mtm **CONVIVA**®

RUNNING AN OTT BUSINESS

State-of-the-Art Operational Best Practices

A RESEARCH STUDY | NOVEMBER 2017

AT A GLANCE

Across North America and EMEA, audiences are increasingly consuming content delivered by over-the-top (OTT) video providers. In April 2017, for example, 51 million US households watched video content delivered via OTT – up from 44 million in October 2016 – with each household watching an average of 49 hours of OTT-delivered content each month[1]. This is partly driven by the greater prevalence of live events – whether sports or high-end drama premieres – now viewed through OTT services alongside on-demand content.

As a greater share of viewers' time is spent watching OTT content versus traditional broadcast content, and the number of peak concurrent views grows rapidly, OTT services are focusing increasingly on delivering high-quality video streaming. Providing this at scale and at a comparable quality to broadcast is challenging and resource-intensive. Dedicated technical teams are often required to monitor a service and to respond quickly to the service delivery alerts that arise when an issue is flagged. Indeed, these tasks can often account for at least half of the technical team's time.

However, as the OTT market matures, publishers are optimistic about the potential for automation and machine learning to enable them to meet audiences' increasing expectations. This paper contains the findings of an extensive research programme conducted by MTM on behalf of Conviva, which captured senior industry executives' perspectives on the challenges of delivering and monitoring high-quality video streaming experiences in an increasingly competitive market.

INTRODUCTION TO THE RESEARCH

Conviva, a measurement and analytics provider for streaming video publishers and service providers, commissioned MTM, a strategy and research consultancy, to explore how OTT video publishers in North America and EMEA are dealing with the challenges of delivering high video streaming quality to their viewers. In particular, the research focused on the tools and methods used by publishers' technical operations teams to deliver a high quality of experience (QoE). This includes monitoring of QoE; alerts indicating QoE issues such as videos not starting, buffering and pixelation; and the identification of root causes of these issues.

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[1] comScore OTT Intelligence, U.S., April 2017

To gauge industry sentiment around the role of monitoring within the OTT video space, during July and August 2017 MTM conducted 26 interviews with technical and operations executives, representing a cross section of OTT video providers in North America and EMEA. These included a range of players, from standalone providers to spin-off services launched by broadcasters, from subscription services to ad-supported services, from newly launched services to well-established services and from small specialist publishers to large players with millions of viewers.

KEY PLAYERS INTERVIEWED

Technical and
Operations Executives ———— +

OTT Video Providers ———— +

From Standalone Providers
to Spin-Off Services ———— +

From Small Specialist
Publishers to Large Players ———— +
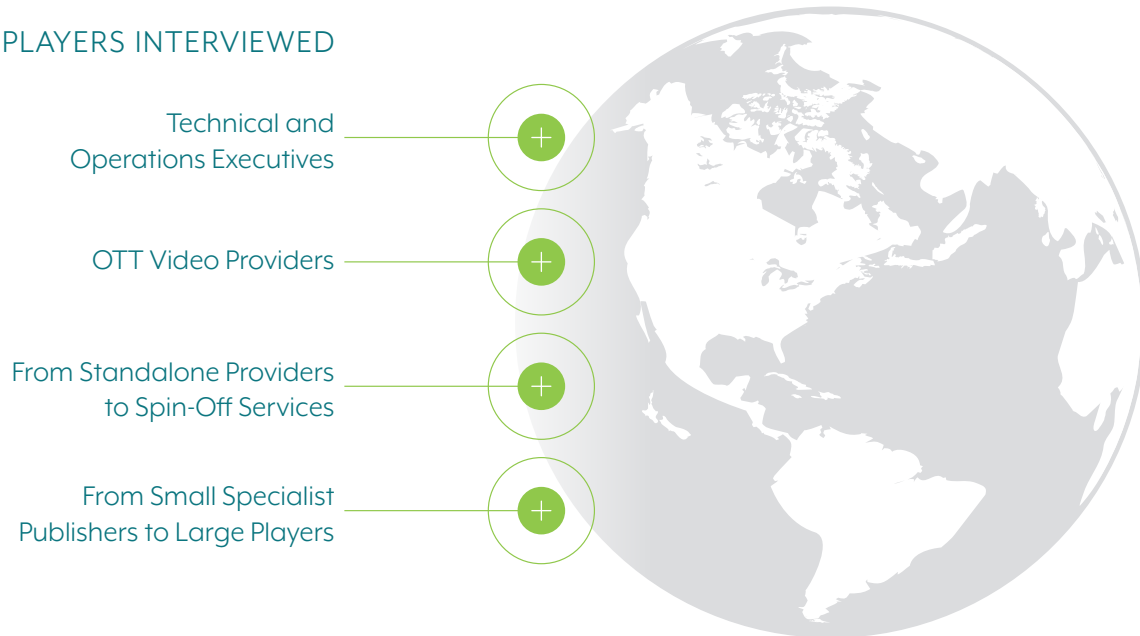
The interviewees' answers were collated and distilled, with anonymised quotes added to emphasise and exemplify the common themes that emerged from the process. This paper contains the key findings from the research.

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OVERVIEW OF KEY FINDINGS

THERE IS NO SUCH THING AS A TYPICAL OTT PUBLISHER

While the broadcast industry has adopted common standards and practices for delivering content, OTT publishers have diverse approaches to managing video delivery and ensuring viewers receive a high QoE.

MONITORING QUALITY OF EXPERIENCE BECOMES A PRIORITY AS OTT BUSINESSES MATURE

Publishers' approaches to monitoring QoE are linked to their maturity more than their scale. For many OTT services, QoE is less of a priority in the first phase of their development, but, as the market and their business mature, publishers recognise the importance of delivering a high QoE to meet consumers' growing expectations.

WHEN PROBLEMS ARISE, QUICKLY IDENTIFYING THE ROOT CAUSE IS PUBLISHERS' BIGGEST CHALLENGE

Publishers reported that, when they are alerted of an issue, their biggest challenge is quickly identifying where in the video delivery chain the issue sits. Currently, tracking down the root cause of problems requires significant resources from technical teams.
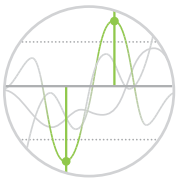
PUBLISHERS MONITORING THEIR SERVICES NEED TO FIND THE RIGHT QUANTITY – AND QUALITY – OF ALERTS

Publishers face a challenge in setting thresholds for service alerts that identify issues on their video services. They must find a delicate balance, avoiding information overload but not missing issues affecting customers.
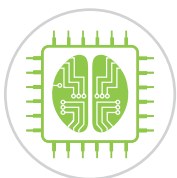
AUTOMATION AND THE USE OF ARTIFICIAL INTELLIGENCE (AI) CAN HELP PUBLISHERS IMPROVE QoE

Industry executives see the potential of applying automation and AI (in the form of machine learning) into the process of monitoring QoE. They welcome tools and methods that can generate actionable, reliable and timely insights and allow technical teams to devote more resources to improving the overall quality of the video service.

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MARKET CONTEXT

Consumers are increasingly spending a greater share of their screen time watching TV and video content delivered via the internet, driven by growth in the number of services available and constantly connected high-definition screens.

The landscape of OTT publishers includes a range of publisher types ranging from large subscription-based aggregators such as Netflix and Amazon to specialised, niche OTT providers.
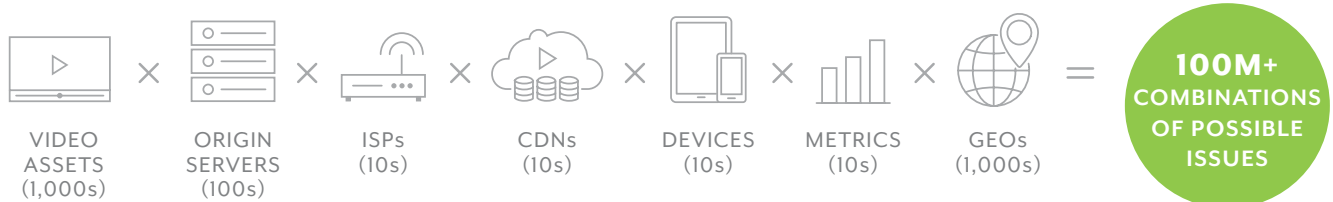
EXHIBIT 1: Types of OTT publishers

CONTENT AGGREGATORS	PAY TV OPERATORS' TV EVERYWHERE	FREE BROADCASTER CATCH-UP AND LIVE STREAMING	OTT-ONLY PAY TV OR PAY TV-LIGHT	NICHE OTT
NETFLIX amazon prime video	DIRECTV Spectrum REACH sky Virgin media	FOXNOW itv NBC	DIRECTV NOW hulu sling NOW TV molotov.tv	hopster DRAMAFEVER DAZN MUBI TENNIS TV

In North America and across Europe, the ubiquity of OTT video apps and services, supported by high-speed broadband and connected devices, is encouraging a shift to multi-screen IP delivery of video content. Consumers value the flexibility and convenience offered by OTT video services, but, as they spend more time accessing content via OTT, their expectations around quality are growing. For many viewers, a video experience should be at broadcast quality – high definition, high bitrate and error free – regardless of the platform or device on which it is received.

However, the reality for OTT publishers is that managing the quality of video streaming experienced by users is challenging, given the complexity of the video delivery chain (Exhibit 2). The journey video content takes before arriving securely and at high quality on a viewer's screen is more complicated when delivered via the internet than via broadcast. More importantly, an OTT publisher has far less control over many constituent parts of the video delivery chain than a traditional TV platform does, such as a pay TV provider that controls the head-end cable plant and set-top box hardware and software.

EXHIBIT 2: Typical OTT video delivery chain

| VIDEO ASSETS (1,000s) | × | ORIGIN SERVERS (100s) | × | ISPs (10s) | × | CDNs (10s) | × | DEVICES (10s) | × | METRICS (10s) | × | GEOs (1,000s) | = | **100M+** COMBINATIONS OF POSSIBLE ISSUES |

In this context, to ensure the best possible viewing quality, publishers need to know when viewers are experiencing problems and, just as importantly, where those problems are. Monitoring tools can provide publishers with visibility of the same experience as their viewers, monitoring the levels of key performance indicators such as video start failures, rebuffering and pixelation. These tools can also generate service alerts for publishers, highlighting when the number or percent of viewers experiencing issues exceeds a predetermined threshold.

KEY PERFORMANCE INDICATORS

Video Start Failures

Rebuffering

Pixelation

Yet these issues can have multiple possible causes, such as a CDN performance issue, a regional problem at an ISP or a bug within the video player framework on a certain device. Some parts of the video delivery chain – such as a viewer's in-home Wi-Fi – are not even addressable by the OTT publisher. For publishers monitoring and responding to these alerts, identifying the root cause of a problem requires detective work and significant expertise.

Large and established OTT publishers are already investing in the teams and the technology needed to ensure they can deliver a high-quality video experience. Further adoption of OTT viewing by viewers in a growing market is likely to intensify the challenges around QoE. As a result, dealing effectively and efficiently with QoE issues is becoming an even greater priority for both established and emerging OTT publishers.

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THERE IS NO SUCH THING AS A TYPICAL OTT PUBLISHER

There has been an explosion in the provision of OTT video services launched across North America and Europe in recent years. But despite this and perhaps surprisingly, there is no clear or established template yet for how such services are structured or run. Publishers vary widely in their scale, in their business models and goals and by their level of maturity. As a result, their approaches to QoE also vary widely.

For example, dedicated niche OTT players with very small operating teams compete for audiences with major OTT services provided by major TV platforms and aggregators such as Amazon and Netflix. Some OTT services are ad-funded, some rely on subscription revenue and others have both. Some services are created by TV platforms or aggregators, bringing in a mix of original content and third-party content from a range of sources, while others are set up by content owners to go directly to consumers. And newer services – those that have been running for less than 18 months – are likely to have different priorities than more mature services.

As a result, there is no consistent model for managing QoE, even within companies of similar scale or at similar levels of maturity. Trying to quantify the resources required by a typical OTT publisher proved impossible, given the lack of any standardised approach. Some large publishers have dedicated resources to monitoring and maintaining QoE around the clock:

> " Our team ensures channels are watchable, playable, at the right quality level – that is important to our user experience. We have 12 people – with four working at all times, 24/7 – watching for alarms and being proactive on incidents."

Others of a similar scale, however, do not have a full-time dedicated resource for QoE:

> " We don't have anyone sitting behind a big bank of TV screens looking at OTT for us. We have tools going 24/7, but there is no one appointed to monitor 24/7."

Most smaller OTT publishers are too small to dedicate resources:

> " Our service is something we spun up and executed with just a handful of folks – the QA team is three or four people. We have one user experience director, one to two product managers. [QoE monitoring] is a portion of the product manager's job."

LARGER OTT
PUBLISHERS

SMALLER OTT
PUBLISHERS

This presents a challenge for technology providers who must cater to different sizes and shapes of operations teams. Vendors need to customise and be flexible due to a wide mix of outsourcing arrangements, team structures and approaches to QoE.

This fragmentation in the market also suggests a need for a set of industry best practices, as OTT video viewership and subscribers continue to grow rapidly. For example, in Europe, 85 million people watched OTT services in 2016, forecasted to nearly double by 2021 to 166 million[2]. In North America, paid subscriptions to OTT services are projected to reach 144 million subscribers in 2017 and grow by a 5.2% CAGR through 2021[3].
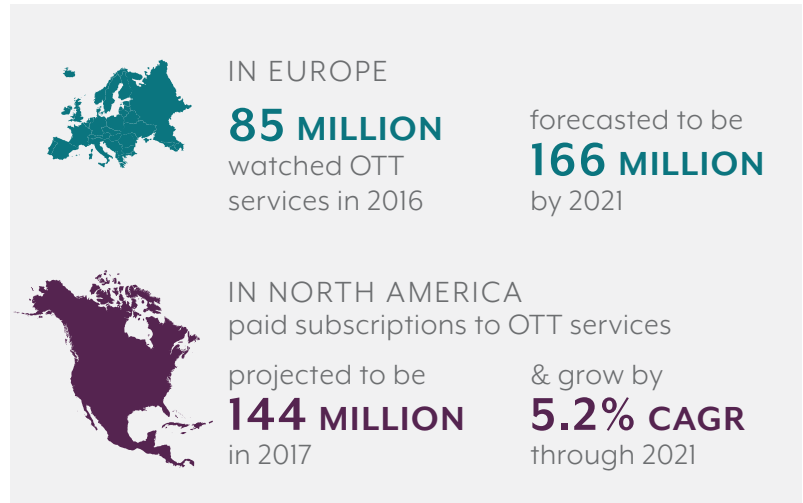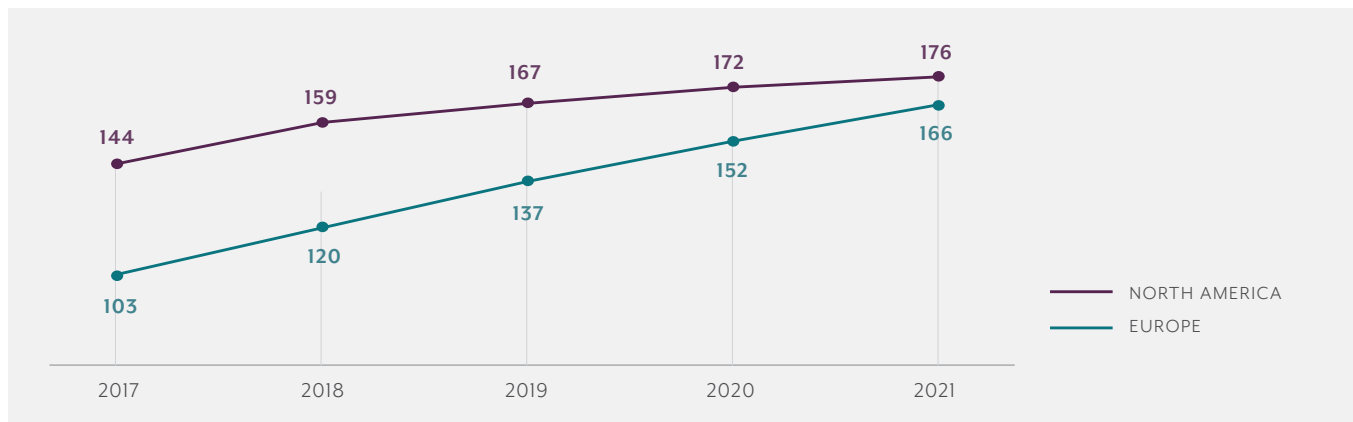
IN EUROPE

85 MILLION watched OTT services in 2016

forecasted to be **166** MILLION by 2021

IN NORTH AMERICA
paid subscriptions to OTT services

projected to be **144** MILLION in 2017

& grow by **5.2%** CAGR through 2021

EXHIBIT 3: Estimated number of subscribers to OTT services (millions)[2,3]

North America: 144 (2017), 159 (2018), 167 (2019), 172 (2020), 176 (2021)
Europe: 103 (2017), 120 (2018), 137 (2019), 152 (2020), 166 (2021)

NORTH AMERICA
EUROPE

There is an opportunity for leading players to provide thought leadership and perhaps industry-approved certification to ensure that viewers can trust they will get a high-quality viewing experience.

The lack of standards also presents on opportunity for OTT publishers to differentiate. In the world of broadcast television, there are homogeneity and long-established playbooks around the technical quality of the content delivered to a screen. In the evolving world of OTT services, however, publishers could seek to distinguish from their peers by focusing on QoE in particular and offering, for example, a gold seal of quality.

[2] Source: Rethink Research, The Rise of paid OTT in Europe (2017)

[3] Source: SNL Kagan, State of North American online video: SVOD (2017)

PUBLISHERS ARE FOCUSING MORE ON QoE AS OTT BUSINESSES MATURE

New OTT publishers have not generally considered QoE to be a priority as their services roll out:

> Publishers need at least 18 months of a service running [until monitoring QoE is a priority]. Before that, they're thinking about other things. As a service matures, you go from the macro to the micro – that is the next level of product maturity."

New OTT publishers have been more likely to focus on growth, on rapid expansion and on fixing bigger, more apparent issues in the first phases of rolling out their services:
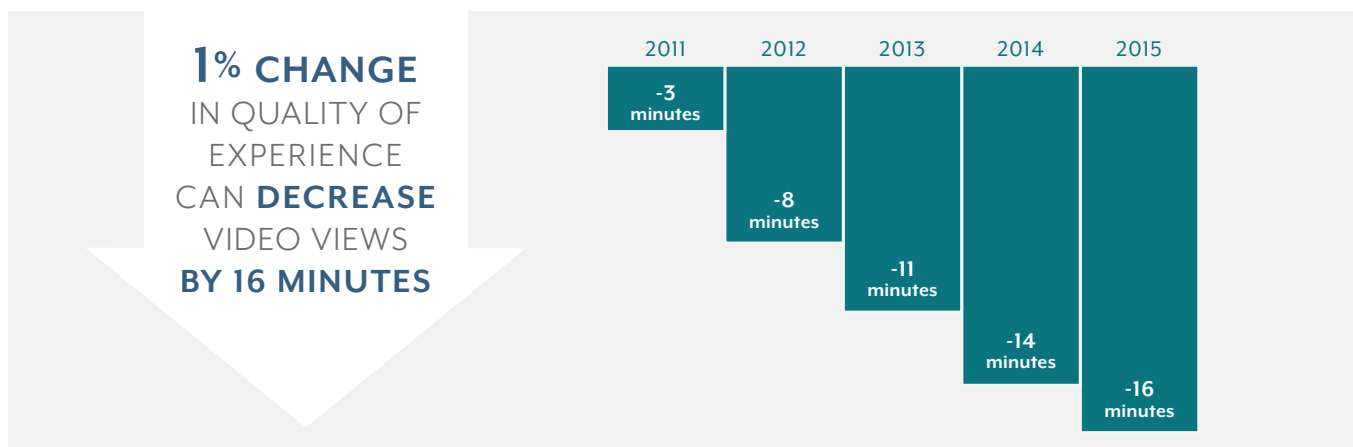
> Internally the strategy and the focus was more on expanding what we had on a global scale than on the fine-tuning and optimisation that other operators in a more stable environment and market would do."

With pressure on resources, many OTT publishers have aimed for a "good enough" video experience and have relied on customer service to flag major issues, opting not to monitor QoE directly:

> What would need to change for QoE to be a higher priority is we would need to have more complaints."

However, as the OTT market matures and as consumer expectations grow, a "good enough" video experience may not be sufficient to maintain viewership in an increasingly crowded environment. Waiting for viewers to complain might be too late to avoid their going elsewhere. Viewers watch less and churn or leave when quality is poor. For example, Conviva's data shows that a 1% increase in buffering can decrease video views by 16 minutes.

EXHIBIT 4: Engagement reduction (in minutes) with 1% increase in buffering[4]

1% CHANGE IN QUALITY OF EXPERIENCE CAN **DECREASE** VIDEO VIEWS **BY 16 MINUTES**

2011	2012	2013	2014	2015
-3 minutes	-8 minutes	-11 minutes	-14 minutes	-16 minutes

[4] Source; Conviva, 2016 Consumer Survey Report

Publishers are realising that no matter how good their content, customer service and recommendation engine are, viewers will stop watching if the video takes too long to start, is constantly interrupted with the buffering symbol or is badly pixelated.

This is especially the case as viewers spend more of their time accessing real-time event TV, such as sports content and live reality shows via OTT services. With valuable live content, OTT publishers note that viewers' tolerance for delivery issues is significantly diminished:

> Our priority is always creating a broadcast-type experience. Whether on-demand, live or on a tuner, we have to have a consistent broadcast-type experience. When you sit in front of your TV, you have TV that doesn't buffer, go off or black out. Our priority is creating consistency of experience through linear and on-demand. It will continue to be one of the top things that drives our business."

Given these factors and given a proliferation of new OTT publishers in the market in the last 12 to 18 months, the focus on QoE is likely to increase, especially as those publishers reach the right level of maturity.

For new OTT services, moreover, the idea that QoE is not initially a business priority for their product may not be sustainable. Audiences used to high-quality video from broadcast TV and from mature OTT services may not tolerate QoE issues, regardless of how small or new an OTT service may be:

> Once OTT services start measuring what their audience engagement looks like and how it can be correlated with QoE issues, the lightbulb comes on and they realise they need to start investing more [in QoE management]."

QoE is a size-agnostic problem. Viewers' expectations are set by the big players, who have invested heavily in delivering top-notch QoE. As a result, newer and smaller players are having to address such issues earlier in the life cycle of their service:

> Viewers compare us to big platforms – 'my iPlayer works so why doesn't yours,' 'Netflix is working, why isn't yours' – but they're very big enterprises with capex of over 100 million dollars. We're not the same scale but are expected to deliver the same quality of service as they are."
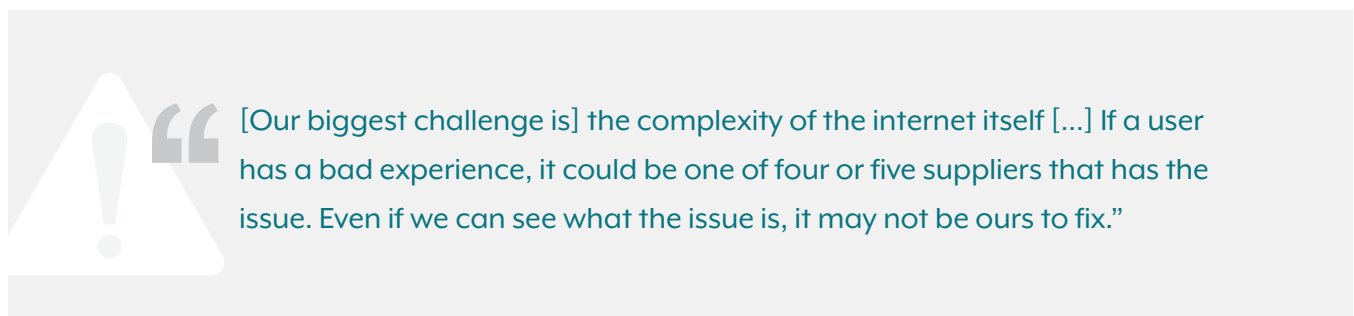
Given these expectations, QoE monitoring is moving from a nice-to-have for new services to table stakes to compete for viewer attention in an increasingly competitive business environment.

WHEN PROBLEMS ARISE, QUICKLY IDENTIFYING THE ROOT CAUSE IS PUBLISHERS' BIGGEST CHALLENGE

Quickly identifying the root cause of issues is viewed as a key challenge – and a priority – almost universally across publishers of all types. Using a range of monitoring tools and systems, it's easy for a publisher to understand when there is an issue or service interruption but much more difficult to determine what the cause of an issue may be in order to apply a solution.

The complexity of the video chain, with numerous parts out of the control of the publisher, makes it difficult to determine where within the chain a problem may be occurring and, as a result, how to fix it. A video start failure, for example, could be caused by a CDN server issue, an ISP, a bug within a video player framework or a user's home Wi-Fi:

> [Our biggest challenge is] the complexity of the internet itself [...] If a user has a bad experience, it could be one of four or five suppliers that has the issue. Even if we can see what the issue is, it may not be ours to fix."

Many organisations have a playbook or a call list they use to systematically find root causes of issues, but this process can still take a significant amount of time:

> [Our biggest challenge is] addressing issues as quickly as possible. We spend too much time waiting for data or guessing at what is wrong. We often need to pull in different teams."

Many publishers believe they aren't getting all the information they need to identify the root cause of a problem flagged by their monitoring systems and alerts:

> If our alerts had more information, that would cut our responding to alerts time down by quite a bit."

In addition, many participants also believe they're not getting information quickly enough; the ability to access real-time data was cited as key to determining root causes as fast as possible:

> A service alert should tell me as specifically as possible what is wrong to solve the problem as fast as possible."

Publishers experiencing a service issue may receive a number of alerts at the same time and often find it challenging to group these alerts together based on shared characteristics:

> [Our biggest challenge is] addressing issues as quickly as possible. We spend too much time waiting for data or guessing at what is wrong. We often need to pull in different teams."

Mature organisations that monitor their services' performance at different touchpoints face a challenge in bringing information from multiple monitoring systems together into a single coherent view:

> I would like a big screen that shows encoders, CDNs, etc. Not just alerting but also educating everyone in the organisation. But it takes a lot of effort to get there."

Improving the speed with which teams can identify the root cause of problems and thereby resolve service alerts within the video delivery chain frees up valuable resources for publishers:

> The less time you spend configuring, setting up, dealing with false positives, the more time you can focus on analysing the things that are real. Any efficiencies mean you can free someone up to do something they're paid well to do."
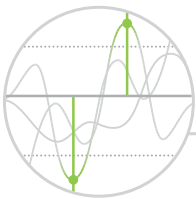
PUBLISHERS MONITORING THEIR SERVICES NEED THE RIGHT QUANTITY – AND QUALITY – OF ALERTS

Publishers monitoring for QoE using service alerts need not just the right kind of information; they need the right amount of information. Setting the right thresholds to deliver a meaningful set of alerts can be challenging. If alert thresholds are too low, there's a risk of getting too many alerts and, with limited resources, genuine issues may get lost amid the noise:

> The more alerts we set up, the more guilty we feel because we can't put resources on fixing them."

Going too far the other way, however, and setting the thresholds too high may lead to too few service alerts, with the danger that issues get missed during monitoring:

> Setting thresholds is a big pain point. We get a ton of false alerts – teams have to dig into it. **90% of the time it is nothing or a blip.** We are constantly adjusting. It's an ongoing challenge."

Working out which issues need to be prioritised can require high levels of skill and experience from the team monitoring service alerts:

> It's almost like parents knowing whether it's a real cry or a fake cry. We've learned that along the way – they cried wolf a lot at the start. You have to be that filter because you can't say 'emergency' all the time."

However, though acquired knowledge within the operations team can help publishers use their finite resources most effectively, setting alert thresholds appropriately continues to be a challenge:

> This is a continuous process. Nobody can say I have the right level of alerts. We fine tune all the time. At this moment we think we have right coverage. Tomorrow we might be exposed."

> "We're constantly trying to look for needles in a haystack. It is time consuming. It is costly, really thinking about it. We have engineers playing out certain channels, but even that doesn't always work."

Finding the balance between too much and too little information remains an ongoing problem for the teams monitoring QoE. In trying to address issues within a complex and ever-evolving video supply chain, there is no right answer, rather a constant discovery process. This is the perfect use case for machine learning that can adjust sensitivity and thresholds to adapt to the current viewing environment. Thus, publishers are keen to understand how automation and the application of machine learning can create new efficiencies in the video monitoring process.
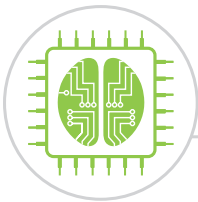
AUTOMATION AND MACHINE LEARNING CAN HELP PUBLISHERS IMPROVE QoE

Industry executives believe that automation – aided by software – will help them address the challenges of identifying root causes and balancing the volume of QoE service alerts. Machine learning software can help publishers address the challenge of setting alert thresholds at the right level in order to receive an appropriate volume of actionable alerts:

> There is a major shift in advanced analytics and machine learning. We want AI to set where the thresholds are – it is where the market needs to go. We are spending time understanding how to predict issues and solve them in a much faster way. [...] You get too many alerts and you turn them off. You get too few, and the issues begin to crack – it is about getting the correct goal set."

If software can make aspects of QoE management easier, it can enable OTT publishers to deliver a higher level of quality to viewers, in turn lifting the overall quality of the OTT video streams – and helping to drive its development.

For a large, mature publisher, monitoring of QoE typically requires around half of a technical team's responsibilities, and these teams can consist of eight to 12 full-time roles[5]. There could therefore be significant freeing up of resources if the processes for identifying thresholds, setting alerts and identifying root causes of issues were made more efficient through the application of automation.

For a less mature publisher, monitoring of QoE can vary widely. Some have one person dedicated full-time to managing QoE, but many do not devote any time to real-time monitoring or to service alerts; instead they look into issues when customer service receives complaints from viewers. Many publishers observe that viewer complaints often appear in public forums, such as on social media and app store reviews. Thus minimising complaints is increasingly important:

> If you look at social media or our app ratings on the app store, you still get people complaining about the experience here and there. In general, some people may be having a poorer experience. Sometimes that minority can hurt you because they're vocal and they're on social, so you want to dig in and try to optimise that."

Automation has the potential to enable smaller, resource-constrained publishers to address issues before they reach customer service or public forums, most likely resulting in higher customer satisfaction, acquisition and retention.

Publishers hope that machine learning can help speed up their biggest current challenge – root cause analysis – by understanding baseline activity and highlighting anomalous behaviour:

> We'd like a system to identify trends in context, to flag something that looks different, where the system would intelligently understand what is different. Lots of resources are spent monitoring – knowing there is a problem but not knowing where the problem exists is time-consuming."

Some larger publishers believe the ability to group alerts together from multiple monitoring sources, based on common elements, could save them time:

> We're trying to find an automatic way of grouping faults together to find common issues."
>
> "Having data from all the sources is important. We would like to see a way to correlate everything so we could build intelligence in there. That would help us to get issues fixed as quick as possible with help from automation."

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[5] Source: MTM interview programme

Nearly all OTT publishers agree that identifying and resolving QoE issues requires experienced engineers with significant domain wisdom. It was noted, however, that the talented engineers would prefer to spend their time developing new products and features rather than debugging service issues:

> It's very time-consuming and difficult and takes a certain skill, and usually the problem lies elsewhere. People who are usually the best at solving the problem – brilliant developers, typically – don't want to fix other people's issues. Talented people doing boring tasks will leave. Can software tools help?"

Some publishers are already extending automation throughout their processes, including fault resolution:

> We try to automate everything. The next time we run into an issue, we'd rather not have people manually working on it. [...] Every time we run into [an issue], this is what we can do to prevent it happening again."

Increased automation in the QoE monitoring process has the potential to free up OTT publishers' resources, enabling three key opportunities: an increased focus on product development; the opportunity to study and understand historical trends to improve quality; and improved customer satisfaction, potentially leading to higher engagement and lower churn. As a result, OTT publishers universally welcome tools and methods that, using automated solutions and machine learning, enable them to improve the quality of the video experience they deliver in a resource-efficient way.

CONCLUSION

Growing viewer expectations about the quality of video streaming mean OTT publishers increasingly need to devote resources to ensuring they deliver a consistently high QoE to viewers. Given these expectations, QoE monitoring is moving from a nice-to-have for new services to table stakes to compete for viewer attention in an increasingly competitive business environment.

As the volume of traffic from OTT video continues to grow rapidly, there is an opportunity for leading players to provide thought leadership and perhaps industry-approved certification to ensure that viewers can trust they will get a high-quality viewing experience.

Monitoring QoE and resolving service issues, however, requires technical staff with domain expertise and experience identifying root causes of problems across a complex video delivery chain. For a large, mature publisher, monitoring of QoE could easily take up around half of a technical team's responsibilities, the equivalent of four to six full-time roles[6]. These teams face an ongoing challenge in bringing information from multiple monitoring systems together into a single coherent view.

In addition, finding the balance between too much and too little information remains an ongoing problem for the teams monitoring QoE. In trying to address issues within a complex and ever-evolving video supply chain, there is no right answer, rather a constant discovery process. This is the perfect use case for machine learning that can adjust sensitivity and thresholds to adapt to the current viewing environment.

Industry participants are optimistic that machine learning and automation can free up top technical talent by speeding up the processes of identifying and resolving video streaming interruptions. They can then focus on improving the quality of the video stream, reducing future issues and supporting product innovations. Thus, automation in QoE monitoring has the potential not just to create new operational efficiencies for OTT publishers but also to improve the overall experience of viewers, supporting growth of the industry.

METHODOLOGY

The findings in this report were developed between July and September 2017 and are based on MTM research and analysis as well as depth interviews with 26 senior technical executives from OTT publishers across North America and Europe. All quotations used in the report come from these depth interviews. All sessions were conducted under the Chatham House Rule (no attribution without prior permission), with participants speaking as individuals and not as company representatives. MTM and Conviva would like to thank all those who contributed to the research.

The opinions expressed in this paper are solely those of the authors and reflect MTM's judgement at the time of writing, based upon the available information. These views do not necessarily represent the views of the interviewees and contributors. Any errors or mistakes are entirely the responsibility of the project team. Inevitably, this paper provides a partial view of a highly complex industry: it represents a snapshot of industry perspectives at a particular moment in time.

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[6] Source: MTM interview programme

NEXT STEPS FOR THE INDUSTRY

1   Establish standards: Industry trade groups, such as the Streaming Video Alliance (SVA), should consider establishing industry-wide agreed standards about what constitutes a high-quality streaming video experience in a way that consumers can understand and publishers can benchmark themselves against.

2   Share best practices: There is an opportunity for OTT publishers to share knowledge and best practices with their industry peers related to operating, alerting and issue resolution. This could improve the quality of streaming video across the industry, potentially accelerating the overall growth of OTT streaming video.

3   Embrace machine learning: Automation and machine learning tools can enable OTT publishers to deliver a better consumer viewing experience by improving service monitoring and speeding up root-cause analysis of service issues to minimize interruptions.

ABOUT CONVIVA

Conviva powers every internet-connected screen with the most engaging viewing experiences imaginable by elevating the way OTT businesses use data-driven intelligence. For years, HBO, Sky, Turner and the like have been using the Conviva Platform to enlighten, reveal and inform with important insights around the consumer in-screen viewing experience, allowing them to connect those metrics to important business outcomes. This allows customers to not only maximize subscriber retention and growth but also understand content and viewing trends so that they can deliver more personalized viewing experiences. We make engagement a data-driven outcome based on actionable quality of experience (QoE) analytics. Conviva is privately held and headquartered in Silicon Valley, California, with offices in New York and London. For more information, please visit us at www.conviva.com.

ABOUT MTM

MTM is an international research and strategy consulting firm specialising in media, technology and advertising. MTM helps clients in the private, public and not-for-profit sectors around the world understand and respond to digitally driven change, providing award-winning consumer research, industry analysis, strategic advice and support for new ventures, business development and organisational change and transformation. MTM's approach combines in-depth knowledge of our sectors, a unique combination of skills and capabilities and wide-ranging engagement with the market. Headquartered in London, MTM is a private company working with clients around the world. For more information, please visit us at www.mtmlondon.com.