SCALABLE WORKFLOWS FOR VIDEO PROCESSING AND DELIVERY

INTRODUCTION

SCALING WORKFLOWS FOR FILE-BASED VIDEO DELIVERY

Launching a new VOD or catch-up TV service can be a daunting task, especially when factoring in the potential growth in both content availability and consumer demand for media. New providers want to make sure their file-based workflows can scale with business growth while well-established providers want to ensure that they can continue to meet the level of innovation, quality and reliability that customers already associate with their brand. In both cases, required resources need to be allocated based on the correct balance between performance and cost.

With traditional, dedicated hardware-based environments operating under capacity in terms of storage, network bandwidth and video processing services risk interruption if demand increases too fast, while overcapacity can result in costs exceeding revenues. Finding the sweet spot between resource allocation and system capacity can require a significant amount of project planning and workflow reconfiguration.

Since hardware is generally inflexible, installing new equipment can mean temporality suspending and reconfiguring a file-based workflow or long delays between ordering a system and its installation.

By applying a software-based solution, hardware becomes abstracted from functionality. Instead of custom hardware, software-defined video workflows rely on off-the-shelf hardware to provide extra capacity. New features or functionality involve a simple reconfiguration of existing software rather than a complete forklift upgrade. Providing extra processing power can be as simple as adding extra server blades or spinning up cloud computing instances. Software-defined video solutions based on operating environments such as Linux provide faster, more reliable and greater levels of scalability than traditional hardware solutions.

This white paper explains how video providers, using a software-defined video solution, can either gradually or immediately evolve from basic to advanced filed-based workflows without a complete overhaul of infrastructure and with minimal service interruption. A video provider looking to expand its STB-based VOD service can introduce support for mobile devices by installing a software-based origin server as part of its existing file-based workflow. A linear television broadcaster can repurpose live content as VOD assets, which can reside alongside exclusive VOD content. While movie and pay TV content may generate revenues through subscriptions, live-to-VOD can rely on targeted advertising. Both types of content and both business models can easily co-exist within a single unified software-defined video workflow that shares a common pool of hardware and cloud-based storage and computing resources.

SCALABLE FILE-BASED TRANSCODING WORKFLOWS

File-based video environments can involve different types of content from single or multiple sources, long or short form content, and low or high volumes. Illustrated below are some typical scenarios, from a simple VOD service, to a complex multi-region combined VOD and live-to-VOD workflow. By applying a software-defined video solution, service providers can easily migrate from one type of scenario to another. Adding a live-to-VOD service on top of an existing VOD service does not require a radical change in workflow or the addition of a parallel workflow. Branching out to other markets can be accomplished within an existing file-based workflow through the use of cloud-based video processing and delivery resources. Software-defined video offers an exceptionally efficient deployment model by not only enabling smoother scalability, but also faster scalability as compared to traditional fixed-function hardware environments.

A basic file-based transcoding workflow presents a deployment best suited for video providers with small amounts of content from a limited number of sources. For example, a television channel offering selection of some of its programs as catch-up content or a production house looking to deliver its content to a third-party service provider. This simple workflow design allows content to be created in multiple video formats including for full-screen, web, and mobile devices. A basic file transcoding workflow makes it possible to tailor video outputs to the specified requirements of content distribution networks and multiscreen devices.

In this case, a single video transcoder is used to support file-to-file transcoding of almost any input source to almost any output source. This transcoder can perform audio conversion, caption conversion, packaging and metadata transfer, allowing a provider to offer various audio formats alongside multiple video formats, such as MPEG-2, H.264 and HEVC.

These more basic types of file transcoding workflows typically include a control PC with a web browser installed. The control PC is used to directly drive the web-based user interface of the transcoder and configure hot folders or watch folders to automate file processing. The transcoder pulls data out of storage and then puts completed files back into storage.

The second phase of this workflow provides distribution, with an origin server retrieving data out of storage and delivering it to end users. Server will transcode a source file into a single mezzanine ABR set (for example, HLS or MP4 or Arumai-Vision™) with multiple profiles and store it.

Depending on which type of viewing device is requesting the content, server is able to retrieve the mezzanine ABR set, and repackage it into the appropriate ABR format such as Flash HDS for RTMP, Microsoft Smooth Streaming (MSS) for an Xbox, MPEG-DASH for a connected TV, HLS for an iOS device, or Arumai-Vision™ for any of the foregoing. Therefore, almost any type of output the customer is targeting can be transcoded and packaged for distribution to any device/player while reducing storage costs. This is typical for those delivering content to a third-party service provider that will either re-encode the content or distribute it directly to consumers.

Video providers with small amounts of content from multiple sources seeking workflow management would typically deploy a slightly more complicated file-based workflow. This type

of workflow solves a few common problems for these types of scenarios. First, it allows content to be ingested in one format and then delivered in another. Secondly, it introduces a content management system that makes decisions based on the source content metadata or the target delivery profiles.

This next step up involves adding a decision management tool, be it a content management system (CMS) or a workflow management system (WFM), into the workflow. The transformation requirement remains relatively simple with a small amount of content, so there is generally only one transcoding system involved. The chief function of the workflow management system in this type of deployment is to manage multiple video profiles per content in order to ensure delivery to multiple types of viewing devices or to automatically apply different output profiles based on input content. A workflow management system can wrap content with metadata and package it for a target playback device.

The workflow management system and the transcoding system can be integrated through a REST interface. This type of integration differs from a basic workflow in that the web-based UI is not the primary communication path between the transcoder and workflow management system. Instead, REST-based commands communicate between the workflow management tool and the transcoder as to where content is stored and to what formats the incoming content needs to be converted. REST commands are able to instantly change these instructions based on both the current incoming requirements and outgoing requirements. Delivery to end users is supported the same way as in a basic workflow, if required. In this way, we can see how a basic single-source workflow relying on a web UI can easily migrate to a more advanced multi-source workflow through a REST interfaces.

The next level of file transcoding workflows depicts a typical deployment best suited for video providers looking to add multiple file transcoders to process large amounts of content, often from multiple sources. This type of workflow allows for daily conversion of large amounts of content, typically 500+ hours per month. It also provides content management for handling multiple video profiles per incoming content in order to ensure delivery to multiple types of viewing devices or to automatically apply different output profiles based on the input content.

Scaling up from smaller volumes is facilitated by the fact that video providers are able to retain the same management controls and REST commands as before while increasing throughput. To help ease the transition from a workflow depending on a single transcoder to one with multiple transcoders, a unified management solution is added to manage additional transcoders as they are added to the cluster. The workflow manager communicates with the unified management tool using the same commands as in the simpler, single transcoder scenario. The REST interface for the unified management system is almost identical, apart from a few lines of XML. Minimizing workflow disruption and system downtime, this illustrates the smooth migration path that a well-designed video solution based on a flexible software architecture can offer.

The unified management tool also enables a few more capabilities to facilitate system-wide management, such as the ability to set up network interfaces, storage and delivery interfaces across all Arumai resources at once. By installing software upgrades onto the unified management system, system operators can also centralize the process of upgrading transcoder nodes.

Introducing cloud transcoding resources into a workflow enables video providers to accommodate large amounts of content, often from multiple sources, and with huge spikes in demand. This type of converged workflow, employing both ground and cloud resources requires a lower up-front investment, since providers only pay for the extra capacity when needed. A cloud workflow retains the same management controls as an on-premise system while increasing processing throughput. This allows for rapid scalability as providers can rely on on-premise equipment for services with a predictable and constant level of demand and on cloud-based transcoder instances for content with sudden spikes in demand.

A workflow manager tool tied to a unified video management system can enable a highly scalable and fully redundant workflow by adding the ability to instantly provision cloud resources. This allows providers to leverage existing investment in infrastructure and employ unified management to push some content into the cloud or use cloud resources in cases where content is delivered to a provider solely through the cloud. Within a software-defined video environment, the workflow management tool can communicate with a single conductor to manage the spinning up of cloud-based transcoders and determine where best to process content based on user-defined rules.

A highly advanced file transcoding workflow is best suited for content providers with international operations, strong content delivery SLAs or high availability requirements. As with the previous example, this workflow provides highly scalable conversion of large amounts of daily content with significant spikes in demand. However, the key difference is the addition of full redundancy across multiple regions, geographical locations or head-ends.

Placing replicate parts or the entire ground-based workflow into the cloud can ensure full redundancy even under extreme circumstances. Arumai intends to support ground plus cloud redundancy through cloud-based versions of all its products. Duplicate conductors can be set up in a high-availability mode so that if one loses power, the other can immediately take over. File-based transcoder redundancy is configured by default so that if one system loses power, the job is marked as stale and the next available transcoder picks it up. A workflow including cloud resources can take things one step further by adding a second cloud region for high availability between two platforms. This type of configuration gives the customer the ability to not only have redundancy on the ground, but also in the cloud.

Ground plus cloud workflows can also improve efficiency across regions. If a workflow manager is receiving content from multiple locations, it can determine where the closest location is and use those local instances. For example, if certain content is being uploaded into region 1 and different content is being uploaded into region 2, the workflow manager tool can specify that for the content uploaded into region 1, storage should be processed within that region exclusively. However, if

on-premise systems are not busy during that time or that day, the content could instead be pulled down and processed on the ground.

File-based workflows can not only be easily scaled up, but also scaled down. Providers can choose how many instances to run at any one time and scale them down depending on the amount of work that is requested. When no cloud resources are needed, conductor can shut all instances down so that there is nothing running in the cloud until needed.

SOLUTION

Software-Defined Video for Scalable Filed-Based Workflows

All of the above file-based workflow examples are built upon software-defined video solutions with a web UI and REST API. By running software-based transcoders and origin servers on premise as well as within cloud environments, video providers are able to evolve and grow file-based content delivery systems without completely reinventing their workflow.

A file-based workflow content transcoding and Arumai-TranStream™ for multiscreen packaging and delivery can be controlled directly through the UI or API. A workflow management system can also be used to control the workflow via the API – the fact that the API is common across all Arumai products simplifies WFM integration.

The Arumai API also enables a file-based workflow to be fully scalable. With a workflow management system integrated via the API, a workflow scales up in order to handle multiple Arumai-TranStream ™ instances and Arumai origin servers. Once a user interface is set up and configured for a specific Arumai component, it can then be exported as an XML file so that the workflow management system can apply the same settings to other instances of the software.

The Web UI and REST API both offer access to the same commands and levels of control. Configuration of resources is handled through either interface, as the two are essentially one and the same. Some system operators may prefer to use the UI, while others may decide to access the API directly or using a third party application to send REST commands. All of these options are there to enable rapid deployment of new resources, on the ground or in the cloud and to make it possible for providers to efficiently scale up their systems.

CONCLUSION

Whether it’s broadcasters, content owners or pay TV operators, media providers are looking to harness the capabilities of software-defined video solutions to expand their platforms and create a unified infrastructure that is more flexible, scalable and future proof in its support of both traditional broadcast and multiscreen linear video delivery. A key component of creating a highly scalable file-based workflow is offering common REST APIs and web GUIs across all the transcoding and origin servers, both on the ground and in the cloud. Arumai-TranStream™ software-defined video solutions have been designed with this in mind in order to make it quick and easy for video providers to scale their file-based workflows in line with business growth.

ARUMAI TECHNOLOGIES, INC.

Arumai is the only leading, independent, pure play OTT products and solutions company in the industry today. Arumai's grounding breaking 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's Cloud Based Transcoding and Streaming System for Media Companies (Arumai-TranStream™) 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, and later through a constellation of multiple private CDN nodes in real time based on real conditions – OTT products and solutions.