Over-the-Top:

The cloud-based path to video innovation

Building a platform for success in the OTT video market

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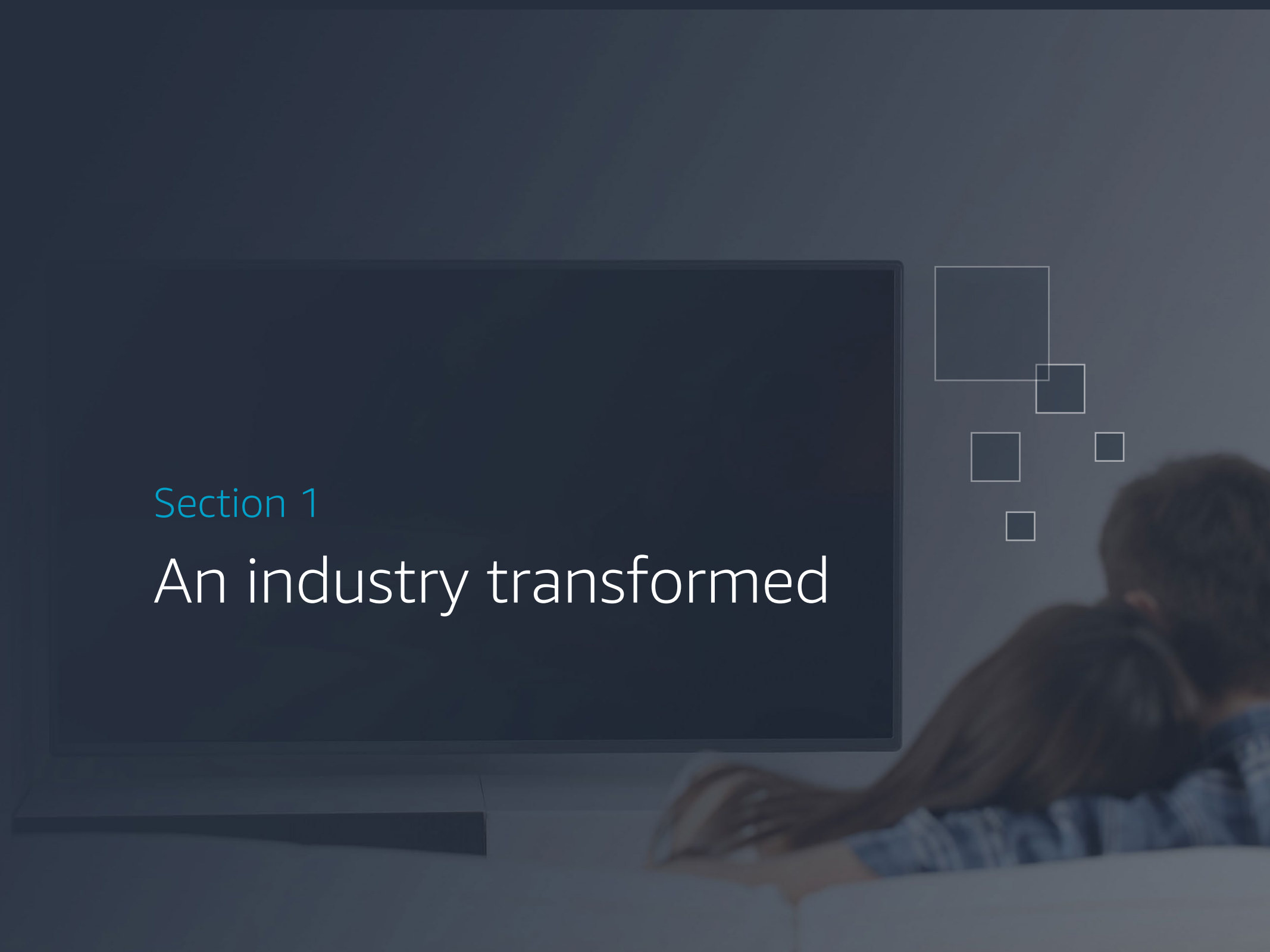

Section 1

An industry transformed

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The rise of internet-powered communications has disrupted a series of industries. Of those, few markets have experienced more upheaval than the media business. In the span of a few years, traditional modes of media consumption that went largely unchanged for decades have been fundamentally transformed—and with them, the business and revenue models that helped ensure consistent growth and profitability for established media brands.

Media organizations whose business practices, content strategies, and technology platforms were slow to anticipate the onslaught of digital transformation now struggle to keep pace with an accelerating rate of change. Adding to their challenge is a new wave of media companies who can trace their success to the ability to move quickly and aggressively in seizing the opportunities of what has been termed the post-broadcast era.

Unencumbered by traditional approaches to creating and delivering content, these companies have fueled the exploding market for over-

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the-top (OTT) video. Launched amid the rise of cloud-based compute services, this new type of media organization aims to shape and disrupt the way video is experienced without relying on hardware-based technologies to build and deploy services. Instead, the combination of OTT video distribution and cloud-based infrastructure gives them an agile, scalable, and cost-conscious foundation for innovating and delivering groundbreaking new offerings.

At the same time, the forces behind the adoption of cloud video services are not only attracting new media organizations. Broadcasters and other established players are increasingly compelled to navigate the shift from legacy infrastructures to cloud, where they can leverage their considerable expertise in broadcast and OTT service delivery to realize unprecedented agility without sacrificing the dependability on which their businesses rely.

Technology infrastructure is a critical success factor for organizations that plan to stake their claim to the increasingly diverse and competitive markets for OTT video. This e-Book discusses the accelerating growth in OTT markets, compares hardware- and cloud-based approaches to creating live and on-demand OTT video workflows, and gives examples of organizations that architected OTT services with a cloud-centric approach.

The booming market for OTT services

"Over-the-top," or OTT, refers to the distribution of video content over the internet, bypassing traditional linear or pay TV services to bring content directly to consumers on their internet-connected devices—their phones, smart TVs, tablets, computers, set-top boxes, gaming consoles, and digital media players. Over-the-top video has experienced tremendous growth; today, there are more than 200 OTT service providers in the U.S. market alone[1], and those services generated more than $20 billion (USD) in 2017 revenue[2]. Revenue from OTT services will exceed $30 billion by 2022 as the OTT market grows at a rate of 20 percent annually[3].

The accelerating market for live and on-demand OTT services has its roots in the fundamental dynamics of digital transformation as applied to consumer markets. In short, driven by the increasing prevalence of high-bandwidth mobile and home internet, the consumer electronics

Today's media consumer is more sophisticated than ever. Their expectations for video content include more choice, and greater relevance to their individual tastes.

1. Parks Associates, OTT Video Market Tracker
2. PricewaterhouseCoopers Entertainment & Media Outlook for 2018
3. ABI Research, Over the Top (OTT) and Multiscreen Video Services 2017

market has become saturated with connected devices that offer sophisticated functionality and exceptional image quality for viewing and interacting with live and on-demand video. The result: consumers' viewing habits have fundamentally changed, and will continue to change, propelled by the constant advance of enabling technologies.

Today's media consumer is more sophisticated than ever. Their expectations for video content include more choice, and greater relevance to their individual tastes. They demand broadcast-grade video quality, on-demand, TV-everywhere functionality, and flawless streaming performance with virtually instantaneous access to content.

Providers of OTT services have responded to increasingly sophisticated consumer demands with more and better services, and innovative viewing experiences. In so doing, they have taken advantage of a fundamental difference between OTT and broadcast: the difference between unicast delivery—a dynamic, one-to-one connection between content provider and viewing device—and the one-way, one-to-many mode of broadcast delivery. As a result, OTT content continues to evolve, shifting from a mere alternative distribution path for broadcast content

to a truly distinct format, one that allows for new modes of consumption and interaction that broadcast content and technologies cannot match. Furthermore, it can be argued that OTT video has begun to unlock its own "over-the-top" capabilities—an increasingly robust layer of video processing technologies, enabled by cloud video infrastructure, that offer new and enhanced video experiences. An example is the integration of machine learning technologies with video processing, which offers virtually limitless capacity to mine new experiences and offerings on top of video content while introducing new efficiencies to the work of creating and managing media assets.

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Building a disruptive technology foundation

In its earliest forms, OTT video technology followed the same mindset as broadcast: that hardware-based infrastructure would serve the needs of the business for years at a time, with no need to update. OTT infrastructure was essentially bolted on to existing broadcast infrastructures: A collection of specialized hardware-based technologies, laid out in a dedicated linear architecture, would process and package video along the distinct stages of a video workflow.

The hardware—typically in the form of networked appliances—did the work of parsing video into discrete segments for compression and transmission over networks, packaging those segments for delivery as live content or as video-on-demand (VOD) assets, and serving that content over networks via open channels or in response to requests from TVs, set-top boxes, computers, mobile phones, or other connected devices. In today's rapidly maturing OTT market, this approach to video workflows built on dedicated, traditional infrastructure is no longer sufficient to meet the needs of unicast distribution, and the demands it places on scale, cost, and continuous innovation.

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Challenges of traditional OTT infrastructure

In fact, traditional architectures present several obstacles to meeting the fast-moving needs of today's OTT video consumer. The challenges they present include:

Slow to deploy

The process of planning, procuring, testing, scaling, and deploying to production a traditional hardware-based video infrastructure takes several months – in some cases, years – to complete. As competition grows and the pace of innovation among OTT content providers continues to increase, organizations planning to win share of market must measure time-to-market for new offerings in weeks, rather than months or years.

Capital intensive

A complete, traditional workflow architecture can cost millions of dollars in upfront capital to acquire and integrate before a single second of video can be used. With redundant infrastructure to provide a high-availability failover option, those costs double. As the increased pace of OTT innovation shortens the useful lifespan of dedicated video hardware, the time between equipment upgrades shortens, driving more frequent expenditures.

Hard to scale

Whether for live or VOD distribution, predicting the potential capacity for viewership that an OTT video workflow must support is more critical – and more challenging – than ever. If the equipment provisioned is insufficient to handle peak processing requirements or unable to scale with audience viewership, this can lead to service failures that result in blank screens and frustrated users. If infrastructure is overprovisioned, money that could have been spent elsewhere is needlessly committed to depreciating assets.

Difficult to adapt

The ever-increasing number of end-user devices, coupled with the accelerating pace of change in video, requires workflows to support an ever-expanding list of standards and protocols. As video production standards move from HD to 4K UHD resolutions and beyond, the amount of data

a video workflow must handle can grow exponentially, requiring ongoing investment in database licenses, processing power, and storage hardware in order to manage media assets. Emerging standardized protocols such as fMP4 and CMAF for HLS and DASH, have significant industry support that will impact millions of devices around the world. Keeping video services current can mean significant upgrades to hardware-based video workflows, and may even trigger a complete infrastructure refresh.

Costly to maintain and secure

Owning video infrastructure in a data center means ongoing management and maintenance. This can leave highly trained video professionals dedicating their time to software updates and patches, filing support tickets with vendors, and other administrative tasks that distract from their core focus. Alternatively, video providers may choose to employ or contract with IT professionals to do the heavy lifting; in either case, the cost of operating a complex video infrastructure can add significantly to the total cost of ownership (TCO) of traditional video processing architectures.

Advantages of cloud-based OTT workflows

For the reasons cited previously, organizations that plan to maximize success in the OTT video market can look beyond legacy approaches when plotting the infrastructure that will power their innovations. The good news for organizations that can architect their technology strategy from a cloud-centric point of view is that cloud vendors have developed media-specialized services that can deliver the performance, reliability, and video quality of broadcast-grade hardware infrastructure, while unlocking powerful new capabilities to enhance the user experience.

These cloud-based services comprise the central functions of the OTT video workflow: Processing, packaging, storing, monetizing, and delivering content over IP networks with the optimal formats, quality, codecs, and features for each viewer's connected device. By operating on a pay-as-you-go cost model, cloud services eliminate significant upfront capital expense, potentially freeing millions of dollars that OTT content providers can instead spend on talent and growth strategies, and conserve for future needs.

By adopting cloud services as the foundation for their OTT video infrastructure, content providers can realize a number of significant benefits that help fuel outstanding user experiences, support operational excellence, and favor the bottom line.

Cloud services are inherently flexible

Cloud-based video infrastructure is designed to grow, shrink, adapt, and evolve with the needs of the OTT video workflow and the audiences it serves. As new formats such as high dynamic range (HDR) video and 4K resolution reach the mainstream, cloud video services can be kept current with the necessary updates in real time. This lets content providers stay out in front of their audiences without the need to upgrade or replace expensive technology.

Flexibility also comes from choice. As an example, Amazon Web Services (AWS) offers customers the option to tailor a best-of-breed approach to their video workflow architecture and preferred deployment model. By providing

easy, API-based integrations between services from a cloud provider and third-party vendors, such as DRM providers, ad decision servers, and content delivery networks (CDNs), these cloud services allow content providers to design their video workflow using solutions that best address their specific requirements at every step.

They provide operational agility

Over-the-top video content providers who build and deliver offerings using cloud services aren't limited by a physical architecture. The capacity to power services up or down on demand, on a pay-as-you-go basis, allows for testing and experimentation at costs as low as pennies per hour, with no physical limits on how live or on-demand channels are configured or load-tested. Once services are production-ready, they can be deployed within minutes, even on a global basis, and can be quickly and easily refined based on audience feedback and analytics.

They scale easily and massively

Cloud services can be configured to scale processing resources up or down automatically, in line with viewer demand. Unexpected peaks in audience demand are addressed in real time, so a viral success or breakout hit can reach every viewer who requests it, and each of those screens can be monetized. Cloud services providers can extend those resources to OTT content providers as needed, unlocking fast and easy access to worldwide distribution.

Live events underscore how uniquely well-suited cloud-based workflows are for OTT video. Only a cloud-based content delivery network (CDN) can scale to serve tens of millions of viewers without requiring a massive upfront investment in anticipation of unpredictable peaks in viewership. For live events, the cloud's global reach also allows providers to locate both ends of the video workflow close to the network edge—ingesting content near the source, and distributing content near the user—to maximize performance and minimize latency across the workflow.

They offer broadcast-grade reliability and consistency

For OTT service providers, achieving eye-popping visual impact no longer requires an eye-popping investment in broadcast-class hardware. Cloud-based video services offer

access to a full range of codecs, features, and integrations that enable visual quality once only associated with video processed and delivered over hardwired broadcast networks. With the cloud, broadcast levels of quality can be achieved at a cost that suits virtually all content providers.

They enable broadcast-grade features and quality

A consistent, seamless, and fault-free user experience can earn positive user feedback and build audience loyalty for OTT video services. While realizing broadcast-grade durability once required substantial investments in physical infrastructure, cloud services can now achieve these levels of quality, reliability, and availability for OTT delivery. For example, to maximize channel uptime and availability, cloud-based video services such as those from AWS are deployed across redundant infrastructures and/or in different geographic zones, with user-specified options to further enhance durability. Components are monitored for health, and degraded components can be automatically replaced without disrupting active workloads.

Taking advantage of the robust analytics furnished by cloud-based video workflows, OTT services can also apply machine learning to optimize the video workflow for better performance and user experiences. For example, by integrating real-time analysis of performance metrics across the workflow, providers can mine the constant flow of data to identify sources of latency as they arise and invoke adjustments, such as scaling distribution resources, optimizing load-balancing, or redirecting CDN traffic across different paths or regions to keep end-to-end latency at the absolute minimum.

They support several paths to monetization

Over-the-top video services generate revenue in a handful of ways: Subscription video-on-demand (SVOD) services offer monthly or annual subscriptions in exchange for unlimited access to content; advertising-supported VOD (AVOD) services offer free access to content in exchange for viewing ads; and transactional VOD (TVOD) services sell content on a pay-per-view basis. Increasingly, providers

may take a hybrid approach that combines some of these models as a means of optimizing revenue and offering choice to customers.

As an example, cloud-based video services from AWS are engineered for straightforward integration with the tools and platforms that power different OTT revenue models. For AVOD services, integrations with third-party ad decision servers offer access to leading ad networks, and support for dynamic ad insertion allows OTT content providers to deliver targeted advertising for increased audience engagement and better returns from ad programs. The prevalence of enterprise services in the cloud allows content providers to integrate their offerings with back-end services, such as subscription management and payment capture, to support SVOD or TVOD services. For any revenue model, powerful integrations with digital rights management (DRM) providers offers industry-standard protection for valuable live or on-demand content.

They are machine-learning enabled

Previously, building and training machine learning tools was an exercise in customized, one-off engineering. It required a great deal of time, substantial development budgets, and the expertise of data scientists. Today's cloud services have democratized access to machine learning for content providers, making machine learning one of the most rapidly accelerating fields in video. Integrated with live or on-demand video workflows, machine learning offers a range of tools with which to drive efficiencies, create new services, enhance current offerings, and add value to content.

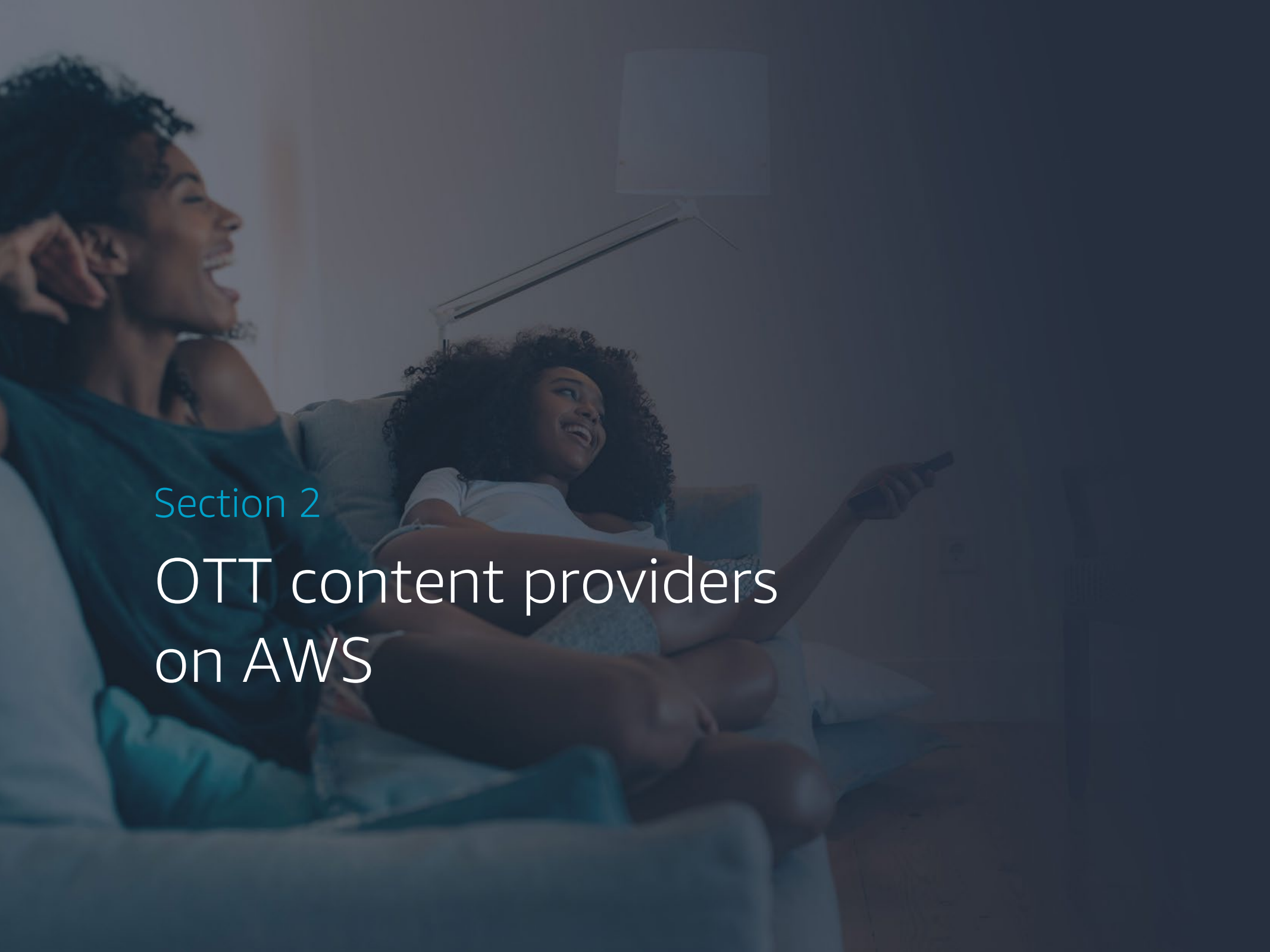
Using machine learning, content providers can automate workloads that consume substantial time and resource, such as content indexing, generating closed captions, creating video clip packages, detecting images or individuals on screen, marking video for compliance purposes, and identifying threats to content security. Machine learning technologies can also augment the efficacy of monetization efforts through improved ad personalization.

They align investment with value

Over-the-top content providers that build their services on a cloud foundation have traded significant upfront capital expense for variable, yet predictable operational expense that is based solely on usage. By doing so, they eliminate

the need to devote significant and precious capital to establish the minimum infrastructure required to develop, test, and then launch new services. Instead of tying up those monies in depreciating assets several months before they can contribute to revenue, OTT content providers can conserve capital throughout product development and testing, then spend only as their services are live—and producing revenue and cash flow. Ultimately, this cost model breaks down the barriers of capital expense that once limited the broadcast and OTT video markets to a few well-established—and extremely well-capitalized—players, and is one of the reasons there are now hundreds of OTT video services competing to gain audience share and revenue around the world.

While there are many variables that must be accounted for when projecting the total cost of delivering live or VOD streaming services from the cloud, content providers can expect costs that start at a few dollars per hour to encode live, 1080p high-definition video streams, to a few hundred dollars per hour for a complete, end-to-end cloud video workflow that delivers a live event to thousands of viewers. For a detailed exploration of the operating costs of broadcast-quality, cloud-based video infrastructure, an **FAQ published by AWS** offers a real-world, step-by-step pricing exercise.



Section 2

OTT content providers on AWS

Snowball digital powers third-party OTT services

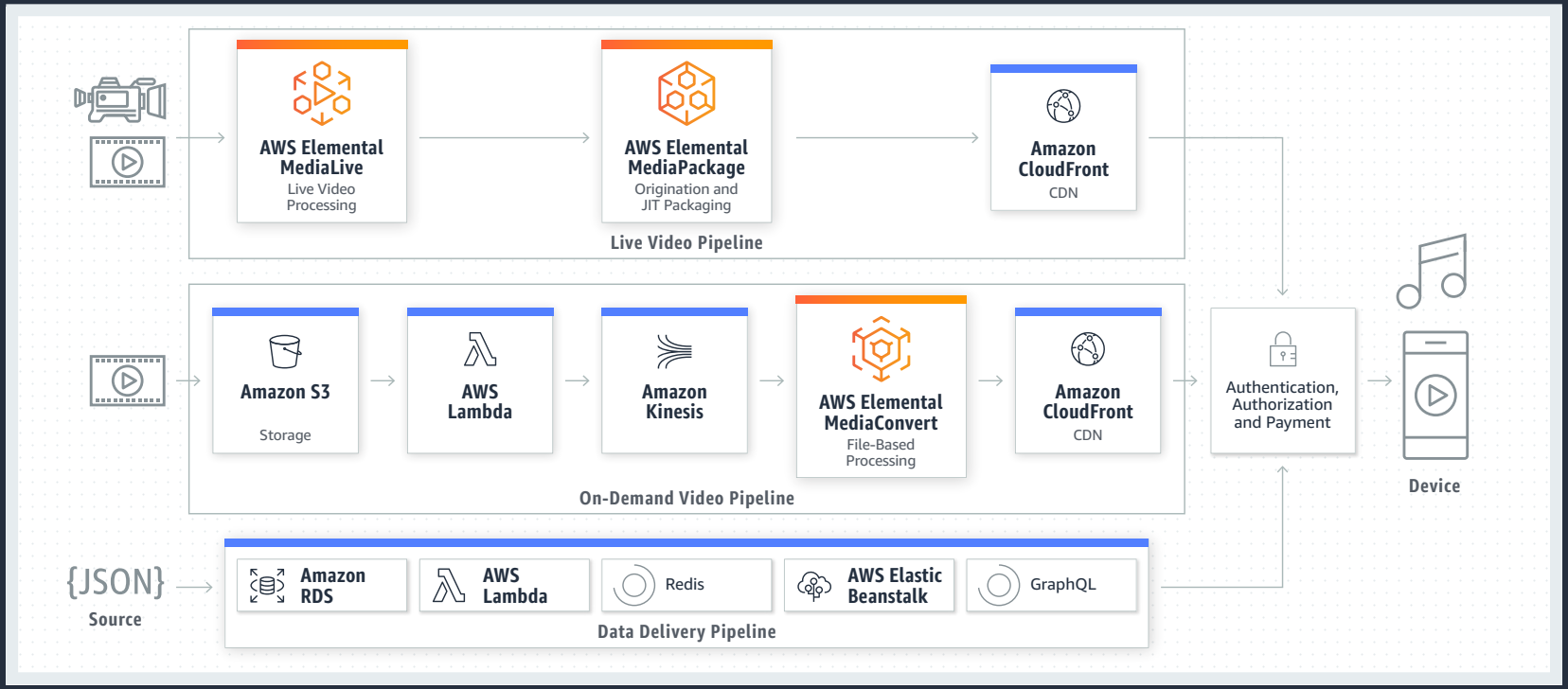
There are many organizations for which video is an increasingly valuable path to reach key audiences, but it is not a core part of their business. For these organizations, such as sports clubs, print media outlets, or enterprise companies, the time, expense, and talent required to build and maintain an OTT video offering may not make sense. Norwegian firm Snowball Digital was formed to bring sophisticated OTT video platforms to such organizations.

Built on the AWS Cloud, Snowball Digital's Crystallize platform combines video processing and delivery technology with e-commerce capabilities to enable live or on-demand OTT services with SVOD and TVOD monetization models. Designed as a "headless" e-commerce solution, Crystallize allows customers to tailor the user experience for their audiences and easily integrate with back-end services. The platform's e-commerce functionality integrates with a broad range of cloud services, including relational database, serverless compute, in-memory storage, and application orchestration, as well as end-to-end video processing and distribution.

When Odds Ballklub, Norway's oldest existing association football team and a member of the country's top professional league, wanted to create a subscription-based live and on-demand video service to connect with its ardent fan base, the club selected Crystallize. The platform provided the comprehensive video processing and delivery

technology and e-commerce capabilities the club needed. Thanks to easy customization to the club's unique requirements, the cloud-powered video service was live only six weeks after the project kickoff.

"Crystallize and AWS give us control over our content monetization strategy and the agility to quickly adapt to what subscribers value most from our service," said Einar Håndlykken, Managing Director, Odds Ballklubb. "Both the transactional aspects and the technical workflows of a paid subscription video service are built into the solution, which allows our creative talent to focus on developing new content, innovating outstanding viewing experiences, and building connections between the organization and our supporters."



An array of AWS services, including AWS Elemental Media Services, manage, process, store, and distribute video for customers of the Crystallize platform

Get started

Today's emerging OTT content providers are the "digital natives" of media organizations. Unburdened by the technologies, and inherent compromises, of hardware-based infrastructure, these media disruptors have the opportunity to build services from a cloud-based foundation, enjoying the unique benefits that a flexible, cost-efficient, high-quality infrastructure can provide. At the same time, established media organizations are accelerating their transition away from traditional infrastructure to tap into the advantages afforded by the cloud for their OTT services. With video processing and delivery in the cloud, these innovators are ready to compete on a level playing field where success is achieved through business agility, service innovation, and competitive differentiation. With careful planning and selection of cloud technology partners that offer the depth and breadth of services they need, and whose vision of the evolving media landscape aligns with their own, cloud-centric OTT content providers will continue to propel the media industry forward with breakthroughs in content, service models, and viewing experiences

For more information about designing and deploying OTT video services in the cloud, you may find the following resources helpful:

- **AWS Media Services**
- **AWS M&E Solutions**
- **AWS Partner Network**
- **Featured Machine Learning Partner Solutions**
- **AWS Machine Learning Blog**
- **Frequently Asked Questions about the Cost of Live Streaming**

To get the latest industry insights, bookmark the AWS Media Blog, and follow us on your favorite social channel for more client stories, events and news.