audio channel in post-processing and will not allow the content to be archived on Facebook. Work with your client early to make sure royalty-free music is used during any live-stream push.

Working through these topics with your client in advance of a live event will ensure that expectations are met and that you can deliver the best-quality viewing experience during the live feed and for archived content as well.

Robert Reinhardt (robert@videorx.com) is founder of VideoRx and is internationally regarded as an expert on multimedia application development and online video, particularly in HTML5, iOS, Flash, AVC/H.264, and HEVC/H.265.
Comments? Email us at letters@streamingmedia.com, or check the masthead for other ways to contact us.

AROUND THE **THE WORLD** IN **1 SECOND**

nano COSMOS

your live stream

nanoStream Cloud
Ultra low latency live video streaming

nanoStream Live Encoder → **nanoStream Cloud** → **nanoStream H5Live Player**

LIVE AUCTIONS • BETTING • GAMING • TELE HEALTH • BUSINESS COMMUNICATIONS

nanoStream Cloud
Scalable end-to-end solution to rock your interactive live streams.
Cross-platform and SUPER easy to use for your own brand.

nanoStream Cloud includes:
- **nanoStream H5Live Player,** ultra-low-latency live streaming on any HTML5 browser, including Safari on iOS.
- **bintu.live API** to create, group, tag and manage streams.

Easy to integrate to existing workflows - worldwide CDN for ultra-low-latency delivery.

nanoStream Cloud add-ons
Power your nanoStream Cloud adding our extra tools to achieve an even better ultra-low-latency experience:
- **nanoStream Apps and SDKs** for true cross-platform encoding and playback
- **nanoStream WebRTC.live broadcaster** for plugin-free browser-based live encoding

www.nanocosmos.de   Android   •   iOS   •   MacOS   •   Windows   •   Browser platforms   •   WebRTC   •   H5Live

A Better HEVC Codec?

The Producer's View

By Jan Ozer

It's easy to imagine the deployment of HEVC as a case study in business and technology schools about how *not* to launch a technology. Not only do you have a launch cycle that clearly limited adaption, you also have classic illustrations of two of the major problems related to standard-essential patents, patent holdup, and royalty stacking.

Patent holdup refers to the practice of waiting to declare your patent rights until after the technology has become accepted. Early adopters choose the technology without a realistic estimate of cost, and once hooked, the costs of changing technologies are so high that the IP owner can charge a much higher royalty than it could at the start. The participants in the Velos Media patent pool, which launched (by my count) 4 years, 4 months, and 5 days after HEVC received first-stage approval, is the perfect example.

The second problem, royalty stacking, describes a scenario where so many patents are involved that even if each is fair, reasonable, and non-discriminatory (FRAND), as standard-essential patents are required to be, the total cost becomes unreasonable. When MPEG LA announced its $0.20/unit, $25 million annual cap pricing, it was tough to swallow, but it felt reasonable. Then HEVC Advance launched with per-unit pricing nearly 10 times as high, and a cap close to double, and the combined pricing didn't feel nearly as FRAND-ly.

As I write this in mid-October, Velos still hasn't announced its rates, so the total damage isn't known. While we know that Technicolor also claims to have other HEVC-related intellectual property, there's actually no guarantee that there won't be others.

Most readers know all this. So why am I recounting? Because there's a Stockholm-based company named Divideon offering a new codec that uses technology from the HEVC and Video Coding Experts Group (VCEG) and a novel design to simplify and add certainty to codec pricing. Specifically, Divideon's xvc codec comes with a guarantee that your royalty will be fixed for the life of the contract, protecting against Velos-like surprises.

Here's how it works: when creating the codec, Divideon traced the IP relating to each component back to its inventor. Patent holders who chose to participate registered with Divideon; if they declined to register, their technology wasn't included. The codec design is modular, so if any infringements occur, Divideon can remove that technology from the codec.

If xvc licensees are approached with an infringement claim, Divideon has 60 days to license the IP (at no cost to you), fight the claimant (and bear all costs and damages), or remove that IP from xvc. Of course, while this guarantees a known royalty, you may lose quality or performance if an IP owner unexpectedly appears and won't participate, forcing Divideon to remove the IP from its codec. I asked about this, and the company responded that licensees pay by the month and can discontinue anytime. While this provides some protection, you still may be forced to convert from xvc sometime down the road if this scenario occurs, which could be seriously problematic if you've deployed xvc in hardware. No solution is without risk.

How does the codec perform? From a development perspective, it's a work in progress. However, the company prepared some test streams that I was able to compare with H.264, x265, the MainConcept HEVC codec, VP9, and AV1 files at the same data rate. It wasn't a totally apples-to-apples comparison for many reasons, but in the two real-world files, xvc was the quality leader. In the Sintel comparison, xvc trailed only MainConcept. Pretty impressive performance.

It's definitely early days, but xvc appears to be a codec you should keep your eye on.

Gazing West to the East

By Tim Siglin

Streams of Thought

L ast month, a who's who of the streaming media industry gathered on the shores of the Pacific Ocean to breathe in the salt-laced air, catch up with colleagues, and hear presentations spanning the gamut from how-to's to how-not-to's.

During one of the sunset, after-hours events at Streaming Media West at the Huntington Beach Hyatt Regency—while the streaming industrialists enjoyed cold beverages, good conversations, and an awesome band—it might have benefited the industry as a whole to collectively cast our gaze as far west as possible across the ocean waves.

The other side of the Pacific is ringed with countries like Australia, Japan, Taiwan, and China. This, the collective Asia-Pacific market (APAC), is a market rife with potential and pitfalls for streaming, full of growth opportunities and tricky licensing bridges to navigate.

One of the latest pitfalls, which only recently came to my attention in the form of a data point on an enterprise video platform (EVP) white paper I was commissioned to create, is the need for online video providers to obtain an Internet Content Publishing (ICP) license in China.

It turns out that, regardless of how popular your content might be in China, it will most likely suffer significant delays and lower quality if it is streamed from a content delivery network (CDN) outside the Great Firewall of China. In fact, some of the content itself may not even traverse the firewall.

This leads to the natural technical conclusion: host Chinese-facing videos within the Great Firewall of China, or at least cache the content somewhere in mainland China. But this delivery conundrum, it turns out, is more political than technical in nature.

Companies that want to host on-demand content in China need to either host it with an ICP-compliant company or obtain their own ICP licences. Even those multinationals that use an EVP for subsidiaries or key Chinese partners—which may be linked to the corporation's headquarters country in Europe or North America via a virtual private network (VPN)—need to obtain an ICP for con-

tent that will likely never be available for public consumption.

Recent statements by Chinese government agencies are adding an additional wrinkle, even for those websites and applications that emphasise live- and social-media-focused video delivery.

Chinese government agency SAPPRFT (short for the State Administration of Press, Publication, Radio, Film and Television) halted live streaming on several Chinese websites in late June 2017, including the ever-popular Weibo, which is a NASDAQ-listed company (ticker symbol WB) owned by a Chinese government entity called Sina (ticker symbol SINA).

The initial announcement sent SINA down almost $20 a share, or around 20 percent, in the days following the SAPPRFT crackdown on Weibo. The stock has since recovered to pre-June levels, and Weibo itself seems to have weathered the storm by quickly issuing a few key changes to its live-streaming and video-sharing features, with its stock rising in the past 2 months more than 25 percent.

According to *Marbridge Daily*, two parts from the new Weibo terms of service highlight the changes:

First, "With the exception of accounts operated by media and government entities, account holders who do not have a type-1 audio-visual license may not upload political and current affairs news programming."

Second, even those with a licence weren't allowed to continue posting until verified, as Weibo stated: "… account holders who have a license must provide proof of licensing to Weibo, so that Weibo may verify their credentials."

What's interesting about this move by the SAPPRFT is the fact that Weibo hosted its content on two approved and licensed service providers: Miaopai and Yizhibo.

Karen Chan, an analyst for Jeffries, made the case for Weibo to weather the storm unharmed. Her response was fairly quickly picked up by *Barron's* less than 24 hours after the initial statement by SAPPRFT.

According to Chan, all of the video served and streamed on Weibo "is hosted exclusively through Miaopai and Yizhibo respectively, both

of which are owned by Yixia Technology, a parent company with the required licence."

Yet, less than 2 days later, Weibo had already changed its terms of service, including this potentially discourse-killing new rule: "Weibo will no longer accept uploads of videos over 15 minutes in length."

The one other company noted in the *Barron's* article was Momo, a service that offers paid live-streaming accounts. Its stock also weathered the SAPPRFT storm, but at the time of this writing in late August it had seen a drop-off in value of almost 20%, despite revenues surging over 200% compared to last year.

The reason for the drop in share price? Lack of investor confidence in Momo's ability to grow the number of paying users for its live-streaming services. According to analysis of Momo's services, the number of new paying users is "more or less flat" compared to the previous quarter.

Might it be possible that the SAPPRFT statements requiring licences for anyone live-streaming content in China could have significantly chilled—or at least significantly delayed—market growth for live streaming there?

That's a question to ponder for those of us on this side of the Pacific.

Tim Siglin is a streaming industry veteran and longtime contributing editor to *Streaming Media* magazine. Comments? Email us at letters@streamingmedia.com, or check the masthead for other ways to contact us.

The 2017 *streaming media europe*

101 COMPANIES LIGHTING UP THE ONLINE VIDEO INDUSTRY

Our sixth-annual list of the most important companies in the European online video market

BY ERIC SCHUMACHER-RASMUSSEN

This year's Streaming Media Europe 101 is our sixth annual list of the most interesting, important, and influential companies in the online video space, and it's our most Euro-centric 101 list yet. We still acknowledge the importance of U.S.-based companies that are active in Europe, but this year's list contains fewer U.S.-based companies than in any of our previous lists —companies that even a Europe-focused list like this one can't ignore.

Those are some of the more familiar names on the list as well; none of the U.S. companies mentioned here are startups, and most have been operating for more than a decade. The same can't be said of the rest of the list, which includes more than 15 companies that weren't on last year's list, pointing to the fact that even though the European market has reached a level of maturity, there are still plenty of upstarts that are worth our attention—and yours.

Once again this year, we stayed away from honouring content publishers, and instead we're emphasising the companies that create the technologies that enable those content publishers to grow their businesses.

So how do we pick the Streaming Media Europe 101? We start with a master list of all the companies we're aware of in our space, then ask our editorial and publishing team to rank them on a scale of zero (doesn't belong on the final list at all) to five (no list of important companies would be complete without it). The top 101 make the list. Interestingly, not a single company averaged a perfect five.

Congratulations to the 101 companies that matter most in online video.

THE 2017 STREAMING MEDIA 101 VOTERS

Troy Dreier
Adrian Pennington
Dom Robinson
Eric Schumacher-Rasmussen
Sjoerd Vogt

100TB

100TB.COM
FOUNDED: 2008
CHIEF OFFICER: TOM HANCOCK,
GENERAL MANAGER

24i Media

24I.COM
FOUNDED: 2009
CHIEF OFFICER: MARTIJN VAN HORSSEN,
CO-FOUNDER AND CEO

3xScreen Media

3XSCREEN.CO.UK
FOUNDED: 2009
CHIEF OFFICER: SCOTT ROBINSON,
FOUNDER AND MANAGING DIRECTOR

Accedo

ACCEDO.TV
FOUNDED: 2004
CHIEF OFFICER: MICHAEL LANTZ, CEO

AccepTV

ACCEPTV.COM
FOUNDED: 2008
CHIEF OFFICER: MATHIEU CARNEC,
CEO AND TECHNICAL DIRECTOR

AdsWizz

ADSWIZZ.COM
FOUNDED: 2007
CHIEF OFFICER: ALEXIS VAN DE WYER, CEO

Agama Technologies

AGAMA.TV
FOUNDED: 2004
CHIEF OFFICER: MIKAEL DAHLGREN, CEO

Akamai Technologies

AKAMAI.COM
FOUNDED: 1998
CHIEF OFFICER: TOM LEIGHTON, CEO

Amazon Web Services

AWS.AMAZON.COM
FOUNDED: 1994
CHIEF OFFICER: JEFF BEZOS,
PRESIDENT, CEO, AND CHAIRMAN

Amino Communications

AMINOCOM.COM
FOUNDED: 1997
CHIEF OFFICER: DONALD MCGARVA, CEO

Anevia

ANEVIA-GROUP.COM
FOUNDED: 2003
CHIEF OFFICER: LAURENT LAFARGE,
PRESIDENT AND CEO

Apple

APPLE.COM
FOUNDED: 1976
CHIEF OFFICER: TIM COOK, CEO

Arkena

ARKENA.COM
FOUNDED: 2014
CHIEF OFFICER: AYMERIC DE CARDES, CEO

Arqiva

ARQIVA.COM
FOUNDED: 2005
CHIEF OFFICER: SIMON BERESFORD-WYLIE,
CEO

Ateme

ATEME.COM
FOUNDED: 1991
CHIEF OFFICER: MICHEL ARTIÈRES,
CO-FOUNDER, PRESIDENT, AND CEO

Avioon

AVIOON.COM
FOUNDED: 2014
CHIEF OFFICER: TILO SKOMUDEK, CEO

AVIWEST

AVIWEST.COM
FOUNDED: 2008
CHIEF OFFICER: ERWAN GASC, CEO

Axinom

AXINOM.COM
FOUNDED: 2001
CHIEF OFFICER: RALPH WAGNER,
CO-FOUNDER AND CEO

Bambuser

BAMBUSER.COM
FOUNDED: 2007
CHIEF OFFICER: HANS ERIKSSON, CEO

Beamr Video

BEAMR.COM
FOUNDED: 2009
CHIEF OFFICER: SHARON CARMEL, CEO

Bitmovin

BITMOVIN.COM
FOUNDED: 2013
CHIEF OFFICER: STEFAN LEDERER,
CO-FOUNDER AND CEO

Bridge Technologies

BRIDGETECH.TV
FOUNDED: 2004
CHIEF OFFICER: SIMEN FROSTAD, CHAIRMAN

Broadpeak

BROADPEAK.TV
FOUNDED: 2010
CHIEF OFFICER: JACQUES LE MANCQ,
CEO AND PRESIDENT

BT

BT.COM
FOUNDED: 1982
CHIEF OFFICER: BAS BURGER,
CEO, GLOBAL SERVICES

castLabs

CASTLABS.COM
FOUNDED: 2007
CHIEF OFFICER: MICHAEL STATTMANN
AND MARTIN TEWS, MANAGING DIRECTORS

Cinegy

CINEGY.COM
FOUNDED: 2002
CHIEF OFFICER: JAN WEIGNER,
CTO AND PRESIDENT

Cires21

CIRES21.COM
FOUNDED: 2008
CHIEF OFFICER: ERNESTO SÂEZ, CEO

Cleeng
CLEENG.COM
FOUNDED: 2011
CHIEF OFFICER: GILLES DOMARTINI,
CO-FOUNDER AND CEO

Comprimato
COMPRIMATO.COM
FOUNDED: 2013
CHIEF OFFICER: JIŘÍ MATELA,
CO-FOUNDER AND CEO

Conax
CONAX.COM
FOUNDED: 1994
CHIEF OFFICER: MORTEN SOLBAKKEN,
PRESIDENT AND CEO

ContentArmor
CONTENTARMOR.NET
FOUNDED: 2016
CHIEF OFFICER: ALAIN DURAND, CEO

Dalet Digital Media Systems
DALET.COM
FOUNDED: 1990
CHIEF OFFICER: DAVID LASRY,
CO-FOUNDER AND CEO

Danidin (A GlobalDots Company)
GLOBALDOTS.COM
FOUNDED: 2002
CHIEF OFFICER: SHALÔM CARMEL, CTO

Datapath
DATAPATH.CO.UK
FOUNDED: 1982
CHIEF OFFICER: BJORN KRYLANDER,
MANAGING DIRECTOR

Dativa (formerly Genius Digital)
DATIVA.COM
FOUNDED: 2012
CHIEF OFFICER: MICHAEL COLLETTE, CEO

DDVTech
DDVTECH.COM
FOUNDED: 2009
CHIEF OFFICER: ALFRED DIJS,
FOUNDER AND CEO

Deltatre
DELTATRE.COM
FOUNDED: 1986
CHIEF OFFICER: GIAMPIERO RINAUDO,
CO-FOUNDER AND CEO

Deutsche Telekom
TELEKOM.DE
FOUNDED: 1996
CHIEF OFFICER: TIMOTHEUS HÖTTGES,
CEO

Edgeware
EDGEWARE.TV
FOUNDED: 2004
CHIEF OFFICER: JOACHIM ROOS,
CO-FOUNDER AND CEO

Ericsson
ERICSSON.COM
FOUNDED: 1876
CHIEF OFFICER: BÖRJE EKHOLM,
PRESIDENT AND CEO

Exterity
EXTERITY.COM
FOUNDED: 2001
CHIEF OFFICER: COLIN FARQUHAR,
FOUNDER AND CEO

Fly On The Wall
FLYONTHEWALL.COM
FOUNDED: 2001
CHIEF OFFICER: JASON GLEAVE,
CHIEF EXECUTIVE

Fraunhofer Heinrich Hertz Institute
HHI.FRAUNHOFER.DE
FOUNDED: 1928
CHIEF OFFICER: HANS-JOACHIM GRALLERT,
MANAGING DIRECTOR

Fraunhofer Institute for Integrated Circuits IIS
IIS.FRAUNHOFER.DE
FOUNDED: 1949
CHIEF OFFICER: ALBERT HEUBERGER,
EXECUTIVE DIRECTOR

G&L Geißendörfer & Leschinsky
GL-SYSTEMHAUS.DE
FOUNDED: 1999
CHIEF OFFICER: ALEXANDER LESCHINSKY,
CO-FOUNDER AND MANAGING DIRECTOR

Garland Partners
GPL-UK.CO.UK
FOUNDED: 2004
CHIEF OFFICER: MALCOLM HARLAND,
MANAGING DIRECTOR

Google
GOOGLE.COM
FOUNDED: 1998
CHIEF OFFICER: SUNDAR PICHAI, CEO

Grabyo
GRABYO.COM
FOUNDED: 2013
CHIEF OFFICER: GARETH CAPON, CEO

Groovy Gecko
GROOVYGECKO.COM
FOUNDED: 1999
CHIEF OFFICER: CRAIG MOEHL,
MANAGING DIRECTOR

Hive Streaming
HIVESTREAMING.COM
FOUNDED: 2007
CHIEF OFFICER: JOHAN LJUNGBERG, CEO

i2i Media
I2IC.COM
FOUNDED: 2002
CHIEF OFFICER: PHILIP RADLEY-SMITH,
MANAGING DIRECTOR

id3as

ID3AS.CO.UK
FOUNDED: 2010
CHIEF OFFICER: DR. ADRIAN ROE, DIRECTOR

Inside Secure

INSIDESECURE.COM
FOUNDED: 1995
CHIEF OFFICER: AMEDEO D'ANGELO,
PRESIDENT AND CEO

Interxion

INTERXION.COM
FOUNDED: 1998
CHIEF OFFICER: DAVID RUBERG, CEO

Irdeto

IRDETO.COM
FOUNDED: 1969
CHIEF OFFICER: DOUG LOWTHER, CEO

Jet-Stream Services

JET-STREAM.COM
FOUNDED: 1994
CHIEF OFFICER: STEF VAN DER ZIEL, CEO

Keepixo

KEEPIXO.COM
FOUNDED: 2015
CHIEF OFFICER: PIERRE MARTY,
CO-FOUNDER AND CEO

MainStreaming

MAINSTREAMING.TV
FOUNDED: 2015
CHIEF EXECUTIVE: ANTONIO CORRADO, CEO

Mangomolo

MANGOMOLO.COM
FOUNDED: 2013
CHIEF OFFICER: WISSAM SABBAGH,
FOUNDER AND CEO

Mobile Viewpoint

MOBILEVIEWPOINT.COM
FOUNDED: 2008
CHIEF OFFICER: MICHEL BAIS,
MANAGING DIRECTOR

movingimage

MOVINGIMAGE.COM
FOUNDED: 2009
CHIEF OFFICERS: ERDAL AHLATCI
& DR. RAINER ZUGEHÖR, CO-CEOS

Nagra Kudelski

NAGRA.COM
FOUNDED: 1951
CHIEF OFFICER: ANDRÉ KUDELSKI, CEO

Nanocosmos

NANOCOSMOS.DE
FOUNDED: 1998
CHIEF OFFICER: OLIVER LIETZE,
CEO AND FOUNDER

Net Insight

NETINSIGHT.NET
FOUNDED: 1997
CHIEF OFFICER: FREDRIK TUMEGÅRD, CEO

Netgem

NETGEM.COM
FOUNDED: 1996
CHIEF OFFICER: JOSEPH HADDAD,
FOUNDER AND CEO

Nice People At Work

NICEPEOPLEATWORK.COM
FOUNDED: 2008
CHIEF OFFICER: FERRAN GUTIÉRREZ VILARÓ,
CO-FOUNDER AND CEO

Paywizard

PAYWIZARD.COM
FOUNDED: 1997
CHIEF OFFICER: BHAVESH VAGHELA,
CHIEF EXECUTIVE

Perform Group

PERFORMGROUP.COM
FOUNDED: 2007
CHIEF OFFICER: SIMON DENYER, CEO

Quadia Online Video

EN.QUADIA.COM
FOUNDED: 2004
CHIEF OFFICER: NICO VERSPAGET,
CO-FOUNDER AND CEO

Quicklink

QUICKLINK.TV
FOUNDED: 2003
CHIEF OFFICER: RICHARD REES, CEO

Rohde & Schwarz

ROHDE-SCHWARZ.COM
FOUNDED: 1933
CHIEF OFFICER: CHRISTIAN LEICHER,
PRESIDENT AND CEO

SES Platform Services

SES.COM
FOUNDED: 2004
CHIEF OFFICER: KARIM MICHEL SABBAGH,
PRESIDENT AND CEO

Sharpstream

SHARP-STREAM.COM
FOUNDED: 2001
CHIEF OFFICER: DANE STREETER,
CEO AND MANAGING DIRECTOR

Siemens Convergence Creators

SIEMENS-CONVERGENCE.COM
FOUNDED: 2013
CHIEF OFFICER: DANIEL-RUI FELICIO, CEO

Simplestream

SIMPLESTREAM.COM
FOUNDED: 2010
CHIEF OFFICER: ADAM SMITH,
FOUNDER AND CEO

SIS LIVE

SISLIVE.TV
FOUNDED: 1989
CHIEF OFFICER: DAVID MEYNELL,
MANAGING DIRECTOR

Sky

SKY.COM
FOUNDED: 1990
CHIEF OFFICER: JEREMY DARROCH, CEO

StreamAMG Media Services

STREAMAMG.COM
FOUNDED: 2001
CHIEF OFFICER: DUNCAN BURBIDGE, CEO

Streaming Tank

STREAMINGTANK.COM
FOUNDED: 2003
CHIEF OFFICER: JAMES WILKINSON, FOUNDER AND CEO

StreamOne

STREAMONE.NL
FOUNDED: 2012
CHIEF OFFICER: RUUD VAN DER LINDEN, FOUNDER AND CEO

Streamroot

STREAMROOT.IO
FOUNDED: 2014
CHIEF OFFICER: PIERRE-LOUIS THÉRON, CO-FOUNDER AND CEO

Streamstar

STREAMSTAR.COM
FOUNDED: 2005
CHIEF OFFICER: RADOSLAV TOTH, CEO

TATA Communications (UK)

TATACOMMUNICATIONS.COM
FOUNDED: 1986
CHIEF OFFICER: VINOD KUMAR, MANAGING DIRECTOR AND CEO

Teracue

TERACUE.COM
FOUNDED: 1991
CHIEF OFFICER: THOMAS BUCK, CEO

THEO Technologies NV

THEOPLAYER.COM
FOUNDED: 2012
CHIEF EXECUTIVE: STEVEN TIELEMANS, CEO

ThinkAnalytics

THINKANALYTICS.COM
FOUNDED: 1995
CHIEF OFFICER: EDDIE YOUNG, CHAIRMAN

Unified Streaming

UNIFIED-STREAMING.COM
FOUNDED: 2007
CHIEF OFFICER: DIRK GRIFFIOEN, CEO

Varnish Software

VARNISH-SOFTWARE.COM
FOUNDED: 2010
CHIEF OFFICER: LARS LARSSON, CEO

VEWD (formerly Opera TV)

VEWD.COM
FOUNDED: 2002
CHIEF OFFICER: ANEESH RAJARAM, CEO

Viaccess-Orca

VIACCESS-ORCA.COM
FOUNDED: 2012
CHIEF OFFICER: PAUL MOLINIER, CEO

Videomenthe

VIDEOMENTHE.FR
FOUNDED: 2008
CHIEF OFFICER: MURIEL LE BELLAC, CO-FOUNDER AND CEO

Vimond Media Solutions

VIMOND.COM
FOUNDED: 2011
CHIEF OFFICER: HELGE HØIBRAATEN, CEO

Vizrt

VIZRT.COM
FOUNDED: 1997
CHIEF OFFICER: MICHAEL HALLÉN, PRESIDENT AND CEO

V-Nova

V-NOVA.COM
FOUNDED: 2011
CHIEF OFFICER: GUIDO MEARDI, CO-FOUNDER AND CEO

Voddler Group

VODDLERGROUP.COM
FOUNDED: 2007
CHIEF OFFICER: ADAM H. LEWIS, PRESIDENT AND CEO

Vualto

VUALTO.COM
FOUNDED: 2012
CHIEF OFFICER: CAMILLA YOUNG, CO-FOUNDER AND CEO

Wiztivi

WIZTIVI.COM
FOUNDED: 2007
CHIEF OFFICER: ARI BENSIMON, CEO

Wowza Media Systems

WOWZA.COM
FOUNDED: 2005
CHIEF OFFICER: DAVID STUBENVOLL, CO-FOUNDER AND CEO

Xstream

XSTREAM.NET
FOUNDED: 1999
CHIEF OFFICER: MICHAEL RASMUSSEN, CEO

Xtendx

XTENDX.COM
FOUNDED: 2003
CHIEF OFFICER: CHARLES A. FRAEFEL, FOUNDER AND CEO

Yospace

YOSPACE.COM
FOUNDED: 1999
CHIEF OFFICER: TIM SEWELL, CEO

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Sub-$2,000 Hardware H.264 Encoders

By Robert Reinhardt

For the last decade, I've used a variety of H.264 encoders for livestreaming events, typically conference events that involve one or more presenters and one or more computer screen inputs. The single biggest factor for my workflow is the available bandwidth on site at the event venue. I need an H.264 that will get the best possible quality over a limited outbound pipe of 1–3Mbps sustained bandwidth. My goal for this article was to find the best encoder on the market for a wide range of live-streaming content, from relatively minor movement such as talking heads to fast-paced sports. I could not identify a single "winner" across all categories, but I could get repeatable results that you can use in your own research and comparisons for these and other encoders on the market.

My typical pipeline uses a first-generation Teradek Cube 255, which has held up very well and served my requirements over the past 5 years. As we have entered the dawn of HEVC/H.265 technology—with very

few economically priced encoders on the market—I thought now was a great time to compare the current stock of H.264 encoders that are available for under $2,000. There are certainly encoders that are much more expensive, but most of my clients need portability and lower costs to add livestreaming to their existing pipelines.

The Contenders

Among the wide variety of encoders available in the testing period for this evaluation, I picked one encoder from four different vendors, each meeting the following minimum criteria:

- 3G-SDI and HDMI inputs
- Ethernet/LAN connectivity
- AVC/H.264 encoder
- Web-configurable interface
- Retail cost under USD$2,000, before applicable taxes and shipping costs

Here's a brief overview of each encoder, from least expensive to most expensive.

AJA HELO ($1,295)

This much-anticipated entry to the H.264 encoder arena by AJA had some initial shipping delays, but was finally released in February 2017. As shown in **Figure 1**, this encoder has a very simple and compact design. While its form factor was the second-largest in this roundup, the HELO is not designed to be camera-mounted. Its rackmountable design makes it a compact addition to an existing footprint for a more permanent A/V rack. All of the input and output jacks for video, audio, network, and power are on the back side of the chassis, while more user-friendly push controls to enable recording and streaming and USB/SD card recording media are on the front side. You can also store multiple presets and profiles for the encoder, making it faster to change from one configuration to another. While the HELO doesn't have a form factor designed for portability or mounting as nicely onto a camera as the Teradek Cube 655, you can purchase separate power adapters to run the HELO from popular battery types.

Discoverability of the HELO on the network is relatively simple. If you're using a Mac or Bonjour-enabled device, the HELO's address will be announced and available over Bonjour. If you have Safari, you can enable Bonjour discovery and quickly navigate to the web configuration page for the HELO. If you don't have a Bonjour-enabled device or browser, you'll need to use the AJA eMini-Setup application on a laptop or desktop computer to discover the HELO. This application will report the IP of the HELO so you can configure the device in a web browser (**Figure 2**).

The drawbacks of the HELO are few, but notable. The HELO requires all configuration to be done within a web browser user interface;
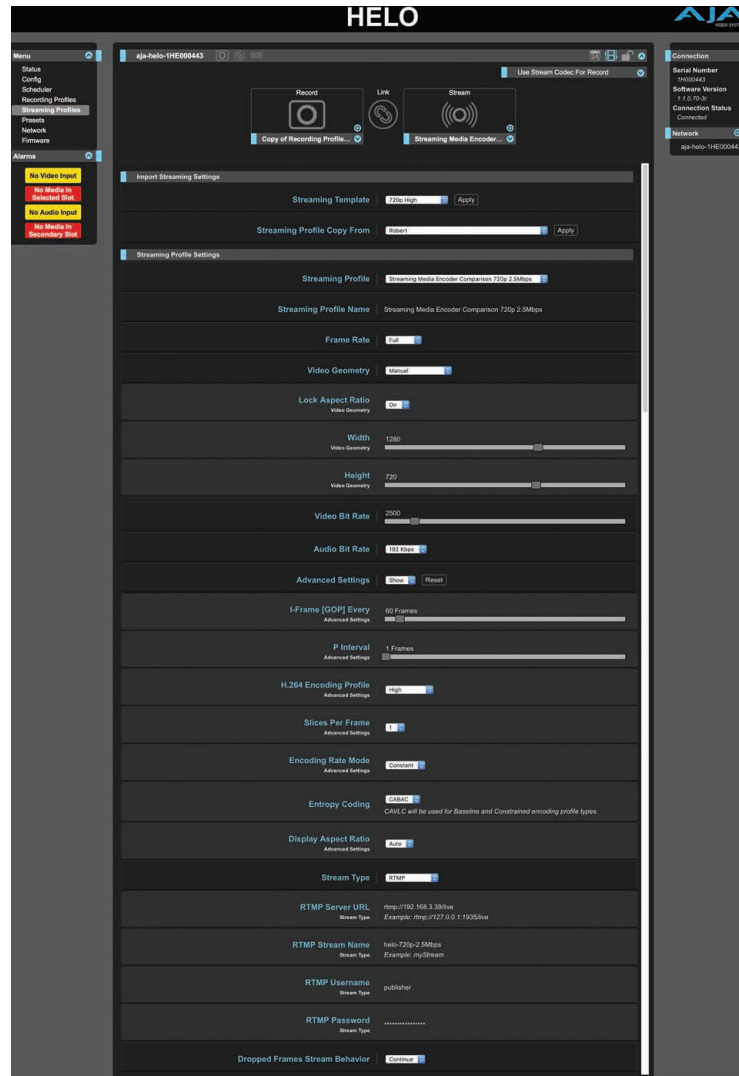
Figure 2.
AJA HELO web interface

there is no display and/or input control on the unit itself. As such, you need to make sure all your configuration data is in place before you start to stream, unless you have a laptop on hand to connect to the same network as the HELO. The silver lining, though, is that the HELO's web interface is incredibly fast. Changes are

near-instantaneous without laborious reboots of the hardware.

The current firmware doesn't seem to support B-frame encoding (available in Main and High profiles of AVC/H.264) very well, at least for typical RTMP pushes to streaming media servers. Lastly, the output audio sampling rate is fixed at 48KHz; there is no option for using a different output sampling rate.

Matrox Monarch HDX ($1,995)

I've been familiar with Matrox's Monarch line for quite some time now, and have used the HDMI-only version of the Monarch HDX for many engagements. Matrox has several Monarch models. The HDX (**Figure 3**) came in just below the $2k price point, and it features both SDI and HDMI inputs. Like the AJA HELO, the Monarch HDX is designed to be installed in a more semi-permanent A/V rack system for routine and regular streaming in a venue.

On the Monarch HDX's back panel, you'll find all A/V inputs and a plug for the unit's power cable. On the front, you'll find controls for starting and stopping streaming, as well as two USB ports and one SD slot for recording media.

Discoverability of the Monarch HDX requires the Matrox Monarch HDX Utils application, which reports the IP address, device name, serial number, firmware version, and status of each Monarch HDX on your network. Once you know the IP address of the Monarch HDX, you can use that address in a web browser to log in and configure your streams (**Figure 4**).

The Monarch HDX, like the AJA HELO, can only be configured with a web browser and not with a built-in menu display and option controls.

The Monarch's web interface is slower to update the unit with new settings than the HELO's. The HDX is the only unit tested that has an audible fan running anytime the unit is powered on.

Osprey Talon G2 Contribution Encoder ($1,890)

This roundup provided my first opportunity to test an Osprey H.264 encoder, and my research started just as the second generation, or G2, Talon was in pre-release. The form factor of the Talon G2, as shown in **Figure 5**, is like that of Teradek's Cube family. While there's no tripod or camera mount on the Talon G2, the form factor is small enough to fit in a camera bag. This unit was the only one that could also encode from an older RCA-style video input/signal, in addition to HDMI and SDI terminals.

Because the Talon G2 has a built-in touchscreen that displays the unit's acquired IP address after booting, there's no need for a discovery tool to configure the device. The Talon

Figure 3.
Matrox Monarch HDX

Figure 4.
Matrox Monarch HDX web interface

Figure 5.
Osprey Talon G2

G2's web configuration is not as quick and responsive as the HELO's, but all of the necessary video and audio compression settings are available (**Figure 6**).

TERADEK CUBE 655 ($1,990)

The last unit tested in this roundup, and the most expensive, is the Teradek Cube 655 (**Figure 7**). Teradek was one of the first "disruptors" to introduce lower-cost H.264 encoding hardware, and the Cube 655 improved on earlier models such as the Cube 255. The Cube 655 is designed for portable use; accessories allow you to mount the Cube directly onto a camera's hot shoe or a tripod screw. While the Cube 655 doesn't have an internal battery source, you can purchase adapters that enable you to power it with popular battery types from Canon, Sony, JVC, Panasonic, and Anton/Bauer.

Like the AJA HELO, the Cube 655's web configuration page can be auto-discovered by Bonjour-enabled browsers such as Safari. The best feature of the Cube 655 is the built-in display and joystick, which can be used to configure nearly every option that's also available in the Cube's web configuration pages (**Figure 8**). The Cube's display can tell you the IP address of the encoder if you want to configure the unit with a web browser. If you want the flexibility of changing encoding or network options without the need for a device that's connected to the same network, the Cube 655 may be the right choice for you.

Testing Process and Methodology

It's relatively straightforward to run qualitative metrics against various renditions of a video-on-demand (VOD) file. To do so, you simply take a high-quality source file, encode it with different compression settings, and compare the results. With live streams, however, the process is a bit more complicated. Each H.264 hardware encoder needs to receive the same input signal and record the compressed output to a file. Because not all the encoders tested can record to a locally attached storage drive, I had to come up with a system that recorded outbound compressed streams over the network.

To reduce network variables, I set up Wowza Streaming Engine on my MacBook Pro, which has a solid state drive (SSD) that easily records live streams without any disk I/O issues. On the same local network, I attached each of the

Figure 6.
Osprey Talon G2 web interface

Figure 7.
Teradek Cube 655
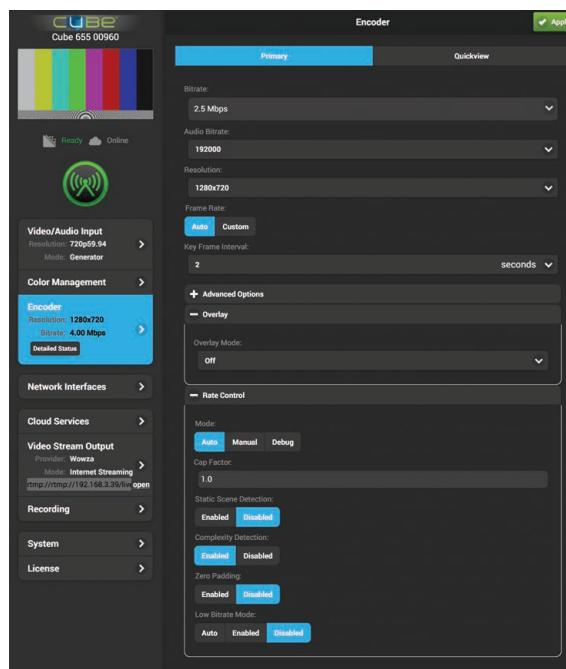
Figure 8.
Teradek Cube 655 web interface
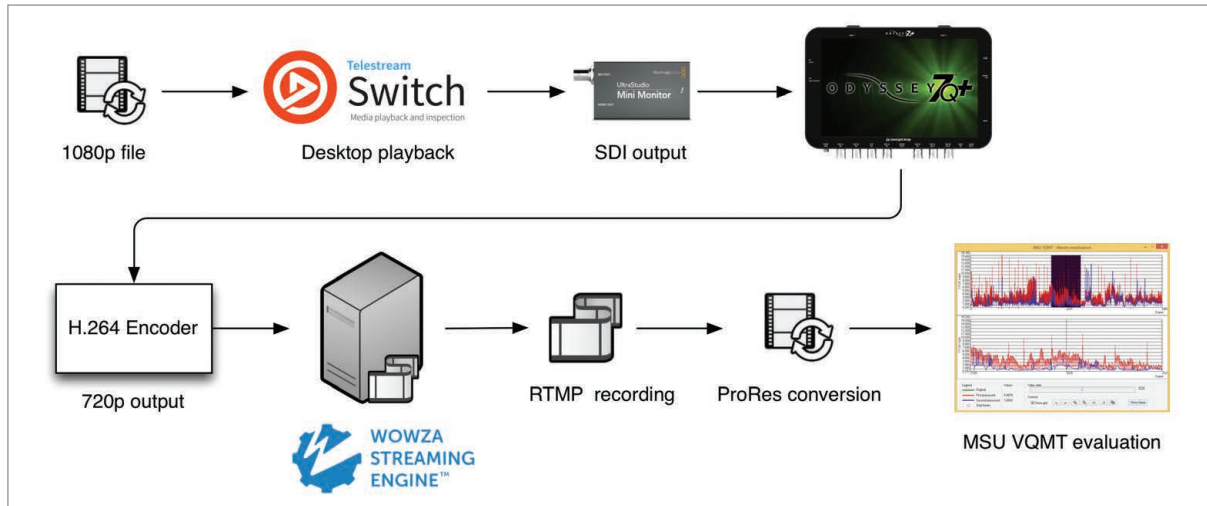
H.264 encoders. For source content, I downloaded high-quality 4K content from 4ksamples.com and downsized to Apple ProRes HQ 1080p 29.97 fps. Using Telestream Switch and Blackmagic Design UltraStudio Mini Monitor, I output the ProRes versions over SDI to a Convergent Design Odyssey7Q+. With the content recorded at high production quality, I could replay the same clip over SDI consistently to each encoder.

Each H.264 encoder was set to use 1280x720p 29.97 fps at various bitrates: 5Mbps, 2.5Mbps, 1Mbps, and 500Kbps. The output stream from the encoders was pushed via RTMP to the local streaming server, where it was recorded. The recorded MP4 files were then converted to ProRes HQ 720p 29.97 fps, and the ProRes file played from the Odyssey7Q+ was also downsampled to 720p 29.97 fps. With each bitrate test, I trimmed the in and out points of each of the recordings to match a trimmed version from the Odyssey7Q+.

This painstaking process typically took 3 to 4 hours to complete for each bitrate tested. Moscow University's Video Quality Measurement Tool (VQMT), was used to compare the downsampled 720p high-quality source to the 720p renditions created by each encoder. (As a side note, you can read more about VQMT in various articles written by Jan Ozer on stream ingmedia.com at go2sm.com/vqmt.) A diagram of the entire process is shown in **Figure 9**.

As a relative baseline metric, a GOP-restricted x264 encoded version of the source file was compressed for each bitrate tested and posted in the results.

Due to space constraints, samples of the encoded output are not included in the print version of this article. You can find screen grabs and MP4 recordings of the samples utilised at videorx.com/h264-hardware-test.

Slow- to Average-Motion-Content Results

The first sample tested was a clip titled "Honey Bees 96fps in 4K." As described earlier, this clip was downsampled to 1080p 29.97 fps and recorded from Telestream Switch to the Convergent Design Odyssey7Q+. The entire clip was played out over SDI to each of the encoders in 5Mbps, 2.5Mbps, 1Mbps, and 500Kbps renditions.

Each encoder used a consistent 60-frame GOP/keyframe interval. The video bitrate was set to 5000Kbps (or 5MBps) in all encoders. The Teradek Cube's automatic rate control (default) produced even lower bitrate values than expected, and as such, I used a manual rate control which was set to the same bitrate value as the average bitrate setting.

5Mbps

For most 720p 29.97 fps content, a 5Mbps video bitrate will be more than adequate for a high-quality live stream. As expected, the Video Quality Metric (VQM) scores (see **Chart A** on page 24) for such high bitrates on hardware encoders was closest to the VQM of a non-live x264 encoded version of the original source file. The HELO produced the best VQM score, with the Talon G2 as a close second. The Teradek Cube 655, though, should be recognised for a decent VQM score despite the actual average bitrate

being almost 2Mbps lower than specified. For 3Mbps, the Cube 655's score should rank it much higher. Having said that, the Cube should have been better at producing a bitrate that was closer to the requested 5Mbps.

2.5Mbps

Things start to get more interesting as we get closer to a real-world bitrate for 720p. In production webcasts, I typically use a 2.5Mbps video bitrate for talking-head- and Power-Point-style presentations managed on my Roland V-1SDI mixer. In this round of tests (**Chart B**), we can see that the x264 comparison video is not quite as good as the 5Mbps version and the VQM scores are all close to each other. Again, the Teradek Cube 655 had the lowest VQM score, but with an actual bitrate that was barely 60% of the requested bitrate. If we take the Teradek Cube 655's score from the 5Mbps round, which produced a bitrate of 3Mbps, closer to this test's bitrate, we can see that the Cube 655 had comparable results to the others in this round.

VQM	Encoder	Video Bitrate	Actual Bitrate
0.30615	x264 VOD	5Mbps	4.943Mbps
0.55109	AJA HELO	5Mbps	4.349Mbps
0.56186	Osprey Talon G2	5Mbps	4.389Mbps
0.61486	Teradek Cube 655	5Mbps	3.01Mbps
0.6251	Matrox Monarch HDX	5Mbps	4.317Mbps

CHART A.
5 Mbps

VQM	Encoder	Video Bitrate	Actual Bitrate
0.39342	x264 VOD	2.5Mbps	2.443Mbps
0.62503	AJA HELO	2.5Mbps	2.256Mbps
0.64045	Osprey Talon G2	2.5Mbps	2.273Mbps
0.68663	Matrox Monarch HDX	2.5Mbps	2.215Mbps
0.74776	Teradek Cube 655	2.5Mbps	1.455Mbps

CHART B.
2.5 Mbps

VQM	Encoder	Video Bitrate	Actual Bitrate
0.63045	x264 VOD	1000Kbps	960.72Kbps
0.83262	Matrox Monarch HDX	1000Kbps	1042Kbps
0.93383	Osprey Talon G2	1000Kbps	956Kbps
0.98872	AJA HELO	1000Kbps	855Kbps
1.14794	Teradek Cube 655	1000Kbps	564Kbps

CHART C.
1 Mbps

VQM	Encoder	Video Bitrate	Actual Bitrate
0.98467	Matrox Monarch HDX	500Kbps	685Kbps
1.01804	x264 VOD	500Kbps	478Kbps
1.51623	Osprey Talon G2	500Kbps	471Kbps
1.63263	AJA HELO	500Kbps	575Kbps
1.67931	Teradek Cube 655	500Kbps	317Kbps

CHART D.
500 Kbps

1Mbps

With this round of tests, similar trends reappeared (**Chart C**). The Teradek Cube 655's actual bitrate was significantly lower than the desired preset. While its score was lower quality than the other encoders in this batch, its VQM score does well against the actual bitrates for the 500Kbps round discussed next. The other three encoders had scores relatively close to each other when adjusted for actual bitrate.

500Kbps

Using a bitrate of 500Kbps on a 720p resolution is not likely to produce high-quality output, but it can help differentiate how well an encoder can reduce complex imagery. As shown in **Chart D**, the AJA HELO and the Teradek Cube 655 seemed to compensate for low-bitrate scenarios by dropping frames. Because frames are lost in the output recording, the VQM score will be worse for such encoders even if the frames that are retained are higher quality. The Matrox Monarch HDX and Osprey Talon G2 retained more lower-quality frames.

Fast-Motion-Content Results

For this category of tests, I used the only sports action clip available on 4ksamples.com and utilised the same encoding settings as the previous test. The only exception was the compression settings for the Teradek Cube 655. Because the slow- to average-motion content consistently produced lower actual bitrates for the Cube 655 compared to other encoders, I thought I would try restricting the default wide

range of quantisers, or QP values. I was able to get actual bitrates that were higher, but still not as close to the desired bitrate preset as I was with other encoders.

5MBPS

In the 5Mbps tests (**Chart E**), the Osprey Talon G2 and the AJA HELO did best with high-motion content. The scores are close to one another, and the actual bitrates were nearly identical across the board. The average viewer would not easily distinguish any significant differences among these clips.

2.5MBPS

In this batch of tests (**Chart F**), the same trend that only started to surface with 1Mbps presets and slow- to average-motion content appear even

in the 2.5Mbps category. The Teradek Cube 655 and the AJA HELO start to drop frames to retain quality, at the expense of smoother motion. Only the Osprey Talon G2 had an average video bitrate that was within 100Kbps of the desired bitrate. With this round, we start to see a quality difference between the lowest score (better) of the Osprey Talon G2 and the highest score (worse) of the AJA HELO.

1Mbps

As the encoders are pushed to encode over lower bitrates at 720p, the differences become more pronounced (**Chart G**). Most viewers would consider the output from all of the encoders unacceptable. The Matrox Monarch HDX produced a better score than the reference x264 file, but the hardware encoder utilised 30% more bitrate in the process. There's a more significant difference visually now between the top two performers and the bottom two.

Again, the Teradek Cube 655 and AJA HELO dropped frames to retain quality, and for a VQMT comparison, that will produce higher scores (worse). Because the encoder will hold on any given frame where there was a drop, VQMT will have a completely different frame to compare from the original source clip compared to the encoded output.

500Kbps

Similar trends continue as the bitrate is pushed below a threshold necessary for reasonable quality at 720p (**Chart H**). The Teradek Cube 655 and AJA HELO drop frames in an effort to keep quality on non-dropped frames, while the Osprey Talon G2 and the Matrox Monarch HDX reduce the overall quality of frames without dropping as many frames. Again, the Matrox Monarch HDX produced a better score than the reference x264 file, but with a higher bitrate than specified.

Conclusions

When I first embarked on my journey to compare these four encoders, I was expecting to see greater differences between the units

VQM	Encoder	Video Bitrate	Actual Bitrate
1.73228	Matrox Monarch HDX	1000Kbps	1300Kbps
2.25679	x264 VOD	1000Kbps	950Kbps
2.84784	Osprey Talon G2	1000Kbps	770Kbps
5.67876	Teradek Cube 655	1000Kbps	638Kbps
5.75963	AJA HELO	1000Kbps	722Kbps

CHART G.
1 Mbps

VQM	Encoder	Video Bitrate	Actual Bitrate
3.16343	Matrox Monarch HDX	500Kbps	687Kbps
3.47908	x264 VOD	500Kbps	472Kbps
5.92516	Osprey Talon G2	500Kbps	418Kbps
7.96526	Teradek Cube 655	500Kbps	375Kbps
10.66322	AJA HELO	500Kbps	394Kbps

CHART H.
500 Kbps

than I observed. The Teradek Cube 655 and the AJA HELO offer much finer control over the encoding parameters than the Matrox Monarch HDX and the Osprey Talon G2. For portability, the Teradek Cube 655 is the easiest to mount and configure with a camera or mixer, but it requires more attention to the live output to fine-tune the bitrate to match your intended target.

As a first-generation product, I was pleasantly surprised with the AJA HELO. Its web interface was the fastest to apply new settings—a feature highly desirable while on location. The quality from the AJA HELO and the Teradek Cube 655 was best when the bitrates were high enough to accommodate the pixel dimensions and frame rate of the 720p output. The Matrox Monarch HDX and the Osprey Talon G2 did remarkably well at retaining smooth motion across very constrained bitrates. The Matrox Monarch HDX had a tendency to use higher-than-specified bitrates under such demands.

Robert Reinhardt (robert@videorx.com) is founder of VideoRx and is internationally regarded as an expert on multimedia application development and online video, particularly in HTML5, iOS, Flash, AVC/H.264, and HEVC/H.265.
Comments? Email us at letters@streamingmedia.com, or check the masthead for other ways to contact us.

WINTER
2017

The **Platforms,**
Players, and SDKs
SUPERGUIDE

deliver an
uncompromised
viewer
experience

Table of Contents

Platform, Player & SDKs

Reaching the largest audience possible is a high priority for multimedia content providers and publishers. Nowadays users are viewing video on a very diverse range of devices and platforms, so video players need to run on every device and on every platform. The player should work and look the same everywhere, whether it's used on a website, in a native application, on a set-top box, or on a smart TV. Successfully integrating into these new devices is a challenging but very necessary part of modern content delivery.

As simple as this requirement may sound, meeting it from a technical and engineering perspective can be harder than many people think. In this article, we will examine the current situation in the video player market and have a look at technology solutions that already exist to simplify the integration process and allow publishers to concentrate on their core business, providing great video content, instead of dealing with the technical complexity of delivering video to a growing, changing, and complex set of platforms and devices.

HTML5

One of the first successful efforts to deliver multimedia content to a wide range of platforms and devices was the soon-to-be deprecated Adobe Flash. It was relatively easy to create and deploy a Flash-powered video player to reach the vast majority of internet-connected devices that were available in those days.

But the market changed rapidly, and new devices and platforms were rising along with new streaming formats like DASH. It showed that the plugin-based approaches like Flash and Silverlight were too inflexible to cope with those developments.

The rising new star on the horizon of cross platform and multi device video delivery was then HTML5. W3C did a great job with the standardization of the HTML5 Media Source Extensions (MSE), which enable adaptive bitrate streaming using MPEG-DASH natively in the browser without proprietary plugins such as Flash or Silverlight, as well as the

HTML5 Encrypted Media Extensions (EME), which enable the usage of DRM-encrypted content using MPEG-CENC.

It is now possible to deliver digital rights management (DRM)-protected and unprotected video content to a large variety of devices and platforms ranging from mobile phones over desktop computers to set-top boxes and smart TVs just by using those standardised browser-based APIs for multimedia playback and content decryption.

But even though HTML5, MSE, and EME are available on many devices and platforms, there are always some that cannot be reached with those technologies. Furthermore, even if modern web-based video playback is available, there are situations where choosing a different approach to video delivery may be appropriate.

NATIVE SDKS

Native SDKs provide a good extension to the capabilities and platform reach of HTML5-based video players. Even on
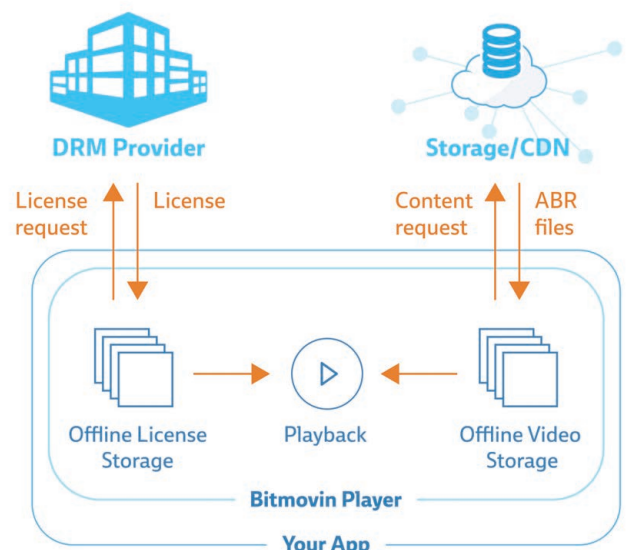
platforms where HTML5-powered video is available, there is sometimes the need for a more native approach.

One of the reasons to go native is that there are more possibilities to optimise and tweak the performance of video playback on a certain platform. For instance, when it comes to VR and 360° video, there is a need to render very high-resolution video with low end-to-end latency using natively available system graphics libraries. Native SDKs will also play a big role in the rising area of augmented reality applications (AR), since they are more tightly coupled to the system they are running on.

Some devices also need to be approached with native SDKs for video playback to enable DRM support. For instance, iOS does not provide FairPlay Streaming support in the mobile version of Apple's Safari web browser.

Native SDKs also enable use cases that are not possible to cover with a HTML5-powered video player at the moment, such as offline DRM. Downloading DRM-protected content to the device and storing it for offline playback can be a useful feature and is provided by Netflix's mobile application, among others.

CHALLENGES OF MULTI PLATFORM SUPPORT
Streaming Formats
Adaptive bitrate (ABR) streaming over HTTP is now the standard for streaming multimedia content over large and distributed HTTP networks like the internet. This approach to streaming is also called over-the-top (OTT) streaming because it does not require a traditional cable or satellite TV service subscription and is delivered "over-the-top" of the existing infrastructure of the internet. It can be seen as a successor of

RTP/RTSP-based streaming and progressive download and comes with many advantages over those technologies.

The big players in the field of ABR streaming are DASH and HLS, but to provide a complete video player product that covers a broad range of devices, platforms, and use-cases, Smooth Streaming also must be supported. HLS recently added support for the fragmented MP4 file format in addition to the already a bit dusty MPEG2TS format and also supports now HEVC. One of the findings of Bitmovin's **2017 Video Developer Report**, which can be obtained from **bitmovin.com**, Apple HLS is still the dominant format in video streaming in 2017, but the format people are looking to in the next 12 months is MPEG-DASH. DASH can be also delivered using several file formats like WEBM, MP4 and even MPEG-2 TS and codecs like AVC, HEVC, VP9, AV1, and so on.

Coping with this diversity in streaming file formats and codecs can be challenging for player developers but also opens new and interesting possibilities. With technologies like multi-codec streaming, which is supported by Bitmovin's encoding and player products, publishers and content providers can significantly save CDN and delivery costs. Delivering content encoded with AVC may be the easiest way to deliver video to as many platforms and devices as possible, but by using much more efficient codecs like HEVC and VP9, or the upcoming AV1, the delivered bitrates can be reduced by 50% and more while maintaining the same high video playback quality the user is expecting.

To provide your video content in this variety of file formats and codecs requires a flexible encoding solution in addition to a cross-platform video player. Built for cloud or hybrid cloud implementations, the Bitmovin encoder offers virtually unlimited scalability, power, and flexibility. It provides encoding speeds of up to 100x real time, outputs MPEG-DASH, HLS, and Smooth Streaming, and supports a long list of container formats, codecs, and DRM systems. It is fast and easy to integrate and set up and offers actively maintained API clients for all major languages.

DRM
DRM systems provide you with the ability to control how people can consume your content. Usually content owners and producers, like all the major Hollywood studios and broadcasters, force content distributors to use specific DRM systems to protect each piece of content. Depending on the copyright requirements, Hollywood-grade DRM protection is not always needed, and sometimes it's

enough to provide basic protection through token-based secure authentication or simple AES encryption of the video without sophisticated license exchange and policy management.

An end-to-end DRM setup needs specific encoding, packaging, and playback, as well as a license server. From an encoding and packaging point of view, it does not make much difference whether the video is "just" AES encrypted or Hollywood-grade DRM encrypted because, for the encryption, AES is used in both cases. The major difference is that for Hollywood-grade DRMs, further metadata information needs to be added in the packaging step. Hollywood-grade DRMs such as PlayReady, Widevine, Primetime, and FairPlay don't differ on the encryption side, they differ on the configuration features that are provided. Features such as offline playback, fine-grained policies (e.g., allow only SD playback, rights visibility for users, APIs, different payment modes such as subscription, purchase, rental, gifting, etc.) and platforms supported (e.g., Chrome, Firefox, IE, Safari, Android, iOS, etc.).

On the player side it's possible to utilize the HTML5 Encrypted Media Extensions (EME) to enable DRM playback without plugins on web-based platforms. If the DRM is not supported through the EME you could fallback to Flash and Adobe Access, if supported by your player vendor. On iOS and Android, playback of DRM protected content is also supported by the system, which usually provides all needed APIs to implement the content decryption and playback process. Android natively supports Widevine and iOS supports FairPlay streaming, but additional DRM support can be plugged in through third party modules if necessary.

If the content is MPEG-CENC multi-DRM encrypted, the player could automatically choose the DRM that is natively supported on the given platform to playback the content in HTML5, Android, or iOS without plugins. The authentication and the license acquisition will be handled by the player through the system APIs with the metadata that is provided with the content.

As you can see, a multi platform end-to-end DRM solution can be quite complex and challenging to implement. At Bitmovin we have met this challenge and provide the encoding, packaging and the player services as an out of the box solution.

License servers are offered by companies that provide a multi-DRM license server setup, such as Irdeto, EZDRM, ExpressPlay, and Axinom. It's also possible to build your own license servers and negotiate terms directly with Google (Widevine), Microsoft (PlayReady), Adobe (Primetime) or Apple (FairPlay), but it usually takes longer.

Managing Players Across Multiple Platforms

Although the playback service has to run on multiple platforms and devices, users expect the product to look and
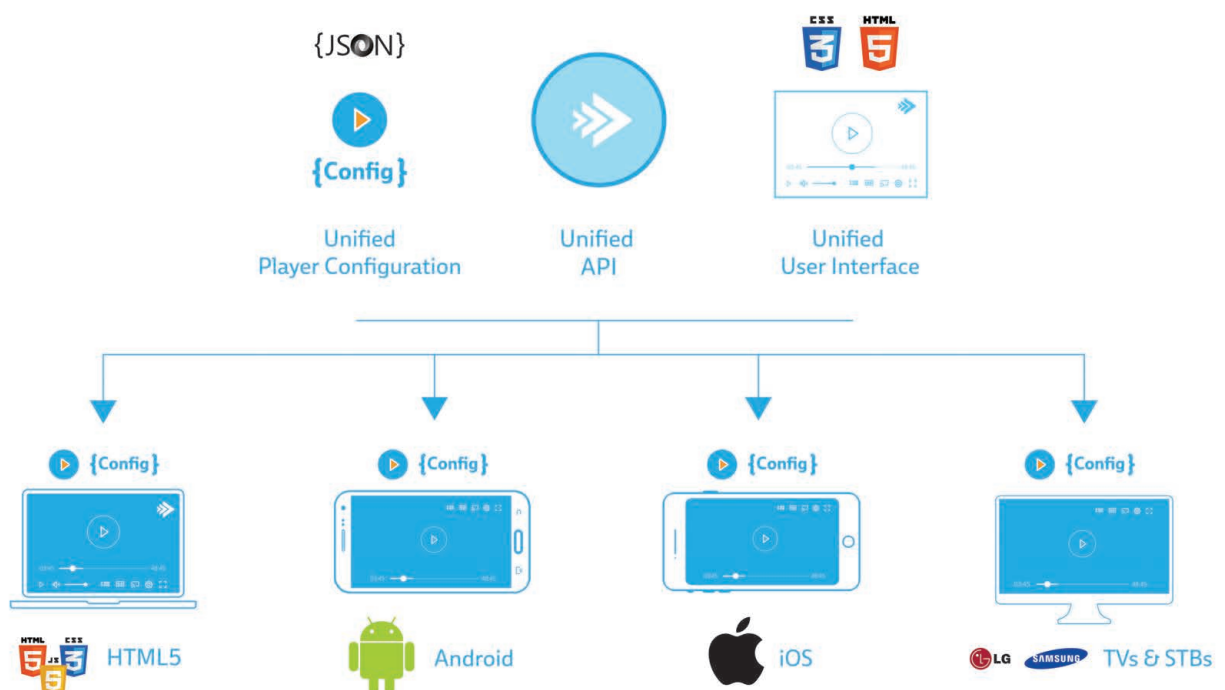
work consistently no matter if they are accessing a service from a desktop or mobile browser, or using a desktop or mobile native application. Bitmovin takes this thought a step further and also thinks in terms of providing developers a consistent experience with the SDKs and libraries when developing such products and services.

Unified Experience Across All Platforms

One main design goal for Bitmovin's player SDKs was to provide a unified experience for integrating our player framework into your projects across all supported platforms. With our SDKs, a homogenous configuration can be used across all platforms, and one player can be deployed everywhere.

Unified Player Configuration

Our HTML5 Adaptive Streaming Player offers the possibility to configure the player using a simple JSON configuration object. This configuration object lets you define and store all the custom settings you want to use to deploy our player. With the introduction of our native SDKs for Android and iOS, you can use the same configuration to deploy your native mobile applications. There is no need to maintain different player configurations across different platforms.

Universal User Interface

With the release of Player Version 7, we introduced an open-source user interface based on TypeScript and SCSS that compiles to JavaScript and CSS. The interface allows you to customize the look of the player to your needs, whether you just want to make some minor changes, like modifying colors or changing image assets, or you want to build an entire custom UI based on the provided UI framework.

This customizable UI capability can be applied to both our adaptive HTML5 player and our native Android and iOS Player SDKs, enabling the same look and feel presented to your users across all platforms. Since this UI is implemented using web technologies, it runs inside a small web component that is layered on top of the video surface in the native player. You benefit from implementing the UI only once, which saves resources and enables easy modification across all players.

Unified Player API

The possibility of providing a universal user interface, which also works in common with our adaptive HTML5 player, was enabled by implementing the same player API across all platforms. All API calls and events you are already familiar with from our HTML5 player are also present in the native player frameworks. This comprehensive and powerful API enables an easy and straightforward integration and lets you tailor the SDKs to fit any use case.

CONCLUSION

Providing and maintaining a consistent video playback experience to the users of services that run on multiple platforms and devices can be a complex and challenging task. To support a wide range of platforms you have to cope with different streaming formats, container formats, codecs, and DRM systems. When it comes to monetization, there is also often a need to support different ad technologies and formats on those different platforms. An easy approach to these challenges is to use already existing solutions like Bitmovin's player and encoding products. They are easy to configure and set-up and provide a proven and well tested way to reach the largest possible audience by supporting all important platforms, devices, streaming formats, and DRM systems out of the box.

ABOUT BITMOVIN
Bitmovin has been a first mover in almost every significant development in online video, from building and deploying the world's first (and fastest) commercial adaptive streaming (MPEG-DASH/HLS) HTML5 Player, to being the first to achieve 100x realtime encoding speeds in the cloud. Bitmovin provides HEVC as well as VP9 live streaming with 60FPS and 4K resolution, and built the first containerized video encoding solution with Docker and Kubernetes. Bitmovin products are completely in-house developed, easy and fast to integrate and highly customizable. In combination with our great support, documentation and SLAs, this is a true enterprise offering. To find out more about Bitmovin's video infrastructure solutions, or about any individual products, contact sales@bitmovin.com, or visit our website: bitmovin.com

Going Live Around the World in 1 Second

Insights into a new cloud-based streaming era without Flash

OVERVIEW

Interactive live streaming is a growing trend, and no one can deny it. The use cases are numerous: webcasters who want to get closer to their audience, bloggers who want to share their lifestyle, bidders who wish to participate in the best auctions around the world, monitoring or maintenance staff who want to keep an eye on machines or premises, or any application which requires feedback from the audience to the camera. Everyone wants to tell a story.

However, there are several goals that are still challenging to achieve:

- Interactive experience: ultra-low-latency delivery and playback

- Cross-platform approach: playback on any device and browser

- Plugin-free: do not need to install additional software

- Flash-free: do not require the outdated Flash technology

- Scalability to large audiences worldwide

Let's have a look at recent trends and explain how nanoStream solutions will help you tackle these challenges.
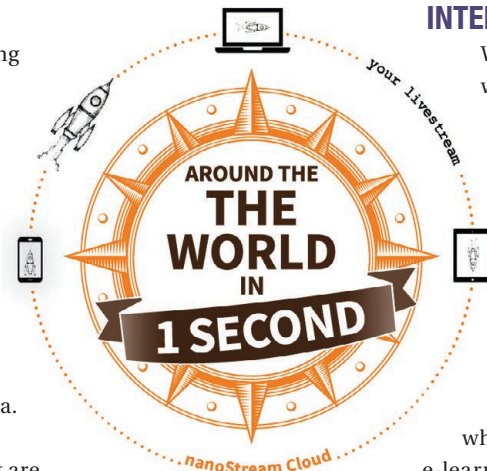
INTERACTIVE LIVE STREAMING

We live in a highly connected world with many interactive use cases. Live audio and video is also turning away from broadcast towards two-way or multi-directional communication. Webcasters and broadcasters want to be able to communicate directly in ultra-low-latency or engage with their audiences by getting live feedback during presentations or events.

Interactive live streaming is a critical point for different use cases when every second counts. Webcasts for e-learning, auctions, betting and bidding are good examples that need a reliable solution to guarantee that all viewers receive video and data near real time. Ultra-low-latency usually means less than 2 seconds end-to-end. This can be quite challenging, but interactive live streaming is definitely a trend that is here to stay.

Interactive Live Streaming - What do you need?

Live Encoder
nanoStream Apps and SDKs
WebRTC.live Broadcaster

Streaming Server
nanoStream Cloud
nanoStream Cloud as CDN

Live Player
nanoStream H5Live Player
ultra-low-latency playback

TECHNICAL CHALLENGES

Currently, live audio/video delivery and playback is the greatest challenge.

Why?

Flash is dying. Is interactive live streaming on any browser still possible?

Flash and the RTMP format have been great protocols for interactive applications. However, browsers are disabling their support for Flash, and RTMP cannot be used as a delivery format any more. In the HTML5 world, only HTTP-based streaming protocols remain available.

HLS and DASH

HLS and DASH cannot deliver ultra-low-latency performance for live streams but instead create latency values of at least 6-8 seconds or even more, which is simply unacceptable for interactive live streaming use cases.

WebRTC

WebRTC is a great emerging technology designed for plugin-free peer-to-peer communication within browser environments. However, it is very limited in terms of scalability to large viewing audiences, complexity and compatibility.

nanoStream H5Live

Customers were asking us for cross-platform, plugin-free and low-latency live streaming solutions, and we at nanocosmos picked up this challenge early on and created a unique delivery and playback solution which works everywhere: nanoStream

H5Live, a unique technology that can achieve impressive latency results on any HTML5 browser. H5Live is compatible to HLS on Safari for iOS, as it gets rid of its latency limitations with its long segments and chunks.

Yes, interactive live streaming is still possible and even better than before!

NANOSTREAM H5LIVE PLAYER FEATURES

H5Live is based on lightweight server and client components. It is a unique delivery and playback solution based on HTML5. The nanoStream H5Live Player was developed to replace Flash-based players and to improve viewer experience. Plugin-free,
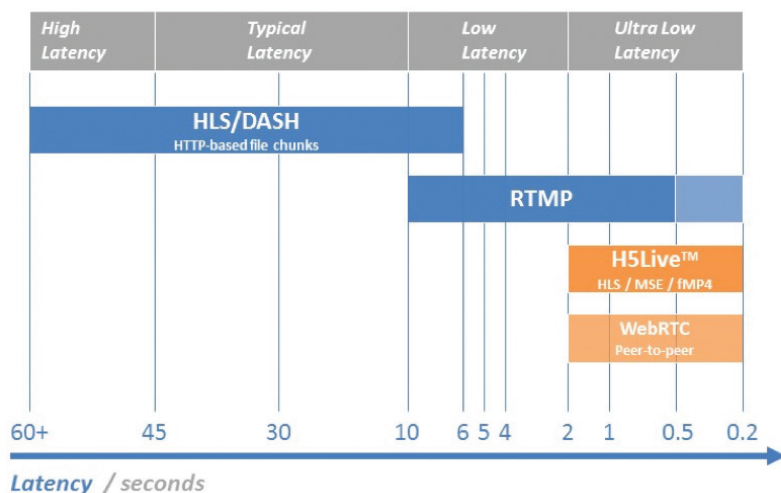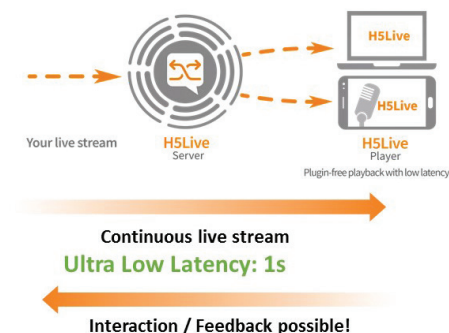
the new technology streams to any HTML5 browser on desktop and mobile devices, including Safari on iOS, Chrome, Firefox, IE and Edge. It is part of nanoStream Cloud and can scale to large audiences worldwide.

LIVE ENCODING

What can you do on the encoder side to support ultra-low-latency? Live encoding is still based on RTMP in most setups, with live encoder hardware and software using RTMP as an upstream protocol to send a live stream in low latency to the media server or CDN. RTMP might be dying for playback, but it is still a great protocol for live streaming!

If you look for a simple and reliable way to do live encoding, you can use nanoStream Live Encoder software (SDK or apps). nanoStream Cloud is fully compatible with H264/AAC/RTMP setups, so our nanoStream software or any other third-party software or hardware encoder can be used (FMLE, Wirecast, etc.).

The plugin-free H5Live player easily connects to RTMP environments.

CODEC AND FORMAT QUESTIONS

Basically all playback platforms, hardware and software today support H264 video and AAC audio for playback of live streams. When using H264/AAC on the encoder side and RTMP as a streaming protocol, you can just pass through the encoded content by repackaging the transport formats. This "passthrough streaming" approach enables high scalability compared to using a lot of transcoding power on the server which is often done in OTT environments. nanoStream H5Live directly supports RTMP ingest and passthrough streaming with H264 and AAC to all HTML5 browsers with low overhead.

MIGRATION FROM FLASH-BASED BROADCASTING APPLICATIONS

Legacy web broadcast applications based on Flash can use H264 video, but AAC is not supported. Usually, they use the outdated "Speex" or "Nellymoser" audio codecs. Adjusting it to HTML5 compatible AAC for delivery and playback requires audio transcoding to provide seamless playback on all HTML5 devices. nanoStream Cloud can handle this for a seamless migration.

NANOSTREAM CLOUD

In a highly connected world like ours, cloud services are a success and the most optimal solution for many businesses. There is a simple reason: setting up a complete, scalable streaming server environment is a big effort and goes beyond what companies usually can achieve with a reasonable effort and budget. Hence, live streaming through a cloud platform is also a trend and the missing key for worldwide audiences.

Cloud-based solutions can scale capacity easily and adapt to changing numbers of streaming users or audiences. Besides, they are cost-effective since they cut costs for setup, hardware, and maintenance, and do not require strong in-house expertise in live streaming infrastructures. Many of our customers also struggled with the vendor fragmentation and mix and match of different technologies from different sources. nanoStream Cloud was developed to provide a hassle-free solution for our customers.

The end-to-end live streaming approach gets rid of the overhead and complexity of building your own live streaming platform, and gives you our full expertise and support for a successful business!

nanoStream Cloud makes it very easy to adapt live streaming applications to different streaming environments with an easy-to-use dashboard and REST API, and grouping/tagging of live streams. You can instantly go live on any device!

Both nanoStream Live Encoder and nanoStream H5Live Player work with nanoStream Cloud, and together enable incredible ultra-low-latency results on any device.

nanoStream Cloud is the perfect end-to-end solution to rock your live streaming around the world in only one second!
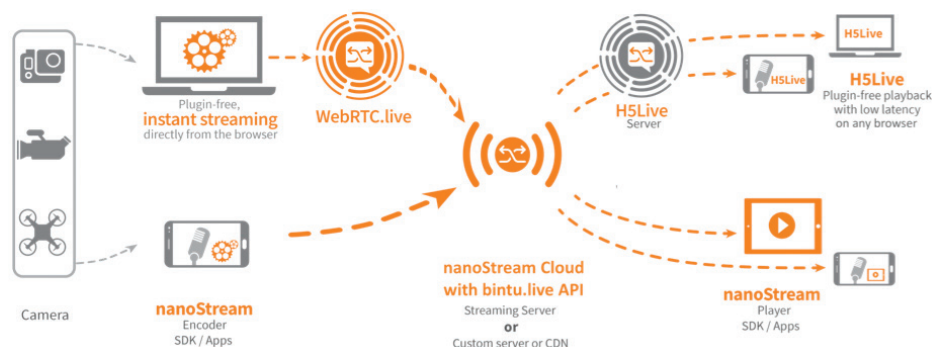
nanoStream Cloud / Global CDN
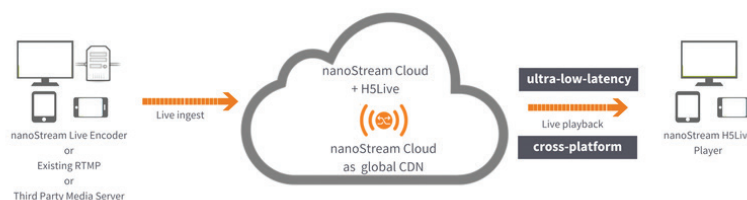
nanoStream Cloud Add-ons

nanoStream Cloud already counts on an easy to use dashboard and API, and the unique nanoStream H5Live Player for ultra-low-latency live playback on any browser. However, to power your live streams with a more unified solution for your own brand, you can add some extra tools.

nanoStream Apps and SDKs are designed for true cross-platform live encoding through H264 and AAC, optimised for latency.

You can even go completely plugin-free with nanoStream WebRTC.live. With just a single click, you can immediately go live from your WebRTC-enabled browser!

This can be audio/video or audio-only for radio-style applications.

WebRTC is an emerging technology originally promoted by Google, it can achieve very low latency but it does not scale well for delivery and playout to large audiences. nanoStream WebRTC.live Broadcaster enables plugin-free live encoding by integrating into nanoStream Cloud or even your existing RTMP streaming infrastructure, and nanoStream H5Live Player takes care of the delivery and playback in a scalable and compatible way.

nanoStream Cloud Add-ons are a great option if you are looking for an end-to-end solution that you don't need to worry about the processes. We do everything for you!

Moving to nanoStream Cloud

The benefits of moving to nanoStream Cloud are numerous: interactive, instant live streaming with ultra-low-latency on all HTML5 browsers, efficient setup, cost-effective, minimum need for multi-bitrate transcoding by using passthrough streaming, and, of course, cross-platform integration!

nanoStream Cloud is an end-to-end solution developed to make your work easier. However, if you already count on an existing live streaming setup, integration with nanoStream Cloud

is possible. nanoStream Cloud can also be considered an unified solution to cover all your live streaming requirements, or as an ultra-low-latency CDN on top of your existing setup.

Trying nanoStream Cloud

You can easily try any of the solutions mentioned above on our website, **www.nanocosmos.de/demo**.

Try it out for seven days for free and convince yourself nanoStream Cloud is the perfect solution to fulfill your live streaming needs. Go live around the world in 1 second! Get your camera ready, and we do the rest!

ABOUT NANOCOSMOS
20 years of experience in live video streaming!

The world is moving fast into a single melting pot of creating and consuming live video. There are a lot of different standards, formats, operating systems, and browsers. Companies around the world trust us to build live video applications successfully across platforms, in a wide range of sectors, from education and medical services to TV broadcasting stations and mobile media enterprises.

We offer private-label apps with an end-to-end service, so you can start live streaming events and promote your business ventures immediately.

Our core product is nanoStream Cloud for seamless integration of live streaming end-to-end. It counts on bintu.live for dashboard management and REST API and nanoStream H5Live Player for delivery and playback.

We also offer nanoStream Cloud Add-ons to power live streaming workflows. It includes nanoStream Apps and SDKs for true cross-platform live encoding and nanoStream WebRTC.live for browser-based live streams.
nanocosmos products are proven to work stable in all professional environments. All our nanoStream products are primarily based on our streaming technology with H264/AAC/RTMP encoding and streaming developed in-house. Businesses worldwide trust nanocosmos.

> c a s t L a b s

Stop Suffering From Buffering

A buffer icon is the blue screen of death of streaming video. When a video starts buffering, it's not long before your service user's impatience reaches levels of incandescent rage.

Simply put, buffering occurs when the user's device is unable to download video stream segments quickly enough to keep it playing over the connection available.

Playback performance is regularly cited as one of the top grievances of streaming service users, with the expectation that once a stream starts it should not stop. Failure to deliver this, at a buffer ratio of just 2%, can cause user playtime to decrease by 30% and the likelihood of user churn to increase by 20%, according to castLabs' business intelligence partner Nice People At Work.

So how can playback technology help you keep hold of your customers, tempted by an OTT market flooded with new niche and mainstream services? How can you avoid reputational damage for poor or intermittent playback performance across all devices?

FROM STABLE CLOSED CONNECTIONS TO SHARED NETWORKS

Multi-bitrate (MBR) streaming was the first model suitable for video streaming, delivering content in a variety of bitrates and determining at the start of the video which would best serve the available bandwidth. For relatively stable, closed connections, where videos are streamed at home, this is a satisfactory solution.

Yet as streaming has moved out of the home, for example watching in transport hubs or coffee shops on shared networks, stable internet connectivity is less assured and more diverse is the range of devices being used to stream content. 65% of consumers surveyed by IBM (2017, 'Becoming a Living Partner for Your Consumers') often or regularly experience buffering while watching video on their mobile devices, with that medium set for large consumption growth.

MULTI-SCREEN ADAPTIVE BITRATE WITH COMMON ABR

Well-suited to environments with fluctuating bandwidth, adaptive bitrate (ABR) streaming switches between a number of available bitrates during playback in relation to the user's available bandwidth, delivering the highest possible quality stream to the user's device. This flexibility during playback makes ABR ideal for content everywhere, where MBR's fixed bitrate quality throughout playback can lead to buffering when connectivity drops.

Yet the complexities of a consistent playback experience across all screens with ABR requires optimizing playback parameters separately across all of your device apps. Monitoring, adjusting, and delivering this to achieve a standardized experience can be resource-prohibitive, and as a result, costly.

castLabs' range of **PRESTOplay SDKs** (castlabs.com/players) make it easy to set the switching conditions for ABR across Android, iOS, Windows, Mac, and browser player apps. Utilizing our "Common ABR" method allows you to configure playback conditions for all screens at once. This slashes time spent on performance management and delivers a consistent cross-device user experience.
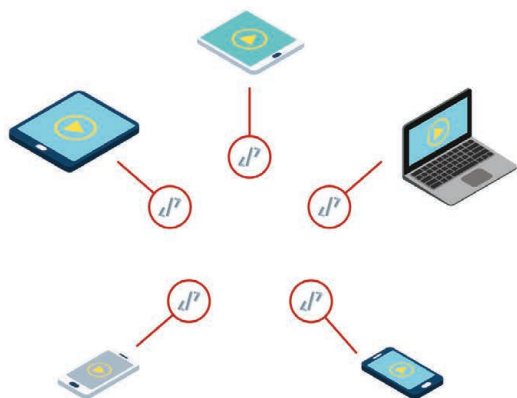
Resource needed without Common ABR   **Resource needed with Common ABR**
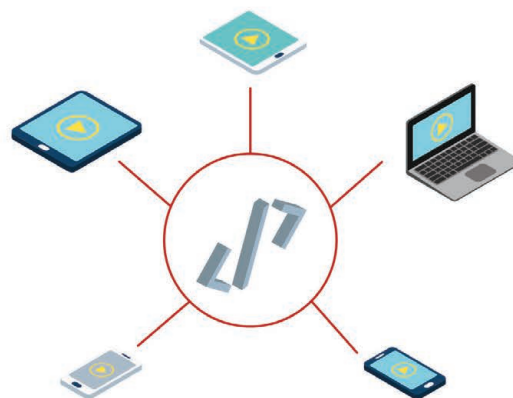
Implementing ABR with and without Common ABR method
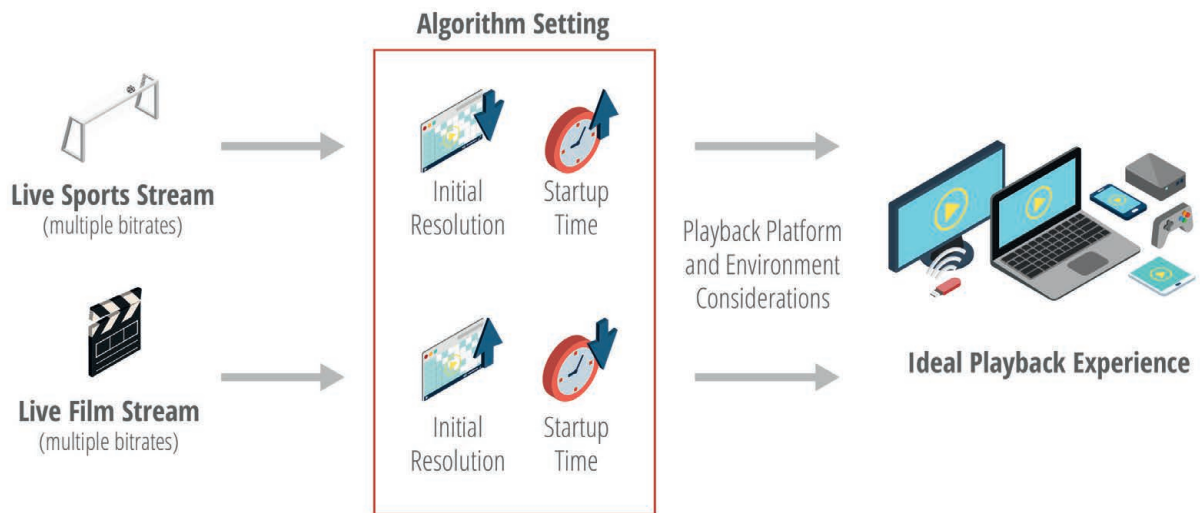
Sports .vs. Film Premiere example of setting algorithm parameters

Taking into consideration that not all playback scenarios are the same, Common ABR provides a set of algorithms that can be leveraged for different streaming environments. For example the ABR strategy and configuration for live streaming differs significantly from that of VoD playback.

Even within a particular scenario, common configuration of the ABR algorithm across different platforms can be used to micro-target with little effort required.

Targeting low-latency, close to live-edge scenarios such as sports events vs. live broadcasting of a movie, you may want to employ slightly different configurations. For sports events you could configure the player to be as close to the live edge as possible, and lowering the initial resolution that the ABR method chooses in favor of faster startup times. For live playback of a movie a better user experience might be created with a slower startup time, but increasing the initial bitrate to start the stream with a higher quality.

SMARTER CONTENT DELIVERY

Setting the algorithm parameters using the Common ABR method already helps you to realize the ideal playback experience, yet PRESTOplay player SDKs are able to make further playback improvements based on the user device and how they choose to view content on that device.

Where playback devices differ, affecting playback performance and required resolutions, the Common ABR abstracts platform-specific details and enables ABR configuration and set-up in a platform-independent way. This could be leveraged in A/B testing where different configurations can be pushed to targeted platforms, managed in a central place.

If a user chooses to watch a video at less than maximum screen size within an application window, PRESTOplay player SDKs can automatically determine the optimal bitrate quality to deliver in that environment. For example, a low bitrate rendition may be perfectly suitable when the user is watching in a quarter screen-size browser window, but the player can switch to a higher bitrate if the video is set to full screen. This allows your player to avoid unnecessary bandwidth usage in conditions where high bitrates are not needed.

Learn more about castLabs' feature-rich PRESTOplay range of SDKs (castlabs.com/players) designed to streamline development of premium player experiences.

PERFORMANCE PAST THE PLAYER

Minimizing performance issues doesn't stop at the player. With many streaming services delivering protected content, connectivity issues between the user device and DRM license server or license server downtime could greatly affect playback performance.

castLabs' multi-DRM service **DRMtoday** (castlabs.com/drm) offers a robust License Delivery Network that connects user devices to the nearest available server for low latency license delivery. DRMtoday can also enable DRM-secure playback offline, in persistent-license sessions, allowing your service users to watch content in low or no connectivity environments without affecting performance.

ABOUT CASTLABS
castLabs pioneers software and cloud services for digital video markets worldwide. The company provides solutions to easily enable the secure distribution of premium movie, TV, and audio assets for high-quality video experiences. You can find out more about castLabs PRESTOplay video player SDKs by visiting **castlabs.com/players**.

THEOplayer

Optimize Device Reach with a Universal Video Player

Video consumption is booming, reaching an overall high in 2016 and expected to rise even further in 2017. Additionally, there is a strong trend in moving away from consuming linear video on TV screens to consuming video content on other, often personal, devices such as laptops, smartphones and tablets.
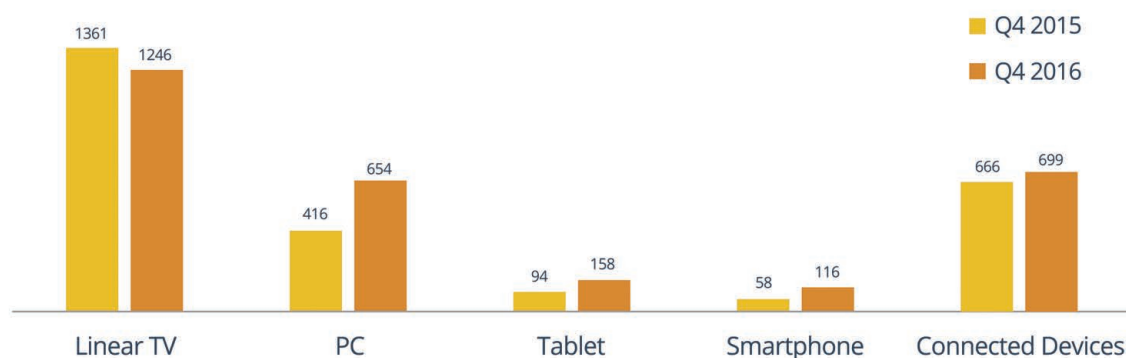
Data Source: MarketingCharts.com analysis of Nielsen Data

Average time spend per week watching online video, 18-34 year olds

Setting up a video service across all these devices is not always straightforward. Using device-specific video players, creates challenges in **delivering a consistent viewer experience**, difficulties in **managing technical and operational costs,** and complications in **extending and maintaining the streaming infrastructure** with each new device family. When using a Universal Video Player, these challenges vanish into thin air. The Universal Video Player takes away complexity when setting up a video service by providing a single video player which can be utilized regardless of the device family.

DELIVER A CONSISTENT VIEWER EXPERIENCE

Humans are creatures of habit, so when they interact with a video service, they typically stick to the content and features that they love the most. It can be very frustrating for them when these features differ depending on the device they use to interact with the service.

Comparing device-specific video players quite quickly leads to the discovery of a variation in the supported features. Even worse, sometimes the underlying mechanisms enabling specific features are different between device-specific video

players. For instance, seeking in the video timeline is a feature supported by most video players. However, one video player might be only capable of seeking to keyframes, while another is millisecond-accurate and can display preview thumbnails on the timeline as well. These behavior differences result in a fragmented viewer experience across devices.

Video services built with a Universal Video Player offer the same video player across devices. This results in a video viewing experience that not only contains the same feature set, but also supports these features in a consistent manner regardless of the device on which viewers consume the content.

REDUCE TECHNICAL AND OPERATIONAL COSTS

The process of setting up a video service across multiple devices includes numerous steps, each with its respective efforts and costs. To ensure a proper estimation of efforts, there are multiple aspects to be considered in each of these steps:

- **Investigation**: Finding a video player matching all your requirements typically involves extensive research, talking with multiple vendors, and creation of requirement sheets, as well as thorough testing of different viable solutions.

![THEOplayer logo]

- **Education:** Developers need time to get fully acquainted with the chosen video player, including studying the documentation, recreating demos. and most importantly, discovering the underlying mechanisms powering the chosen solution.

- **Integration:** The video player must then be integrated with the rest of the video streaming infrastructure. Once functioning correctly, the chosen solution should be customized to match the company branding and can be launched to viewers.

- **Support & Updates**: Post launch, the solution must be supported. This involves managing issues, often spread over multiple vendors, where no single vendor takes full ownership of resolving these issues.

  ° Every minor change made in the video streaming infrastructure needs to be validated with every video player.

  ° When one of these video players receives an update, compatibility must be retested across the whole infrastructure.

  ° Specific testing and Q&A procedures must be set up for every video player.

In case of device-specific player, these steps are repeated per device, as shown below:
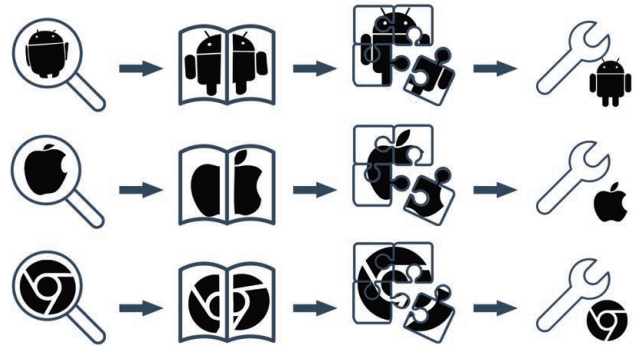
Delivering to iOS, Android, and Google Chrome with Device Specific Video Players

In case of universal player, these steps are covered in a streamlined manner, as shown below:
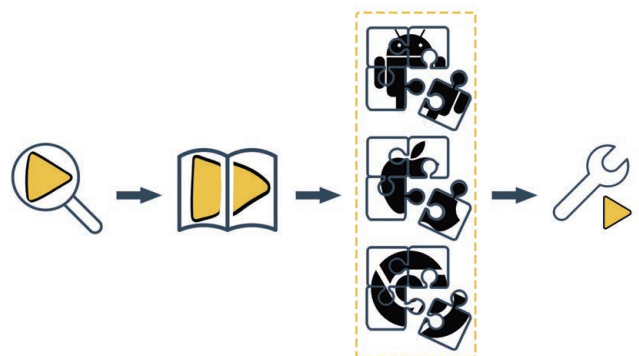
Delivering to iOS, Android, and Google Chrome with a Universal Video Player

CONNECT YOUR STREAMING INFRASTRUCTURE

The video player is the most consumer-facing component of the video streaming infrastructure, and it is responsible for delivering an amazing video experience to the viewers. However, delivering this amazing viewer experience requires the video player to seamlessly bring together all other components of the video streaming infrastructure such as streaming, content delivery, advertising, content protection, and analytics.

In case of device-specific video players, integrating them in the video streaming infrastructure is often challenging. Since the underlying mechanisms of each of these video players is different, extensive testing and fine tuning must be carried out in advance, for each of the supported devices. This often leads to the need for "glue code," which provides a workaround for the device-specific issues. This glue code could be error prone and difficult to maintain, resulting in additional difficulties when identifying issues in the video service, and during upgrades of the glued-together components.

Since the inner workings of a Universal Video Player are identical across platforms, testing, fine-tuning and glue code development would only have to happen with one video player. This drastically reduces the points of failure and makes it easier to replace and upgrade components. Even better, some Universal Video Players provide pre-integrations with other major components in the video streaming infrastructure. Pre-integrations take away the need to develop and maintain glue-code and ensure both solutions work together seamlessly out of the box.

CONCLUSION

It is integral to carefully consider the repercussions before finalizing the video player strategy. Using a device-specific player might often seem the most straightforward choice, but it has many hidden challenges and costs associated with it. A Universal Video Player takes away a lot of these challenges and thus is the best video player choice in the long run.

▽eepl△y

10 Things to Consider When Choosing a Video Player for Mobile Apps

Mobile video reached new heights in 2017, accounting for more than 60% off all video playbacks with a significant chunk of it happening in-app. This is without a doubt a fundamental shift that forces every video content publisher to reconsider its mobile monetization strategy. The fundamental building block for successful monetization strategies is the video player. Here are the top 10 things your player should cover so that you're not left behind:

1. MONETIZATION OPTIONS

The most important feature of a mobile video player is its ability to maximize your video content monetization through different ad types. There are two types of in-stream video ads that can be used to monetize video content.

- **Linear ads**: These ads interrupt various points of the video stream. Linear ads further split into three types: pre-roll, mid-roll and post-roll

- **Nonlinear ads**: Often referred as "overlay video ads," these ads run simultaneously with the streamed video content, hence the user sees the ad without interruption.

Within a video stream you can have multiple linear video ads and/or nonlinear ones.

One of the most important technological capabilities would be for the user to be able to interact with the ads in full screen mode, no matter the ad type. A native mobile video player has this capability over a HTML5 player.

Nonlinear ads are banner overlays that can be programmed to be shown anywhere within the video stream and can be displayed for any amount of time up to the duration of the video.

The video player has to be capable to run VAST tags delivered by the ad server you're working with. As there are a sea of ad networks, you need to choose a player that works out of the box with any VAST compliant ad-server or exchange.

The player solution has to be VAST 1.0, 2.0, 3.0 compliant. VAST is the most common format, but MRAID and VMAP should be included too.

2. EVENT TRACKING

Key metrics are crucial for understanding how video content is consumed. Your player of choice must be able to track crucial linear events such as creative view, start, first quartile, midpoint,

third quartile, complete, mute, unmute, pause, resume, fullscreen, exit fullscreen, close linear, skip, progress, clickthrough, and click tracking.

In order to gather the information about how your audience is consuming your video content, the video player either has to have an easy-to-integrate API with analytics platforms to provide you access to such information or a dashboard where such information is exposed.

3. DRM-READY

Protecting the video content through DRM solutions like Marlin, Verimatrix, or PallyCon goes a long way towards solving publishers' problem, since they need a player that can be integrated with such security providers.
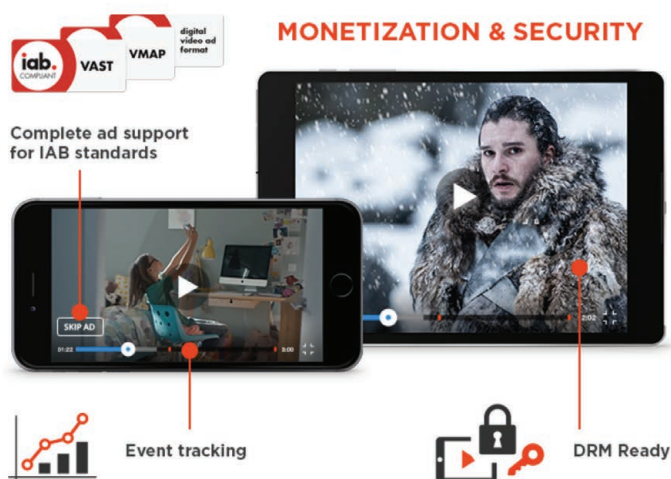
4. TV PLAYBACK

Although most video consumption is done on smartphones and tablets, while at home most viewers prefer having that content streamed on TV. Your player needs to be capable of supporting video & ad playback on platforms like Apple TV, Android TV, Chromecast, Google Cast, Amazon Fire TV, or Nexus Player.

5. GAPLESS ADAPTIVE STREAMING PLAYBACK

While the quality of recorded video has improved over the years, along with the ability of smart devices to play high-quality

video, we see a downturn or concern for publishers when delivering such large video files, users' data consumption. In order to solve such issues and not affect the users in any way, publishers need to choose a player solution that has adaptive streaming capabilities. The video player must be able to select the media file based on device type and bandwidth support.

If you'd need the player to support HTTP Live Streaming (HLS), across all mobile platforms, you would need such automatic adaptive streaming where the bitrate is changed automatically based on network conditions and the HLS manifest presented.

6. SUPPORT FOR ALL MOBILE PLATFORMS

Supporting both iOS and Android platforms is a must for any video player solution. When looking for a video player, you can go with HTML5 or native video player SDKs. If you are looking to achieve performance and stability and maximize your monetization, you'll have to go with a native video player solution.
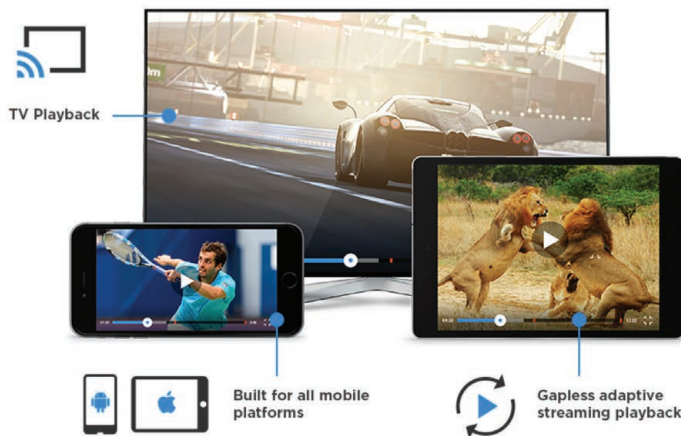
7. COMPLETE CUSTOMIZATION

Each app has its own custom UI/UX, and you'll need to have a fully UI-customizable video player solution, to fit the app's design.

8. CLOSED CAPTIONING

If you're delivering video content that comes together with subtitles based on SRT or WebVTT (the best-known formats), you'll need a player that supports that ability.

9. MULTITRACK AUDIO

Delivering movies that have multiple audio tracks comes in handy for users, and your player should support multitrack audio so they can choose the preferred language.

10. PRICING

Publishers come in all shapes and sizes, so if you're starting small you should be able to choose a player that grows with your business.

While small & medium publishers should be able to choose a progressive pricing scheme that tracks their ad & video playbacks, enterprises should be able to keep their costs under control with a flat-fee option that covers their needs regardless of playback or ad volumes.

SUCCESS STORIES WITH VEEPLAY

7TV - Pro7S1
"We are glad to have found a reliable partner in Veeplay, whose player technology allows us to keep pace with the fast moving environment of mobile video."

Dr. Tilman Buchner
CMO ProSiebenSat.1Media SE

Sport1
"The Veeplay player SDKs allowed SPORT1 to significantly improve video distribution and gather full control on its InStream advertising strategy."

Alexander Poch
Product Manager Video at SPORT1

Markiza
"Veeplay unlocked mobile video advertising for Markiza and allowed us to deliver a great video experience to our users while not compromising on monetization options and security?"

Anton Zdarilek
Head of New Media at Markiza TV

ABOUT VEEPLAY
Veeplay is a technology company dedicated to helping publishers worldwide deliver the best video experience and better monetize their video inventory on mobile devices. Veeplay's providing mobile video player SDKs for iOS and Android to unlock new ad formats, improve video distribution and stability and offer our customers a better understanding of their users behavior.

RADIANT
[MEDIA]
PLAYER

HTML5 Video on Every Device at Anytime

HTML5 video for all devices

We've seen many changes in the past year, but one thing has not changed in 2017: When it comes to building an online video service, the device market is still as fragmented as it was in 2016. From mobile phones and hybrid PC-tablets to dongle sticks and smart TVs, one can get lost trying to answer this question: How to reach viewers on all those devices? There is one simple answer: HTML5.

Web technologies have matured to the point where it is now possible to use them to build a video-oriented service that run on most popular devices, be it a mobile app, a Fire TV app, or a web site. Technologies like Apache Cordova cross the gap between web-based code and native code.

WHAT ARE THE BENEFITS OF USING WEB TECHNOLOGIES?

You only need a polyvalent web developer (or team of developers) to reach this fragmented landscape. Your application will feel homogenous and your development cost and time to market will be reduced drastically.

Yet I already hear the sweet voice of scepticism: "My app won't feel native and I won't have all the native features … so I still need dedicated resources for each major device."

If this was 2012, you'd probably be right. But this is 2017, and frameworks like Ionic have proven to be reliable while providing a near-native experience. In a nutshell, you do not need a senior Java developer to run a 360° video player in an Android app anymore—you just need a web developer and an HTML5 video player with 360° video support. At Radiant Media Player, we have got you covered and you can embed our player with its rich features, including 360° video, in a web-based mobile app for Android or iOS.

WHAT FEATURES TO LOOK AT WHEN CHOOSING A PLAYER?

Viewers are out there—and they yearn to consume quality content. The message you want to share is important, but it must be shared reliably. All viewers expect fast start-up times, intuitive player controls, and little to no buffering in varying network conditions.

RADIANT
[MEDIA]
PLAYER

At Radiant Media Player, we use and contribute to open source projects like hls.js to insure the streaming experience delivered through our player is top-notch.

Your player should also cover generic features like live streaming, captions, skinning, playlist, HTML5 audio, and so on. But let us scratch the surface and try to go a little bit further.

Opting for a Future-Proof Player

In our digital age new policies and standards are constantly emerging, and you need to opt for a player that will adapt to those changes. Recently Apple and Google updated their views on autoplay and are progressively restricting autoplay to muted autoplay in their browsers. Anticipating those changes, at Radiant Media Player we have implanted promise-based autoplay as soon as those new policies were announced to make sure that on D-day our player would not fail.

Tailor your Application to Your Audience

Customising your application to a specific audience can be challenging. We have several customers at Radiant Media Player using our player as part of a SVOD service for anime (e.g. Japanese animation). There is one feature that matters most to an anime audience: multi-language support. An anime fan will want to have the option to switch audio and caption tracks while watching an episode. Elon Musk is probably going to be able to build a player that can fly to Mars, but if it does not have good multi-language support an anime fan is probably not going to care.

Tailor your application to your audience

MAKE YOUR DEVELOPERS HAPPY (API)

A well-known fact among entrepreneurs is that when a project is successful it comes from people enjoying the day-to-day work. When choosing a player on the market you need to make sure your developers are going to be conformable working with it. That means a player with a rapid development cycle, a rich API, clear product documentation, and someone technical to talk to when needed. At Radiant Media Player we work closely with our customers and their developers to achieve outstanding technical support. Many of the features we have implemented in 2017 are coming directly from relevant customers' requests.

DIY PLAYER OR FULLY-FEATURED ONLINE VIDEO PLATFORM?

It really is up to you to decide which is best for your project. A fully-featured online video platform will provide encoding, hosting, player and monetisation services. With a DIY approach you will be using different services that you will need to coordinate so that they can work together. So why pick a player that only does the player job?

First, granularity. Online video platforms have several areas to cover and may only provide mainstream features. For more advanced features, you will need to use services that specifically focus on one section of the online video chain. This is what we do at Radiant Media Player—we only focus on the player, and that gives us the flexibility to do things others cannot do.

Secondly, you need to consider your budget. By carefully picking standalone services that match your business requirements, you could significantly reduce your operational costs.

Lastly, if you are a Lego fan, then the DIY way is 100% for you.

ABOUT RADIANT MEDIA PLAYER
At Radiant Media Player we love web video. We provide a fast and fully-featured HTML5 media player that embraces the way we consume content in our digital age: everyday, everywhere, on every device. Display live, DVR and on-demand content with HLS or MPEG-DASH and monetize it with our advanced video ads solution. Go secure with DRM, fancy with 360 video or custom with our powerful API.

Learn more at **radiantmediaplayer.com.**

Transloadit

Tus.io – the new standard for reliably transferring large files

Both professional and consumer recording devices are constantly producing ever-larger video files. With a multitude of formats like 1080p, 4K, 8K, and RAW, for both photos and video, it is getting more common to see file sizes in the range of 10GB to 100GB. Being a company in the transcoding business for nearly ten years, Transloadit began to notice a steady increase in transmission errors and lost or corrupted videos, even though our own encoding clusters handling the ingestion were running smoothly. As it turns out, the quality of networks often isn't able to keep up with these larger file sizes. In other words, people are pushing more and more weight over the same old primitive suspension bridges. And while, admittedly, these bridges are sometimes upgraded to be wider and people are moving faster, they have certainly not become any sturdier.

tus.io
Open Protocol for Resumable File Uploads

If you are distributing content over HTTP, you have been in luck. Downloads have already been resumable ever since HTTP version 1.1. But for file ingestion, such as uploading content to an encoding platform, there has never been an open standard. While a number of projects have come to fruition over the years, they had a commercial aim or were focused on their own situation. They were not interoperable because they lacked common language. It was like there was no NFL and every football team just played by their own rules.

At Transloadit we decided to do something about this situation. Together with Vimeo and people at Google and GitHub, we set out to create 'tus.io', an open source file transmission protocol designed to withstand packet loss, mobile sources on the move, and flaky Wi-Fi. In addition to that, it can also be deployed in datacenters to achieve higher performance while exchanging videos between servers.

Key benefits of sending files with tus.io:

• **Reliability**: When you upload using tus.io, a connection may still drop, but the upload is retried aggressively and only the remaining bytes are uploaded again. This means connection drops are hardly noticeable.

• **Performance**: Besides its increased reliability, tus.io has the ability to split up large files into chunks. Each chunk is then simultaneously sent as an individual tus.io upload, meaning it can benefit from automatic resumability as well as all other tus.io features. Once all chunks have been sent, they are merged on the receiving end to restore the original file. It is like teleportation, but without the risk of turning your files into half-fly mutants—and also much more performant than regular TCP uploads.

• **Cost-Efficient**: tus.io is completely open sourced under a liberal license and can be adapted and embedded in commercial products without paying any fees. SDKs have been made available in all programming languages, so adding tus.io's transmission benefits is often as easy as adding a line of code to your own SDK or app.

How tus.io can increase both speed and reliability of file uploads
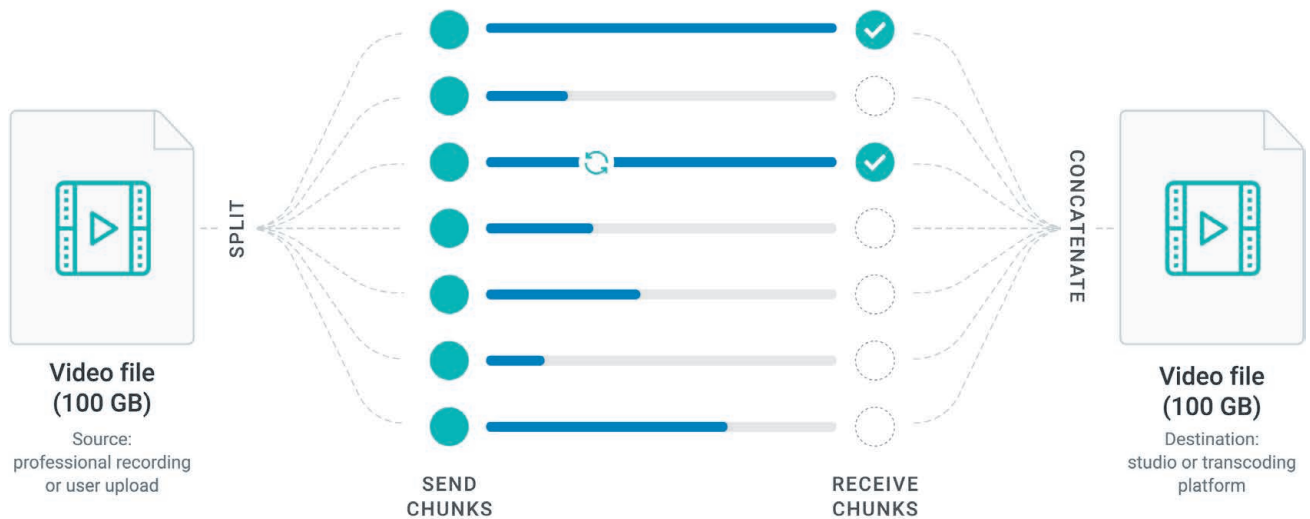
Achieve maximum throughput by sending chunks in parallel. Auto-resume each individual chunk for reliability.
Tus works over HTTP so can be deployed with web browsers and works with all firewalls/proxies.

• **Compatibility**: Non-HTTP or UDP solutions are usually blocked in corporate firewalls and hotpots in airports, hotels, etc. Fortunately, since tus.io works as a thin layer on top of regular HTTP, it can be load balanced, proxied, and cached, and has no problems passing through firewalls like regular web traffic. In fact, tus.io can also work right from apps or the web browser, in case you want to offer first class file uploading to end users without them ever having to leave your app or website. We recommend taking a look at our next-gen file uploader uppy.io, which layers a number of convenient UX features (drag & drop, webcam support, pick files from cloud services) on top of the raw transmission power that tus.io has to offer.

• **Security**: Since tus.io works over HTTP, all traffic can easily receive end-to-end encryption using your existing TLS (HTTPS) setup.

WHY IS THIS FREE? WHERE'S THE CATCH?

Transloadit does not and will never charge for tus.io. Our business model revolves around releasing great open source projects that are complementary to our commercial offering: our versatile encoding platform. Besides that, we also offer

hosted versions of our open source projects for customers that either don't care for the associated DevOp headaches, or have found that due to economies of scale, it is more cost-efficient for them to take a subscription on our content ingestion and encoding platform than to roll one themselves.

MORE INFORMATION

For more information or a demo you can contact **hello@transloadit.com**, or start implementing right away by visiting our community protocol website: **https://tus.io**.

ABOUT TRANSLOADIT
Established in 2009 by founders who met through the open source community, Transloadit is a B2B SaaS cloud service for uploading and encoding files. Transloadit can process video, audio, images, documents, websites and allows powerful chaining and custom workflows. A strong believer in the benefits of having a globally distributed workforce, Transloadit made the decision early on to operate as a remote-first company. Open source remains fully ingrained in the company DNA and many of its releases have grown to be industry standards. To date, Transloadit has catered to the needs of small startups all the way up to high-profile enterprises including Viacom, Khan Academy, Coursera, and The New York Times. Transloadit is bootstrapped, profitable, and privately owned by its two founders: Kevin van Zonneveld and Tim Koschützki. Website at **https://transloadit.com,** and **@Transloadit** on Twitter.

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Information Today, Inc.

IMF:

One Format to Rule Them All?

By Tim Siglin

IMF may offer a potential 'master format' approach, but it's not quite there yet.

The Interoperable Master Format (IMF) holds the promise of drastically reducing the number of different versions of a file that a video publisher needs to deliver to viewers—a promise so strong that the world's leading video subscription service has been taking notice.

"A few years ago we discovered the Interoperable Master Format (IMF), a standard created by the Society of Motion Picture and Television Engineers (SMPTE)," wrote Chris Fetner and Brian Kenworthy in a Netflix Tech Blog posting in late 2016 (go2sm.com/netfliximf). "By using this standard, Netflix is able to hold a single set of core assets and the unique elements needed to make those assets relevant in a local territory."

"[Our global] supply chain needed an efficient way to vault our masters in the cloud that didn't require a different version for every territory in which we have our service," Fetner and Kenworthy wrote.

So what is IMF and where did it come from? And what are the benefits and limitations of IMF? This article highlights several of those key areas, including the use of an extensible markup language (XML) and the material exchange format (MXF), the audio- and video-track container format that underlies IMF.

"The goal behind IMF is to provide a single interchangeable master file format primarily for distribution," says David Schleifer, Primestream's chief operating officer.

Schleifer, who provided a good bit of detail for September's article "MAM and DAM Evolve Into the Cloud" (go2sm.com/mam), noted that Primestream strives to support the latest standards as a way to deliver new workflows and efficiencies their customers. However, he warned that IMF isn't exactly a universal format when it comes to the acquisition and post-production processes.

"We do not currently see IMF as a format in the production process upstream from distribution," says Schleifer, "but rather as a deliverable for the final product."

Understanding IMF: Bits and Bobs

The IMF family of standards, according to SMPTE, is maintained by its Media Packaging and Interchange Committee 35PM. IMF is a superset of MXF and XML, with the benefits of both in addition to the ability to move beyond MXF's binary-based versioning (to what IMF refers to as the Composite Playlist, or CPL).

A good overview of MXF and how it compares to IMF can be found in a blog post by Dalet's Bruce Devlin (go2sm.com/daletimf). The blog post argues that XML, which has been used for everything from Microsoft Word to websites, is a more approachable option for creating playlists.

"There are maybe 20 or 30 really good MXF binary programmers in the world today," writes Devlin. "XML is much more generic, and there must be hundreds of thousands of top quality XML programmers out there."

In essence, IMF uses XML as a human-readable way to represent various content versions while, according to Devlin, "maintaining the proven AS02 media wrapping to store the essence components."

The entire standard resides under SMPTE ST 2067 (go2sm.com/smpteimf), with the most recent versions being designated as 2016, such as the Core Constraints standard, which is ST 2067-2:2016.

In addition to the ST 2067-5 essence components—including audio, basic metadata, timed text, and video—the SMPTE family of IMF standards also maintains a series of profile lists (100-103, currently) as well as key application use cases.

The profile lists, which were last updated in 2014, provide common image or audio definitions and macros, as well as common image pixel colour schemes.

The applications are where the heavy lifting—or at least the previous thoughtful constructing of typical use cases for the IMF container format—is done.

For instance, Application 2 is geared toward "studio applications where a TV or movie title is transformed into multiple content versions (airline edits, special edition, languages…) that are made available to multiple consumer distribution channels (internet, optical media, broadcast…) across multiple territories and over the span of many months to over a year."

The Netflix Tech Blog post explains one of the practical approaches to the Application 2 use case. In their blog post, Fetner and Kenworthy point out that that for certain titles,

such as the Netflix-owned *Narcos* series, the video asset is largely the same in all territories, although key elements at the beginning and end of an episode might change, such as the post-episode title sequence.

"[W]e can hold the Primary AV and the specific frames that are different for, say, the Japanese title sequence version," Fetner and Kenworthy wrote. "This reduces duplication of assets that are 95% the same and allows us to hold that 95% once and piece it to the 5% differences needed for a specific use case."

Playing Content in an IMF Container Format

While the main assets, or essence, of an IMF container centre on audio and video, another powerful feature of the IMF family of standards is the ability to play back content.

ST 2067-3:2016 (go2sm.com/smpteimf3) uses the underpinnings of XML to generate a CPL

Ramki Sankaranarayanan of Prime Focus Technologies sees two benefits to IMF. "The first of these is helping media enterprises better manage the business of content, and the second is using automation to boost efficiency and cost-effectiveness when syndicating across platforms, regions, and audiences."

that acts as a "representation of a single version of a finished IMF composition (feature, episode, trailer, advertisement, etc.)."

The CPL contains the information necessary to describe the composition and to synchronise its underlying essence for a series of use cases, from playout or transcoding.

Because it uses XML, it is both extensible, in terms of how the playlist is laid out and new features are added, as well as readable by humans. As ST 2067-3:2016 currently stands, it is designed for file-based operations.

An example of a company seeing immediate benefit from IMF playback functionality is Prime Focus Technologies.

"PFT is a strong supporter of the Interoperable Master Format because it is aligned with two of our driving principles," says Ramki Sankaranarayanan, CEO and founder of Prime Focus Technologies.

"The first of these is helping media enterprises better manage the business of content, and the second is using automation to boost efficiency and cost-effectiveness when syndicating across platforms, regions, and audiences," Sankaranarayanan says.

Prime Focus has created an IMF-compatible player that provides the preview, review, and playback. In addition, the player can distribute, over a streaming proxy, a CPL with all its essences including video, audio, and timed text (e.g., captions, subtitles).

Storing Assets Within IMF

One area where IMF offers promise is the ability to move full packages of content around without requiring a relinking step that's often necessary in many container formats.

As referenced in the Netflix Tech Blog, above, lowering overall storage requirements is a sizable benefit of avoiding duplication of assets.

But there's also another benefit, wherein IMF acts almost like a folder on a desktop computer, holding

multiple assets in a single logical storage location.

The assets don't need to be only audio or video files, although an IMF can just as easily contain multiple camera angles and multiple language audio files, but can also be subtitles or timed-text files. The beauty of a single format container holding many complementary files is that these assets can be bound together in one of multiple permutations at the time of delivery—called late binding—that are supported by multiple streaming technologies such as MPEG-DASH or Apple's HTTP Live Streaming (HLS).

Late binding from a grouping of complementary assets within the IMF container means that IMF is as beneficial for delivery as it is for storage. But editing IMF content can be tricky.

Why? Well, it turns out that IMF packages are active document containers similar to the Microsoft Binder concept in early versions of Microsoft Office. While IMF is made up of modern video and web technologies likes MXF and XML, it turns out that the IMF package essentially works the same way as Binder, which housed all the PowerPoint slide decks, Word documents, and Excel sheets for a given project.

Binder allowed Excel sheets that were dynamically linked into a PowerPoint slide deck to be always available when the PowerPoint slides were edited or delivered. It's true that Binder added to the size of a typical PowerPoint deck, but only by a negligible amount, since the Excel sheet was a much smaller file size, and the convenience of having the Excel and PowerPoint files together in one container format outweighed the show-stopping inconvenience of having a broken link to an Excel table embedded in the PowerPoint presentation.

One problem with the Microsoft Binder approach, and perhaps a major reason that it was discontinued around the time of Office 2007, was the problem of editing. While the Microsoft Office suite of products could easily edit Binder

documents, other editing tools that were Excel- or Word-compatible were often unable to understand the same document types integrated into the Binder format. Even those that did understand the Binder format often could not extract or edit either the internal Excel or Word documents without damaging the document's relationship with the Binder or other files within the Binder.

Editing Within IMF

As mentioned earlier, the idea of using IMF as a container format for acquisition or post-production processes is not the initial intent of IMF.

It's true that IMF is based partly on MXF, which itself is a video and audio container format used in acquisition, but IMF's additional payload options make it more suited for delivery than a production workflow.

"Although IMF uses 'simple' MXF variants for the storage/transport of the actual media

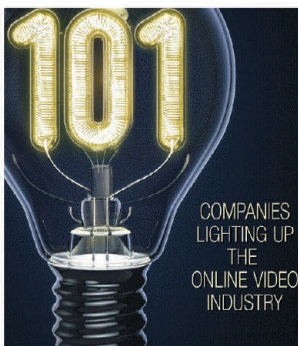frames, it does add an extra layer of complexity in the form of XML files," says Primestream's Schleifer.

"These XML files are used to describe the relationship between the different media and their versions, and this extra metadata has more value when the files are transported between systems, and less value when production is occurring within a system or workflow that maintains the same and in many cases even more metadata," says Schleifer.

But what about editing the CPL, in the same way an M3U8 or MPD manifest file for HLS or MPEG-DASH, respectively, would be edited?

In theory, editing limitations should not be a major roadblock, but editing itself will be an important litmus test for IMF-compatible software tool vendors to overcome.

"Not many editing/archive/ingest/playout components or systems in the production workflow currently support IMF," according to Schleifer.

One step in the editing process would be to properly modify IMF compositions created with one of several available desktop CPL edit solutions. Another would be meeting necessary interoperability standards when it comes to proper ingestion of complete or supplemental IMF packages.

Not only are storage and playback important, but the included metadata in any IMF package must be readable by both human and software parsers. Therefore, the ability to index, search, and retrieve key portions of an IMF package are critical requirements.

Finally, editing also brings into focus the need to properly allow updating of a CPL within an existing IMF package, whether the package is on the local machine where CPL edits are occurring or on a local server or stored in the cloud.

As such, the ability to upload and download complete or partial packages as part of the overall distribution scheme is critical. In some instances, this distribution may also require stripping away the IMF package itself in favour of transcoded output. In other words, the final deliverable may be the audio-video files rather than a total IMF package.

Next Steps for IMF

In all the excitement around IMF, it's easy to forget that not only must the XML be extensible, but that the IMF packaging structure must be flexible enough to handle new audio and video formats. Steps are underway to address 360° video as well as VR video.

In addition, continued improvement around packaging data XML—the XML within the IMF that allows for asset mapping, packing lists, and even practical constraints such as a volume index for movie and broadcast delivery compliance—will address VR video and other more exotic use cases.

Already, there is an Application 2E, with the E standing for Extended, which offers support for imaging that has wider colour depth—High Dynamic Range, or HDR—as well as larger resolutions.

Specifically, Application 2E addresses "colorimetry specified in IEC 61966-2-4 and Recommendation ITU-R BT.2020" as well as "colour primaries specified in SMPTE RP 431-2."

Following the HDR transfer function specified in ST 2084, IMF packages can now contain HDR frames at a "maximum width and height of 4096 and 3112 pixels, respectively," to handle both ultra-high-definition (UHD) as well as the Digital Cinema Initiatives 4K specifications.

On the vendor front, Prime Focus' Sankaranarayanan says that the player portion, while critical, is only one step in streamlining overall workflows.

"The IMF Media Player was just the first step in our innovation-driven product roadmap towards IMF readiness," says Sankaranarayanan. "Our integrated software offerings offer smart possibilities with automation, and are well-positioned to deliver more speed, more control and much lower Total Cost of Operations (TCOP) to M&E companies. We know that IMF will be a core technology in that future, and we are already well underway."

Encrypted Media Extensions

by Jan Ozer

O n July 6, 2017, Tim Berners-Lee, the director of the World Wide Web Consortium (W3C), moved the Encrypted Media Extensions (EME) to recommended status. Although this move was later appealed and the final decision is on hold, this felt like a good time to review the status of EME as a replacement for plugin-based DRM.

Let's Review: What Is EME?

Briefly, EME is an API that lets browsers and other applications communicate directly with digital rights management (DRM) systems, replacing the functionality that plugins like Flash and Silverlight previously performed. While few mourned the loss of plugins, this immediately complicated the lives of publishers that distribute content to browsers.

That's because in a plugin-based DRM world, publishers could work with one DRM provider to stream to all browser-based targets. Publishers that used Adobe Flash used Access (now Primetime) DRM; those that chose Silverlight used PlayReady.

However, once plugins were out of the picture, browser vendors had to incorporate one or more DRM technologies directly into their browsers. Predictably, Apple chose FairPlay, Google chose Widevine, and Microsoft chose PlayReady. Mozilla originally chose Primetime, then also integrated Widevine into Firefox.

So with plugins, you could support all browsers with a single DRM. With EME, to distribute protected content to Chrome, IE/Edge, and Safari, you'd need to support three DRMs, not only from a licensing perspective, but also from an encoding and playback perspective. The licensing aspect is simple; the EME specification easily supports multiple DRMS in the same source file.
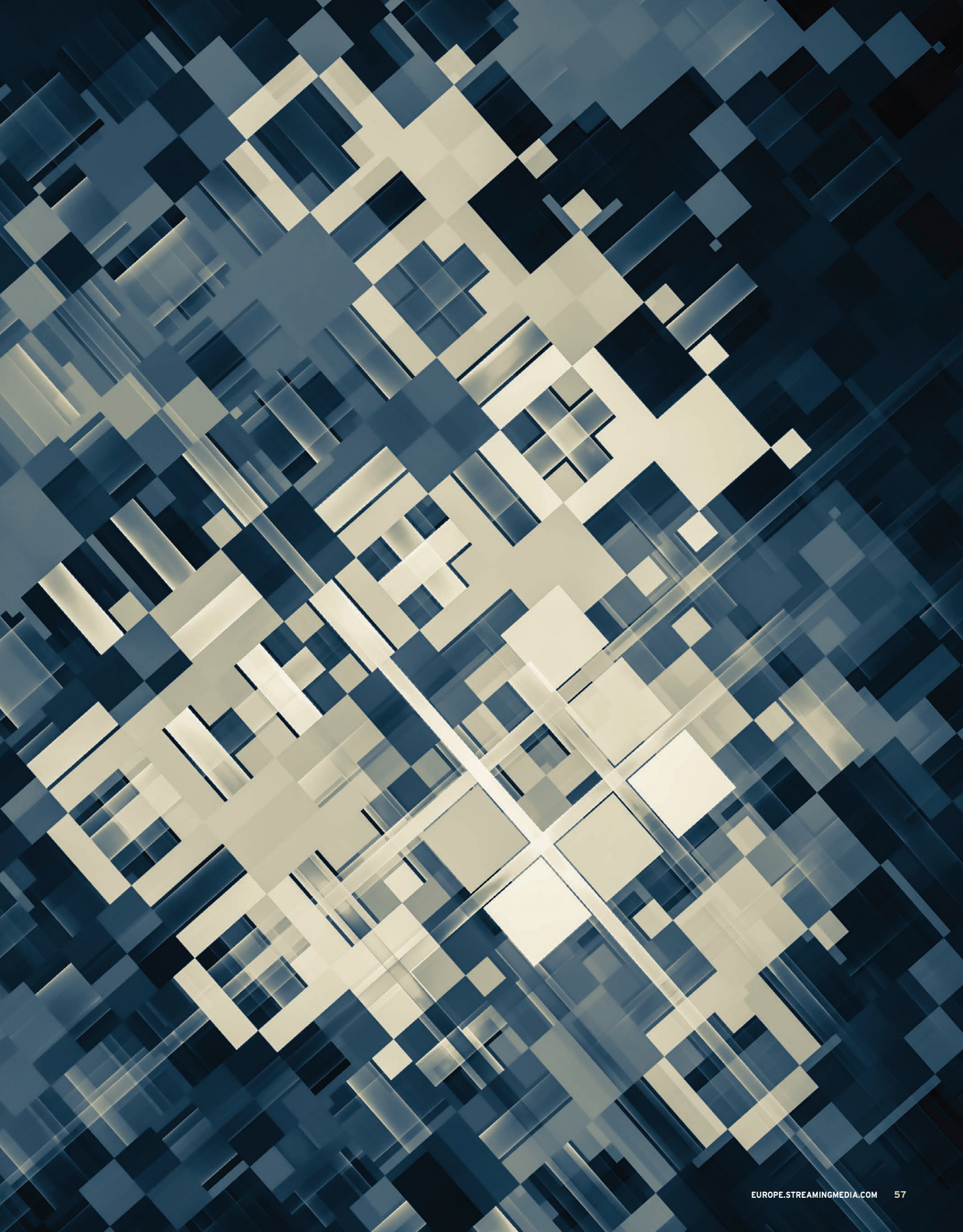
The problem is the multiple incompatible formats, such as Dynamic Adaptive Streaming over HTTP (DASH), Smooth Streaming, and HTTP Live Streaming (HLS), that are required to deliver to the multiple targets. In many cases, this means that publishers have to store multiple sets of encrypted files to serve these targets, boosting storage costs and diminishing the effectiveness of browser caches. Expanding support for DASH and new technologies like the Common Media Application Format (CMAF) are helping, but EME is still more complicated and expensive for producers than the plugin model.

What Did the W3C Do?

According to its website, the W3C is "an international community where Member organizations, a full-time staff, and the public work together to develop Web standards" (go2sm .com/w3c). Tim Berners-Lee, who is widely considered the inventor of web, heads the organisation. On July 6, 2017, the W3C issued a Disposition of Comments for Encrypted Media Extensions and Director's decision (go2sm .com/w3ceme). The document reviewed all the objections that members had to the EME spec, and concluded the following:

> The Encrypted Media Extensions specification remains a better alternative for users than other platforms, including for reasons of security, privacy, and accessibility, by taking advantage of the Web platform. While additional work in some areas may be beneficial for the future of the Web Platform, it remains appropriate for the W3C to make the EME specification a W3C Recommendation. Formal publication of the W3C Recommendation will happen at a later date.

Subsequent to this filing, the Electronic Frontier Foundation (EFF) appealed this decision. I'll discuss that later in this article.

What Does Recommended Status Mean?

From the perspective of most W3C members and other parties interested in the theoretical appropriateness of EME, it ends the debate, or it least it will once the appeal is settled. From the perspective of companies that actually use EME, like browser and player developers and DRM vendors, it means surprisingly little.

Unlike other web standards like H.264/H.265, which aren't commercially released until the standard is formalised, EME has been in use for 2 or more years, depending upon the browser.

Writing for Medium (go2sm.com/medium eme), author Sander Saares states, "Web standards are usually developed in parallel with implementations and EME was no different. Two major browser manufacturers—Microsoft and Google—each had their own DRM technology and they were eager to get it on the market in a widely usable form. While discussions were ongoing, their browsers implemented what seemed to be the most sensible opinion of the day and sometimes created custom API extensions where there was no EME-provided solution."

Saares goes on to describe how that commercial usage tended to reduce the urgency of creating and finalising the specification, and observes, "EME in practice has been a done deal for a year or two already. It is in widespread use and blocking standardisation will not get rid of EME or change what browsers do. In many ways, EME survives at the mercy of browsers, not the other way around."

W3C director Tim Berners-Lee seems to agree. In his lengthy and surprisingly readable blog post, "On EME in HTML5" (go2sm.com/eme lee), which addresses many of the objections to EME, Berners-Lee states:

> When a company decides to distribute content they want to protect, they have many choices. This is important to remember.
> If W3C did not recommend EME then the browser vendors would just make it outside W3C. If EME did not exist, vendors could just create new JavaScript based versions.

Viewed in this light, the W3C recommendation is more a ratification of the work already implemented than a directive to be observed by those who implement. That said, this doesn't mean that the specification serves no essential purpose. Beyond thoroughly documenting the specification for all users, the final spec sets expectations regarding one of the key issues that hindered its adoption.

What Concerns Did EME Raise Among W3C Members?

There were a number of concerns raised which fell into two categories, concerns about

CDM Contained by a Sandbox

An open source, auditable sandbox limits what data flows in and out of the CDM.

USER

Firefox

CDM (Adobe)

Open source sandbox

Operating system (disk, network, etc.)

■ Encrypted video/audio data
■ Decrypted video/audio frames
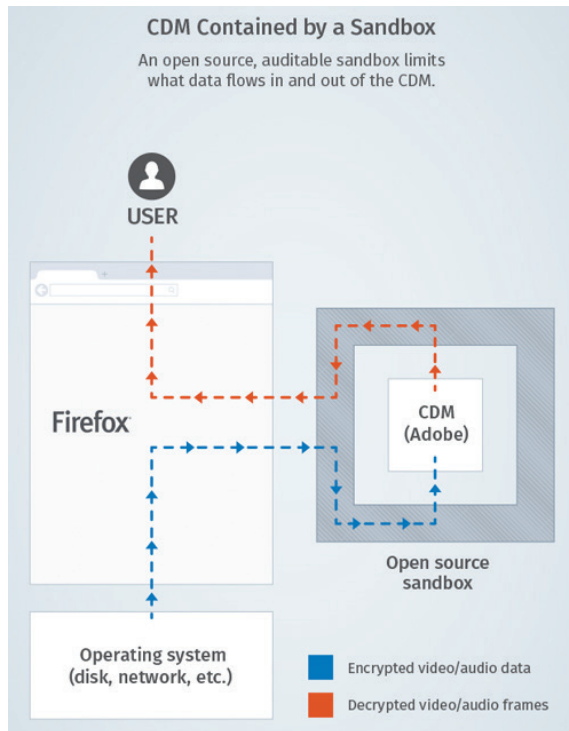
DRM in general and concerns about the EME implementation. Berners-Lee disposed of the generic DRM-related concerns in his comments above; basically, premium content companies won't ship content without DRM, so either the W3C includes it in the spec, or the browser industry incorporates DRM anyway.

Most of the EME implementation concerns related to the fact that the content decryption modules (CDMs) actually inserted into the browser code were black boxes, so users couldn't tell if they were accessing personal data or installing some kind of malware on the computer. These concerns are not totally unfounded, as Sony was caught doing that in 2005 in the famed rootkit scandal (go2sm.com/sonybmg). You can draw your own conclusions about the likelihood of Apple, Google, Microsoft, or Mozilla trying something similar.

Either way, according to Philippe Le Hégaret, project management lead for the W3C, these concerns led to a new section in the W3C draft spec entitled CDM Constraints. This section states in part, "User agent implementers must ensure that CDMs do not access any information, storage or system capabilities that are not reasonably required for playback of protected media using the features of this specification." The specification leaves the implementation

details up to the implementer, and specifically mentions a sandbox as a valid alternative.

As shown in **Figure 1**, a sandbox controls all of the communications the DRM has with the computer. As described in the blog post "Reconciling Mozilla's Mission and W3C EME" by Andreas Gal: "In our implementation, the CDM will have no access to the user's hard drive or the network. Instead, the sandbox will provide the CDM only with communication mechanism with Firefox for receiving encrypted data and for displaying the results" (go2sm.com/mozilla hacks). Since Mozilla is an open source browser, users, DRM providers, and/or content publishers can audit the sandbox to ensure that it provides all the necessary protections. Anyone who thinks Mozilla's users aren't passionate about DRM should check Gal's post, which had 466 comments when we checked in August, including, "I agree with many others: EME is unnecessary, and just plain evil."

So the final W3C spec did what it could to address these and other concerns.

What Was the Appeal About?

The appeal raises three specific issues. First, the EFF wants the ability to audit the sandboxes in the browsers to ensure that user privacy is being preserved. The appeal requests "independent verification in the form of adversarial peer review by outside parties who do not face liability when they reveal defects in members' products." While Firefox is open source, most other browsers are not, and whether Apple, Google, Microsoft, or other vendors will open up their code for inspection remains to be seen.

The second issue relates to the automatic generation of accessibility metadata, which could warn viewers about potential issues like strobe effects, which can trigger photosensitive epilepsy. The appeal wants to make sure this data is generated and included in the file metadata before encryption.

The final issue is the most complicated. Briefly, in the U.S., DRM laws are enforced by the Digital Millennium Copyright Act (DMCA), which includes a clause that lets companies sue competitors that attempt to circumvent electronic and digital copyright protection systems. The EFF asserts that this clause prevents competitors from entering the player market because they can be sued if they attempt to reverse engineer the copy protection scheme required to

play the videos. The EFF is asking member companies to agree not to sue potential competitors under the DMCA for any attempt to circumvent their DRM schemes. I asked W3C's Le Hégaret whether he thought such an agreement likely, and he pointed out that "Several past attempts in agreeing on a covenant within the W3C Membership failed."

At the end of the day, the EFF's objections feel like attacks on DRM itself, which they characterise as follows (go2sm.com/effdrm):

Corporations claim that DRM is necessary to fight copyright infringement online and keep consumers safe from viruses. But there's no evidence that DRM helps fight either of those. Instead DRM helps big business stifle innovation and competition by making it easy to quash 'unauthorized' uses of media and technology.

The EFF has fought DRM and EME from the start, despite widespread industry acceptance. Judging from Netflix's 54% penetration rate into U.S. households (go2sm.com/varietynetflix), most end users either don't know about DRM or don't care. This doesn't mean that the EFF's concerns are unfounded, it just means that the commercial market, both supplier and customer, has chosen to ignore them.

What Does the Appeal Mean?

The meaning of the appeal is unknown, but it's clear that the browser and publishing industries and W3C are on roughly parallel paths that may or may not intersect. The W3C is in a tricky position; if it makes EME too onerous, the industry might simply ignore it. As Berners-Lee stated in his "On EME in HTML5" post:

If the [W3C] made a Decree that there would be No More DRM in fact nothing would change. Because W3C does not have any power to forbid anything. W3C is not the US Congress, or WIPO [World Intellectual Property Organization], or a court. It would perhaps have shortened the debate. But we would have been distracted from important things which need thought and action on other issues.

Berners-Lee is taking the practical position that it's better to find a reasonable consensus position than to push for provisions that major players are likely to find offensive—that a spec considered flawed by some, but actually followed by the industry, is better than a pure spec that the industry ignores.

So, that's the tempest in a teapot raging within the standards body. What's particularly frustrating for actual users is that none of these issues are resolving the significant implementation challenges imposed by EME.

What Major Challenges Does EME Create?

I spoke with Christopher Levy, CEO of DRM provider BuyDRM, regarding how EME impacted content providers using DRM. He described two areas—technical complexity and storage costs.

Regarding technical complexity—before EME, some customers could use a single DRM technology and set of encrypted files to serve the bulk of their target users. For example, Smooth Streaming content encrypted with PlayReady could play on the Mac and Windows computers via the Silverlight plugin, and on iOS and Android via apps. Smooth Streaming with PlayReady was also widely supported on OTT devices (excepting Apple TV, of course), smart TVs, and gaming platforms.

According to Levy, today, many BuyDRM customers have to produce three sets of files: one in HLS format protected with FairPlay, one in Smooth Streaming format with PlayReady for legacy devices, and a set of DASH encoded files with EME and PlayReady and Widevine DRM for browsers, OTT boxes, and smart TVs.

From a complexity perspective, content providers now need encoders than can package and encrypt into three formats/DRMs rather than one, and a player, players, or apps capable of decrypting and playing these formats. From a storage perspective, content publishers now need to store three times the number of files at the edge, which triples their storage costs.

What's Available to Minimise These Issues?

In the short term, Levy reports that many customers are packaging and encrypting on-the-fly via servers like the Wowza Streaming Engine, Nimble Streamer, or via BuyDRM's own recently announced KeyOS MultiPack Server (see **Figure 2** on page 62). Multiple content delivery

networks like Akamai also provide this service, as do multiple products, like AWS Elemental's Delta product.

As shown in **Figure 3**, Wowza Streaming Engine supports multiple suppliers, including castLabs' DRMtoday service, which is not shown in the picture. Obviously, implementing real-time packaging with the Wowza Streaming Engine is simplified if your DRM vendor is directly supported.

While on-the-fly packaging and encryption (also called dynamic packaging) does add some technical complexity and cost, it could reduce storage costs by two-thirds. (Note that we discussed multiple approaches to dynamic pack-

aging in a December 2016 article, "Containing Costs: How Publishers Can Save Money on ABR Encoding" at go2sm.com/containingcosts.)

What About CMAF?

CMAF is the Common Media Application Format. By way of background, HLS originally used only MPEG-2 transport stream segments, while Smooth Streaming and DASH used fragmented MP4 files. For this reason, even with common encryption, publishers needed at least two sets of files to deliver to their multiple targets.

CMAF is a specification jointly authored by Apple and Microsoft that uses fragmented MP4 files. In 2016, Apple announced that HLS would

support CMAF. The problem is that CMAF also enables two incompatible common encryption modes: cipher block chaining (CBC) and counter mode (CTR). CBC is supported by Apple's FairPlay and Google Widevine, but not by Microsoft PlayReady, while CTR is supported by Widevine and PlayReady, but not FairPlay. So you still can't create one set of encrypted files that will play on all major platforms.

Basically, it's a stare-down between Microsoft and Apple to see who blinks first—Microsoft to incorporate CBC or Apple to support CTR. There have been multiple reports that Microsoft has already blinked, but I couldn't confirm this directly with Microsoft.

Even if Microsoft or Apple does blink, it will take a while for many publishers to feel comfortable delivering one data set to all targets, particularly those who are switching HLS from MPEG2 Transport stream fragments to fragmented MP4, which may not be compatible with older, but still relevant, targets platforms. Obviously, if you don't need DRM, the CBC/CTR issue is irrelevant, but you still have the same concerns about backward compatibility with HLS delivered via fMP4.

At the moment, all we can report is that the EME standard is stuck in the standards bodies, though that should be resolved pretty quickly. At the implementation level, we're getting closer to that holy grail of a single encrypted format for universal distribution, but for the time being, that appears to be a ways off.

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Comments? Email us at letters@streamingmedia.com, or check the masthead for other ways to contact us.

FIRE UP THE FLUX CAPACITOR, DOC

2018 EXECUTIVE PREDICTIONS

What a shame that Doc and Marty McFly only took their DeLorean forward to 2015. Yes, it did mean that we found out in advance about hoverboards, and it at least partially prepared us for Trump's presidential shenanigans (Marty's arch nemesis, the wealthy Biff Tannen, was based on The Donald), but it now means that beyond 2015, we're left entirely to our own devices when it comes to predicting the future. There's no flux capacitor to help out, at least not until there's another sequel made, so there's no risk to the space-time continuum. Ah, but that's a good thing, isn't it? Yes it is. Let's try to think positive thoughts.
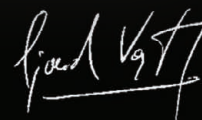
Anyway, I was intrigued to recently read a *New Scientist* article from July that a clutch of clever chemists has successfully encoded video into the DNA of live bacteria. It's still early days, and it was only five frames. But here's the really neat bit: these frames are now sewn into the genome of these little critters, so they get replicated and passed on through the generations. Before you know it, you have a billion copies. And when you consider that just one gram of single-stranded DNA could potentially encode the contents of 100 billion DVDs, then I reckon there's still plenty of storage room on this planet for a few more *Back to the Future* sequels—even with HD, HFR, and HDR thrown in.

I've told the studios: plenty of storage for a sequel. Just make sure you take that DeLorean forward in time by at least 10 years. And then you can come back and tell us where we've gotten to in the world of streaming.

On second thought, rather than wait for that sequel, it's probably a better strategy to consider carefully the thoughts and advice on the pages that follow, to trust the built-in flux capacitors of these thought leaders. They will help us ensure that our DeLorean is at least pointing in the right direction.

Hang on. I've just consulted my tea leaves, and they tell me, "The future is what we make of it."

The tea leaves have spoken.

Sjoerd Vogt

Sjoerd Vogt • UK and Europe Sales

Let's put ourselves into the shoes of a modern digital content consumer. No matter where we go, what we are doing, we still want to have the same optimal seamless user experience and access to the content on any device that we prefer. This is why we see centralized entertainment offerings in the form of digital platforms as an integral part of our future. There will be for sure changes in the user behaviour, but one will always remain and that is that consumers know exactly what they want, when and where they want it. Simply offering quality content is not enough, and will not be enough, due to the increased demands and requirements of different target groups. Axinom has developed a strong software stack to launch digital platforms that support all use case scenarios in any smart industry. Built on top of our products, they satisfy the needs of a passenger in a disconnected scenario like an aircraft, as well as OTT solutions for broadcasters, telcos and other media consumers in a connected environment. For our customers, there are many benefits from having a centralized digital platform offering built on Axinom, such as revenue increase, streamlining of internal operations and more. By including ads, promotions, special loyalty programs, backed by secure payment methods and mechanisms, companies can increase their revenues, efficiency, and customer loyalty. Besides, accessibility, availability and richness of the digital platform always remains in the centre of our attention throughout the development process.

Ralph Wagner
CEO | AXINOM

Containerization is my pick for the biggest disruptor in the video industry for 2018. This year we have seen a steady growth in the adoption of containerized computing across many industries. In 2018 I predict that this trend will gain momentum as video development teams start to exploit the potential cost savings and performance improvements that are available with software based containerized encoding stacks.

This transition will bring a lot of processes away from the cloud and back to on-premise, as architects build hybrid infrastructures using hardware agnostic platforms such as Kubernetes and Docker. These systems will incorporate on-premise hardware and public cloud infrastructures into massively scalable and flexible video delivery infrastructures. This transition will likely be the beginning of the end for dedicated hardware encoders.

Another area of focus in 2018 will be reducing bandwidth and CDN costs. This is an important topic for every content provider, and for that reason optimizing video delivery is already top of mind for most of the software architects in the industry. There are a range of solutions available today which can reduce bandwidth usage, including Multi-Codec Streaming, Per-Scene Adaptation and Per-Title Encoding. All of these will gain in popularity in 2018.

AV1 will be another hot topic in 2018. Early 2018 will see the code freeze and from there we will see a lot of companies incorporating AV1 into their products. I predict that Youtube and Netflix will be first movers and start using the new standard as part of their delivery and others will follow shortly to benefit from the bandwidth savings and/or improved quality to differentiate their service from others.

Christopher Mueller
CTO | BITMOVIN

castLabs pioneers software and cloud services for digital video markets, delivering billions of DRM licenses worldwide, handling multi-format video processing including embedded session-based watermarking, and offering fully-featured multi-screen player SDKs for online and offline viewing.

2018 is set to be an exciting year for streaming media, driven by applied intelligence and the increased adoption of high quality content formats. Convergence is another hot topic for the coming year.

Developments we're hoping to see include:

- Machine learning and AI taking centre stage. Advertising, content insights, recommendation engines, and content delivery will all become intelligent. Data exchange is key, and video delivery infrastructure components will need to provide integrations with external services to tap into AI.

- CMAF and WAVE will gain additional momentum with a caveat - broad deployment will remain hindered by device fragmentation.

- UHD with HDR and NG Audio. Critical mass of end devices likely to be reached this year. Format fragmentation will still be an issue, while content generation remains complex.

- Increased traction of forensic watermarking, especially for UHD content.

- Offline experiences to enable ubiquitous content consumption.

- Improvements in VBR encoding techniques, some using machine learning, which will improve coding efficiency and extend the lifecycle of H264.

What we believe won't happen in 2018:

- Common Encryption format won't be realized for existing devices, but convergence in newer devices seems possible.

- Common Streaming Format won't materialize. HLS and MPEG-DASH are both here to stay. CMAF however will enable DASH-HLS hybrid content.

Michael Stattmann
CEO | CASTLABS

OTT Projects: Business teams are back!

In the past few years, broadcasters, sports federations and top brands have experimented with different forms of OTT services. We saw a variety of models being tested, some leaning towards a free or ad-funded model, while some looking for paid models – mainly **Pay-per-View** or **Subscription VOD**.

In our experience, these projects were often led by tech teams, who had a significant role in selecting (a set of) providers that will set up a good platform, at the best cost. The decision-making process was largely driven by features and pricing.

Nowadays, the business teams are back in the game. User experience is King, while ROI is Queen. A set of features doesn't make a great service anymore. The full kit of all OTT components makes a great service.

The notion "less is more" will be a key differentiator in the industry. Simplicity and clarity in business models, features, interfaces will drive success, together with the increased focus on quality-of-service and customer care.

Business teams want holistic dashboards that provide a 360º view of the business. They want to know what drives satisfaction, engagement, churn, and ultimately high ROI. The industry has reached a new maturity level, similar to what we've have seen in the retail industry in the late 2000s. Not anyone can be Amazon, neither be Netflix, yet these are the ones to beat in order to succeed with OTT. The future of digital entertainment is bright, and Business is Back!

Gilles Domartini
CEO AND FOUNDER | CLEENG

Broadcast IP production is slowly becoming a reality, and we will see more facilities built on ethernet than on SDI. An IP is essential because it will pave the path to pure software, virtualized, and cloud infrastructures. This results in cost-effectiveness and flexibility. However, before we get there, we will have to start using more of the standard IP formats. Therefore, I will be carefully watching the adoption of open VSF TR-01 standards for IP contribution and remote production. Inside facilities, we will witness a battle between uncompressed and compressed IP. Even if the uncompressed video has its place and proponents, I still believe in compressed IP infrastructures in the long run. The reason is that the bandwidth requirements will be growing with UHD, high dynamic range, and high framerate. The compressed IP is more future proof and necessary for future in the cloud. With that regard, we will see two new compression standards to emerge. The JPEG XS was designed as a light and fast, high-quality compression for broadcast IP and I will be even more interested in a standard called HT-J2K; it is a high throughput (HT) variant of popular JPEG2000 codec. It will bring up to 5x throughput and lower latency and will be a hot candidate for both contribution and local IP video networks. The common denominator will be software processing which brings flexibility and scalability. In 2018, we will witness a renaissance of GPUs which will play an essential role in the real-time processing of high volumes of the video data.

Jiří Matela
CEO & CO-FOUNDER | COMPRIMATO

Smart TV data will start to disrupt the European ecosystem

European Smart TVs are already equipped with automatic content recognition, and we expect this service to be switched on over the next few months pushing a massive new dataset into the market.

This data will challenge the dominance of industry joint ventures (Barb, AGF, SKO) and walled garden OTT measurement. The lack of data in the European ecosystem has hampered the development of next-generation advertising models from retargeting from TV to mobile to attributing conversion from a cross-platform buy that includes TV.

A few of the Pay TV platforms - notably Sky - have dipped their toes in the water with set-top-box data but they've only really used its data for their internal purposes and advertising sales.

We expect this to change in 2018 as Smart TV data begins to become available in European markets. Smart TV data has already disrupted the US market creating whole new categories of advertising products that are not tied to platform providers, and we expect these to thrive in Europe.

GDPR will bite at least one streaming video provider

The new General Data Protection Regulations (GDPR) arrive in May 2018 and require all streaming video providers to re-work not only their terms-and-conditions but also much of their processing pipelines for consumer data. We've already started working with some providers to upgrade their platforms so allow users to erase or update their data history in a fully transparent way - across ALL of their data platforms.

Most providers underestimate what's required, and we expect substantial fines to come to players in the industry who have not prepared sufficiently.

Michael Collette
CEO | DATIVA

sponsored supplement

EXECUTIVE *predictions*

As expected, we are seeing OTT becoming more the focus for video. It won't be long now until OTT is the main way video content is consumed. Latency is as big an issue as ever, with the 5-15 seconds that is now the generally accepted "best possible" no longer being low enough for many use cases. We'll see new techniques being pioneered to decrease that latency further. Seeing as HLS is still the lowest common denominator for video playback, many of those techniques will focus on working around HLS' inherent latency problems. I do expect mixed-format delivery to become more common as a way to improve experience on various devices, however. Now that iOS has embraced HEVC and most consumer devices can decode it with hardware acceleration, it's likely to gain more traction over H264. That traction will probably be short-lived, as AV1 is almost upon us and is set to be backed by all major players. The way WebRTC is now fully supported by all major browsers is also interesting, and I'm looking forward to seeing it used more for practical applications besides video conferencing.

All in all, the coming years are promising to be quite exciting, and hopefully will be a turning point in the way we view video delivered over the internet - both literally and figuratively speaking! MistServer will of course keep innovating and pushing the boundaries of what is possible, just like we have done in the past.

Jaron Viëtor
CTO & CO-FOUNDER | DDVTECH B.V.

2018 is the year to step up content protection

Streaming Media recently reported that streaming-specific piracy will equate to losses of $52 billion by 2022. And the last year has seen several high-profile content leaks and huge numbers of viewers consuming programming illegally. At the same time Netflix has announced plans to boost investment in content production and internet-only organizations like Amazon are spending increasingly huge amounts on live sports rights.

All these events are intrinsically linked - brought about by audiences now expecting TV wherever, whenever. So 2018 will see some substantial bolstering of anti-piracy measures.

Watermarking internet-delivered content is one of the key ways content owners can protect programming. Using the latest in delivery technology for streaming media, content owners or distributors can add a unique code to each stream which can be used to track any would-be pirates. Content owners can make unnoticeable changes to pixels, embedding a code directly into streams which is extremely hard for pirates to cover up.

Deploying a self-built content delivery network specifically for TV services can also help protect content. Having eyes on streams all the way through the delivery process is key and broadcasters are increasingly realizing this. By deploying their own TV CDN, they can take complete control of the delivery of their programming because they don't need to relinquish content to a third-party network owner.

With the increased threat of content theft, the coming year will see broadcasters and content distributors taking steps to stop pirates getting their hands on what are becoming increasingly valuable assets.

Johan Bolin
VP PRODUCTS | EDGEWARE

IP video is gaining momentum in the industry as the delivery mechanism of choice for enterprise video. Organisations eager to create more immersive experiences for their core audiences are increasingly turning to this network-based premium content distribution approach to modernise and broaden their communications.

While IP video enables content providers to cater to their customers' evolving needs, ensuring that content is accessed and distributed legally can be an ongoing challenge. In an era with vast amounts of digital content passing across different networks, video piracy and new video consumption habits combine to pose new risks. The onus is on the end user to protect premium content when distributed over IP. It is, therefore, imperative that they adhere to the latest protection requirements – and the increasingly stringent protection demands of broadcasters and other content owners – to ensure that content is secure, controlled and distributed legally across different types of networks and to an ever-widening range of mobile devices.

Being equipped with the latest content protection solutions is a critical step for end users in ensuring the secure, end-to-end delivery of premium content. Technology is readily available from the likes of Pro:Idium®, Verimatrix®, ARRIS SECUREMEDIA®, Samsung LYNK™ DRM and DCP's HDCP Pro, and with this issue becoming a challenge for the entire industry, I anticipate that 2018 will be the year that those who are currently ignoring these standards will no longer be able to get away with circumventing the rules and will have to start taking content security more seriously.

Colin Farquhar
CEO | EXTERITY

I n 2018, content delivery architects will use reliable UDP as the default protocol with TCP plus congestion control as a backup, depending on delivery context. Dynamic encoding that takes into consideration specific content features for quality and cost optimization will be the standard for OTT video. HEVC and to a lesser extent DASH will struggle with licensing cost threats. HLS with CMAF will be the road to go. Consumers' tolerance for HTTP streaming end-to-end-latency will go down to 10s. The AV1 codec will get a lot of attention and press coverage, but will not yet be of any practical relevance. New OTT setups will by default be based on Multi-CDN and Multi-Cloud, devops-optimized.

Conversational access to online content via bot interfaces and smart speakers will get a lot of traction in 2018. Navigation by voice will not be a comfort feature but is expected. Content producers will suffer from additional device fragmentation pain and have to produce audio in multiple loudness levels to accommodate for various platforms and consumption environments.

On Monday, July 16th CDNs all over the world will issue press releases stating how the soccer world championship final broke previous records of concurrent users and bitrate delivered.

Alexander Leschinsky
CO-FOUNDER & MANAGING DIRECTOR
G&L GEISSENDÖRFER & LESCHINSKY GMBH

Since forming Garland in 2004, we've helped numerous broadcasters, sports organisations and media companies transition through several generations of video codec. 2018 will see HEVC (High Efficiency Video Coding) fully established as the next generation, and now is the time to embrace the many benefits it offers in the digital video ecosystem.

The adoption of HEVC by iOS devices, and broadcasters introducing it on their latest set top boxes is pushing this new high compression format to the forefront. Improvements from lower data rates to higher quality, increased reliability and broader platform delivery means

content providers can give sharper, colour rich pictures without increasing transmission costs, or choose to maintain the same level of quality, and increase revenues by delivering more content.

Imagine having new ways to enhance value to new subscribers. We've been working with leading UK broadcasters to deploy HEVC for football and motorsport coverage. With HEVC, they are providing 4K UHD video across more live content, and producing a wider range of HD content due to lower acquisition costs — where it matters, fans get to see more of what they want and the perceived value of their subscription increases.

In an ever-changing world, it is even more important to report those

breaking news stories, particularly from the most difficult to access places. Applying HEVC to bonded cellular technology, you can get pictures clearly over previously unmanageable data rates, and reduce news-gathering costs by using lower data rates while producing the same quality video. The net effect: satisfy the ever increasing demand for live news.

Who doesn't like more content choices, variety and viewing options, and faster downloads? In turn, content owners will gain more subscribers, while existing subscribers stay loyal to brand offerings. Viewers are the barometer of success, and they going to love the adoption of HEVC, even though they may never really know what is behind their pictures!

Lorna Garrett & Malcolm Harland
CO-FOUNDERS | GARLAND

Other than an in-person meeting, video is the most vibrant manner of communication that executives can use to convey their message to large, far-flung audiences within their respective organizations. Streaming video is described as

an "effective" tool for business communications by more than 90% of executives (Wainhouse Research Q4, 2017). Despite this statistic, the networking of enterprise video often gets scant attention. We think 2018 will be the year that video networking will be front and center in most large organizations.

There are market dynamics that support this proposition:

- Growing list of Enterprise Collaboration tools have announced support and encourage use of live and on demand video including; Microsoft Stream, Skype Meeting Broadcast, Microsoft Teams, Workplace by Facebook, Slack, and HipChat.

- The Death of Adobe Flash Player will accelerate the search for alternatives and the adoption

of standards-based video technologies.

- Growing browser support for WebRTC which will enable peer-based technologies, such as Hive Streaming, to stream live video within enterprises without additional hardware or a software client.

We predict these market dynamics will result in 2018 being the year where live video broadcasts become commonplace in the workplace. Impromptu broadcasts from the executive work desk, not enterprise disrupting town halls, will help reduce a significant portion of corporate travel and help foster unity.

Thanks for your interest in my perspective. Best wishes to you all for a happy and prosperous 2018!

Johan Ljungberg
CEO | HIVE STREAMING

Having secured our first Russian customer, what better then to go there and bag some more whilst the iron was hot.

Of course I could have chosen a better date because there was plenty of the fluffy white stuff on the ground, but nothing that a trusty Lada could not plough through. After a few days urban ice surfing, I had a call from Sjoerd asking for some predictions for 2018.

Frankly, I didn't have a clue so it was time to ask the locals if they knew of any soothsayers or general fortune tellers. I was directed to a monastery where this very old chap was introduced. Apparently he was part of the Putin family because he seemed to be called Mr Rasi-Putin or Rasa-Putin or some such other tongue twister.

Although he keep banging on about how he could cure my ailments in the bedroom department, he did predict:

- As attendances fall, expect some cinema chains to eye up the launch of their own VOD solutions
- More content producers starting their own standalone streaming services rather than relying on aggravators like Netflix
- A bun fight between the studios and the Netflixs' of this world as the studios realise how valuable their content is
- More terrestrial channels to follow BBC3 by going online only
- New codecs to better compress 4k video
- More short form content to plicate decreasing attention spans
- Better targeted content derived from online monitoring
- Someone from China to make a $100 million offer for i2i Media

Philip Radley-Smith
OWNER | i2i MEDIA

Online Media Delivery, now & the future

The original Content Delivery Networks (CDN) were designed for caching traditional content and not built for today's standard of rapidly changing content and the growth of video and audio. As social networks supply users with constantly updated content, and broadcasters and media companies focus on delivering media such as sports and news, traditional CDN's have found it difficult to meet the needs of the industry today. This has kept them strained, vulnerable and expensive to operate with the bulk of the cost having to be passed on to their customers.

To stay up to date with today's needs and to maintain a focus on the future; these media organizations have adopted a video first approach to give users access to the latest and freshest content in real-time. It has now become a necessity for CDN's to be able to deliver seamless video and maintain HD quality regardless of how many users are engaged with the content.

We have built MainStreaming around today's requirements and have made caching a thing of the past with our full stack solution for delivering video and audio in real-time. With our global solution, MainStreaming customers now have complete control over how their media is viewed, played and distributed across all channels.

We foresee tremendous growth in the coming years for all types of media, especially in video and audio, and with our revolutionary Hypernode technology & advanced algorithms in place, MainStreaming is in prime position to support the global delivery of them.

Antonio G. Corrado
CEO | MAINSTREAMING

2018 GO OTT or GO HOME

While 2017 was an exceptional year for OTT adoption, 2018 is going to witness a faster growth momentum with the smaller broadcasters and publishers streaming their content online. Our aim at Mangomolo over the past few years was to make OTT available for every publisher and broadcaster no matter how big or small through providing them with a full ecosystem that includes an AI Powered OVP Backend Part with the Transcoding Services, Realtime Audience Analytics and Behavioral Statistics, etc... moving into the client side apps for smart devices/ tvs or computers and also providing them with a marketing tool that allows them to create short form engaging videos very easily and publish them to social networks and other distribution channels. This has made OTT within the reach of every publisher and in just few weeks and everyone can start making more money starting with the smaller YouTubers that publish viral short form content to bigger broadcasters and networks.

The Focus for 2018 is pushing the bars of innovation and integrating AI into OTT to facilitate the workflow and to better understand audience behavior. Our main implementations of AI include Speech Recognition with On the Fly translation, Topic Extraction to automatically understand what content is about and for automating the meta data process and eventually building topic audience relationships and topic Advertising relationships. Second screen integrations are also increasing which is giving advertisers a more interactive way to engage with captive users. On the AD Serving Perspective we expect more players to adopt SSAI to increase CTRs and Conversion.

Wissam Sabbagh
FOUNDER | MANGOMOLO

Interactive live streaming is definitely a huge trend that will keep rising in the next years. Ultra-low-latency is the main feature of this kind of live streams, as it is necessary to achieve real-time engagement. On the other hand, cloud services are a success and can scale capacity easily, besides adapting to changing viewership.

Together with the death of Flash by 2020, these two concepts bring up a new era for live streaming. Live Streaming applications are more and more mainstream and required to work within any kind of business application as a simple "add-on". Customers do not want to hassle with looking to different vendors, devices, formats, etc. and setting up their own infrastructure.

Therefore, in 2018 we can expect an even higher adoption of cloud-based solutions for live streams, mainly focusing on scalability and ultra-low-latency. Since RTMP will lose power for playout, new technologies must come up to fulfill this gap.

Keeping it in mind, nanocosmos has developed nanoStream Cloud and the unique H5Live technology and player, an end-to-end ultra-low-latency solution that works on any HTML5 browser and mobile device, including Safari on iOS.

Adding nanoStream Apps and SDKs, you will find true cross-platform live encoding, while nanoStream WebRTC.live will be the perfect solution for browser-based live streams and webcasts.

nanoStream Cloud lets you go live around the world in 1 second. You only need to get your camera ready, and we do the rest!

Oliver Lietz
CEO | NANOCOSMOS

We are currently experiencing a situation where the technology and viewing behaviours are moving faster than many media companies.

The technology shift, with live OTT as a key driver, is the perfect enabler to start developing new creative concepts that will reach a new and more engaged audience.

New challenges can never be solved by old processes. To do what you have always done, is not an option. It's time to stretch our minds. Work together. Think big and think different.

History is full of companies that refused to change and made it into a sport to sleepwalk through decades of rapid change.

In my mind there has never been a more exciting time to be in the media and broadcasting business. Being able to offer technology that brings people together and creates communities, with a shared experience, is a true pleasure. Being able to offer new revenue streams for the media industry, which have struggled for years, is a bonus. These are the questions you need to ask yourself;

- How can we use technology to broaden our audience?

- How can we use technology to increase the audiences' loyalty?

- How can we integrate our digital strategy cross functional in every touch point?

- How can we make more money and attract new partners?

We are convinced that technology will continue to set the scene, transform business models and drive change years to come. It will also challenge the way we think and do business.

Fredrik Tumegård
CEO | NET INSIGHT

When Streaming Media asked if I wanted to participate in the 2018 executive predictions I answered no. Anything that relates to chance I just run away from. I can never get the coin to flip on the "right" side. When they objected that it was a popular section of their magazine I said to myself: "what? people are going to read about this on top of that". I slept over it and had a vision that night of receiving an academy award. So, I called back and said yes. A couple of things I can also remember from this vision:

- Developers will be the next decision makers: technical complexity has increased over the past few years in the online video industry. Having a team of savvy technical people has no price. They should tell you what to do, because they will be the ones responsible for making your service a great service.

- HLS should continue dominating over DASH. Using DASH could require paying royalties and it is still not available in iOS Safari. With fmp4, HEVC and DRM becoming widely available in HLS most use-cases for streaming should be covered.

- Is a new codec dilemma upon us? HEVC vs. AV1 – HEVC vs. AVC. I will tend towards a yes.

- Who is your average viewer? High mobile usage and emerging economies gaining wide access to the Internet should raise the question of what kind of bandwidth your average viewer can really enjoy ... and what kind of experience you want her/him to have.

Arnaud Leyder
CEO | RADIANT MEDIA PLAYER

There's a continuing and accelerating trend that sees the better integration of technologies. We've already seen some good uses of data to add value to video – but there is a long way to go. We have used data to index video but since our integration with the Press Association we see a great deal of opportunity to use data to create automated and meaningful clips.

Increasingly all these technologies will become wrapped up within the 'AI' label. So 'image processing technologies' that were previously used to identify significant parts of video and images will now be referred to as the 'AI engine'. Despite this added vagueness, the contribution of AI will grow hugely, led by major players such as Amazon Web Services making the technology easy to access. We have already implemented their Amazon Rekognition service to tag live and on-demand video archives and bring these tags into our recommendation engine.

A consequence of this harmonisation of diverse technologies will be the increased value of OTT video rights – particularly within sport. The money generated by OTT is set to surpass traditional broadcast at just about the same time as the latter term becomes redundant. Coincident with this dynamic will be the contractual demand for better securitisation of streams – i.e. really effective DRM combined with Forensic Watermarking and effective policing. The effectiveness of DRM alone has been largely misunderstood, but the ROI advantages from proper application will change that.

Duncan Burbidge
CEO | STREAMAMG

Developing and delivering cutting edge ip Innovations is our task at Teracue. Virtualization of infrastructure enables players of all sizes to participate in the online video and live streaming environment.

We provide several hardware and software solutions that empower our clients to deliver outstanding experiences to their audiences. For 2018 we see a growing demand for Transcoding Hardware in order to create and distribute multiple streams from a single source signal. Our Live Transcoder „MC-Trans" is a live stream transcoder platform for IPTV headends, OTT broadcast channels and mobile streaming. It supports a wide range of transport streams, encryption and multi stream output.

At the same time multiple stream monitoring is taking its place in the first rows of services at Teracue. Since more streams are published overall, broadcasters need to now in real time how every single stream is performing. ICUE GRID is our latest product and a decentralized, IP-based video wall solution for the variable display of video streams. The ICUE GRID video wall uses pure IP video data and distributed processing, meaning that its architecture is limitless. There is also no limit to the window size, resolution, positioning and number of streams being displayed.

We are more than excited to enter 2018 and well prepared to rock all of the projects being ahead of us.

Thomas Buck
GENERAL MANAGER | TERACUE GMBH

Video is not just a big part of the web; it is on its way to becoming the dominant way we consume content online. Now on average, people watch over an hour of digital video each day, and **online video makes up nearly three quarters of all internet traffic**. Many of the changes over the last 5 years have been led by technological advancements and specifically on the device side with the move from linear TV to on-demand consumption. This is the case for PC, smartphones, tablets and Smart-TVs. The result has increased the market for video services exponentially.

The media industry we have long known is changing. Today's viewers are pulling out tablets, laptops, and smartphones, accessing video content when – and increasingly where – they choose. This transformation has not been subtle. In growing numbers, **consumers are replacing their traditional cable and satellite TV** packages with smaller, more customized, and often less expensive mixes of programming, cobbled together from an array of online and on-demand services.

Where it was typically still sufficient to only support browsers, tablets and smartphones in 2017, in 2018 **your viewers will require support on all their connected devices**. Just like Netflix you will have to support all types of Smart TVs, consoles (Xbox, PlayStation) and streaming devices like Roku or Chromecast. Furthermore, your viewers do not only require you to support these devices, they are also expecting a **consistent experience across these devices**.

THEOplayer is at the forefront of this rapidly evolving online video landscape. Our award winning **Universal Video Player**, built in HTML5, provides a single player across all major devices, platforms and browsers. The Universal Video Player is pre-integrated with leading solutions across the video ecosystem including streaming, analytics, DRM and content monetization to remove the complexity of service development.

Steven Tielemans
CEO AND FOUNDER | THEOPLAYER

Open by default

My prediction for 2018 is that an overwhelming number of companies will be transitioning to open tech. Within ten years, I expect all significantly complex and successful back-end technology to be open source. It is already hard to name a market where open source doesn't either have the most momentum, or outright dominates it – be it mobile operating systems, cloud orchestration, browsers or transcoding software. A lot of money is still being made in these domains, but mostly by companies providing complementary services around a core that is open source. Not a single new successful proprietary database has been released in over a decade, while open variants are flourishing.

Many companies that traditionally kept technology close to their chest, are now betting on open source: Microsoft Edge has an open source engine at its core, Windows 10 embeds Linux as does Azure, and Oracle is acquiring open solutions to complement their proprietary offering. We will also soon see a new open codec called AV1, which is royalty-free and backed by Amazon, Google, Microsoft and Mozilla. Our own cloud encoding scale-up Transloadit will be among the firsts to support it.

Looking at our own company, the advantages of going "open by default" are clear to see. We have been able to decimate expenses in R&D, Marketing and Recruitment, while simultaneously improving product quality and attracting more customers and talent alike.

Whenever we create new software, it's open source – and some of these releases have even become industry standards. tus.io and uppy.io, for instance, are already changing how the world does file uploading. Each of these therefore not only serves as a compelling onramp to our commercial offering, they provide greater value by being free for anyone to use. If there is one thing science teaches us, it is that sharing accomplishments for others to build upon leads to evolutionary progress at revolutionary speed.

Kevin van Zonneveld
CO-FOUNDER | TRANSLOADIT

How 360 video VR might be changing the advertising industry

360 videos can present an opportunity for advertisers to reach massive audiences. This year will be 90 M active VR users worldwide and this figure is predicted to reach at 171 M active VR users globally, while the VR headset shipments will increase from 12 M in 2017 to just over 55 M in 2022.

An experiment was conducted to find out whether 360 video advertising drive more viewer engagement than standard video advertising.

Each campaign featured a 60-second spot, one version was shot and presented in 360 video, and the other was a standard format video ad. Both ads included a call to action button that drove to an extended version, so that we could see if the 360 video ad was better than the standard ad at driving viewers to a full-length video.

The experiment result was interesting with the following facts:

1. 360 video doesn't over perform on traditional viewer metrics

2. 360 ad had a higher click-through rate, meaning that viewers were more interested in checking out the full-length version of the video.

3. 360 video drives viewers to share, subscribe, and view other videos. In total, the 360 ad drove 41% more earned actions than the standard ad. The full-length 360 video had a 46% higher view count than the standard full-length piece.

The conclusion of the experiment is that 360 video has the potential to drive engagement in promising new ways.

Veeplay is a technology company dedicated to helping publishers worldwide deliver the best video experience and better monetize their video content on mobile devices through native mobile video player SDKs.

Alex Dragos Cercel
CEO | VEEPLAY

Over the past few years, our vision for this column has covered the adoption of Just-in-time Video Delivery, the widespread move to Multi-Vendor DRM with EMEs and the simplification of the Live2VOD. Now, if not ubiquitous, at least these subjects are more widely understood. Going forwards next year, our focus is to ensure that these key aspects of video delivery are tightly integrated into robust and flexible, workflows rather than being seen as disparate parts of an overall solution.

At VUALTO, we certainly don't believe in prescribing a one-size fits all video delivery workflow for our clients. From our experience, each Broadcaster and Content Owner has specific requirements for their video workflow, whether it be interfacing with existing systems, dealing with legacy content, non-standard subtitles or just needing to process video in a specific way. Our approach has always been to use our established building blocks/best of breed tools and use them to construct flexible video delivery workflows that are tailored to each of our clients. This flexibility allows us to respond to a fast-changing video landscape more quickly than some established off-the-shelf solutions. This will continue to be our focus for 2018, improving coherence between the individual parts of the delivery workflow, adding more pluggable components and providing the best Workflow Orchestration tools to provide overall control of the video delivery. 2018 will be about even smarter workflows and setting the bar high for Live and On-demand Video Delivery.

Camilla Young
CEO & CO-FOUNDER | VUALTO

ONLINE VIDEO PLATFORMS BUILT ON AXINOM

CONTENT
- MPAA
- MOVIES
- IMAGES
- TV SHOWS
- EPG
- LIVE CHANNELS
- METADATA

VIDEO INGEST AND PROCESSING VIP
PRODUCT Axinom! PRODUCT

INGEST & PROCESSING

Axinom CMS
Content Management System

CONTENT SETS	MOVIES	TV SHOWS	CHANNELS	MUSIC	LIVE EVENTS
12	93	42	8	5	3

Content Pipelines · Subscriptions · Administration · Files · Dashboard

Customers · Images · Collections · Translations

Not Published / Published / Changed / Not Changed

CMS
CONTENT MANAGEMENT SYSTEM
PRODUCT Axinom! PRODUCT

- BACKGROUND JOBS
- CONTENT PIPELINES
- REGIONS
- CONTENT SETS
- AVOD
- E-COMMERCE
- SVOD
- TVOD
- COLLECTIONS
- ASSETS
- PUBLISHING
- PROPERTIES

Microsoft® PlayReady®
WIDEVINE
FairPlay

UNIFIED API
DIGITAL RIGHTS MANAGEMENT
DRM
PRODUCT Axinom! PRODUCT

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