



The Cloud Based Path to Video Innovation: Building a Platform for Success in the OTT Video Market.

An Industry Disrupted

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 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 White Paper 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

Today, there are more than 200 OTT service providers in the U.S. market alone, and those services generated more than \$20 billion (USD) in 2017 revenue. Revenue from OTT services will exceed



\$30 billion by 2022 as the OTT market grows at a rate of 20 percent annually.

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 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 technologies, such as Arumai's classical form of artificial intelligence 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.

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. . 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.

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, Arumai

Arumai Technologies, Inc. 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.

Arumai-TranStream™: Cloud-Based Transcoding & Streaming System for Media Companies:

Today, content, service, and network providers including broadcasters are expanding the distribution of their On-Demand and Live offerings to the Web and across multiple devices beyond TV. Due to the increasing customer expectations, the success of media companies is dependent on the video quality they provide. Therefore, Arumai provides its high-quality end-to- end adaptive



bitrate transcoding and streaming services, enabling highest quality on the Web up to HD and 4K, while keeping the distribution costs low by using the efficient HTTP infrastructure.

Transcoding and streaming of audio and video content for Web delivery is an increasingly complex task with substantial requirements and costs in terms of:

- hardware and systems (encoders, servers, network, etc.);
- bandwidth & connectivity; and
- specialized staff for encoding/streaming.

Furthermore, companies need to balance investments in (hardware) systems and connectivity with the required scalability and flexibility. Today's encoding systems are dimensioned on peak loads (e.g., during special events) while the financial returns on those systems are driven by overall utilization of the infrastructure. As a result, content providers have not enough infrastructure for peak hours and special events, although their existing infrastructure is underutilized or idle at the rest of the time.

Arumai's Cloud-Based Transcoding & Streaming System for Media Companies™ provides benefits across multiple dimensions:

- Remove capacity bottlenecks in the streaming media workflows;
- Flexibility to scale resources and associated operational costs with the demand;
- Right-size encoding and streaming infrastructure;
- Eliminate the necessity for capital investments in dedicated encoding systems;
- Full flexibility to choose quality and speed of encoding; and
- Reduce reliance on specific technical encoding/streaming expertise.

Due to these benefits Arumai's customers can focus on operating their business more economically, while delivering a better service to their customers and gain a faster time to market.

Arumai offers an end-to-end portfolio: from content generation (Arumai-eCode™ transcoding portion of Arumai-TranStream™) to content consumption (Arumai-Vision™ clients streaming portion of Arumai-TranStream™). Arumai-TranStream™ v1.5 will include a Private OTT CDN for Licensees only.

Arumai's solution is suitable for OTT playout of all types of audio/video content and media file formats, including live streams - such as TV broadcast signals, live events, etc. – and On- Demand media. Using the cloud-based transcoding platform Arumai-eCode™ it is possible to generate highest quality adaptive bitrate streaming output for any type of device, ranging from smartphones to set-top boxes and smart TV sets.



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.

They are enabled by Arumai's classical form of artificial intelligence

Previously, building and training 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, learning offers a range of tools with which to drive efficiencies, create new services, enhance current offerings, and add value to content.

Using Arumai's classical form of artificial intelligence, 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. Arumai's classical form of artificial intelligence can also augment the efficacy of monetization efforts through improved ad personalization in a trade secret called System and Method for Adaptive Ad Insertion.

ARUMAI TECHNOLOGIES, INC.

Arumai is the only leading, independent, pure play OTT products and solutions company in the industry today. Arumai's groundbreaking video frame manipulation techniques, proprietary streaming systems and methods, and OTT Video Suite of products make any video content universally enjoyable in high quality on any screen, by any viewer, across any network, at any time enabling a pure play OTT products and solutions company. Arumai-TranStream™ individually and when combined with Arumai-Multiscreen OTT Platform with Social Media Layers for OEMs™ is prepared to deliver millions of content streams to mobile phones/handhelds,



tablets/laptops/PCs, Blu-ray Players, Game Consoles, and Smart TVs, and in every market in the world on behalf of content owners, mobile service providers, cable companies, satellite companies, telecom operators, streaming video providers – OTT products and solutions.