

Cisco Videoscape and NetApp Clustered Data ONTAP: Unified Storage Meets Cloud-Based Video Delivery

Introduction

Today's service providers face a new TV delivery challenge - individualized TV delivered anywhere, to any device, at any time. Cisco Videoscape and NetApp Unified Storage combine to solve this problem for service providers and deliver world-class video delivery service to end users.

The individualized TV experience is growing, and so is the variety of end devices enabled to receive video content, ranging from traditional set-top box (STB) delivered-TV to PCs, tablets, and smartphones. Each new device places increasing demands on video ingest and preparation work steps as new video-screen profiles and delivery mechanisms are introduced. Video content must be re-encoded for each new screen size, and it must also be re-encapsulated for each delivery method (Apple, Flash, MS smooth, and MPEG-TS). All of this content must also be stored in preparation for delivery, resulting in an ever-increasing storage load.

The individualized TV experience also affects video content in terms of catalog size and time shifting. Video catalog assets continue to grow with a mixture of long- and short-tail content requiring appropriate levels of ingest. Larger catalogs require greater ingest capacity to remain current. Time-shift video services, which allow you to "record" a live broadcast for later consumption, also contribute to increasing ingest load.

The net result of all of these video service enhancements - more devices, more delivery, more content, and time shifting - is dramatically increased video workflow demands that must be met with an expanded video processing infrastructure, including data center compute, network capacity, and core storage.

What Is the Solution?

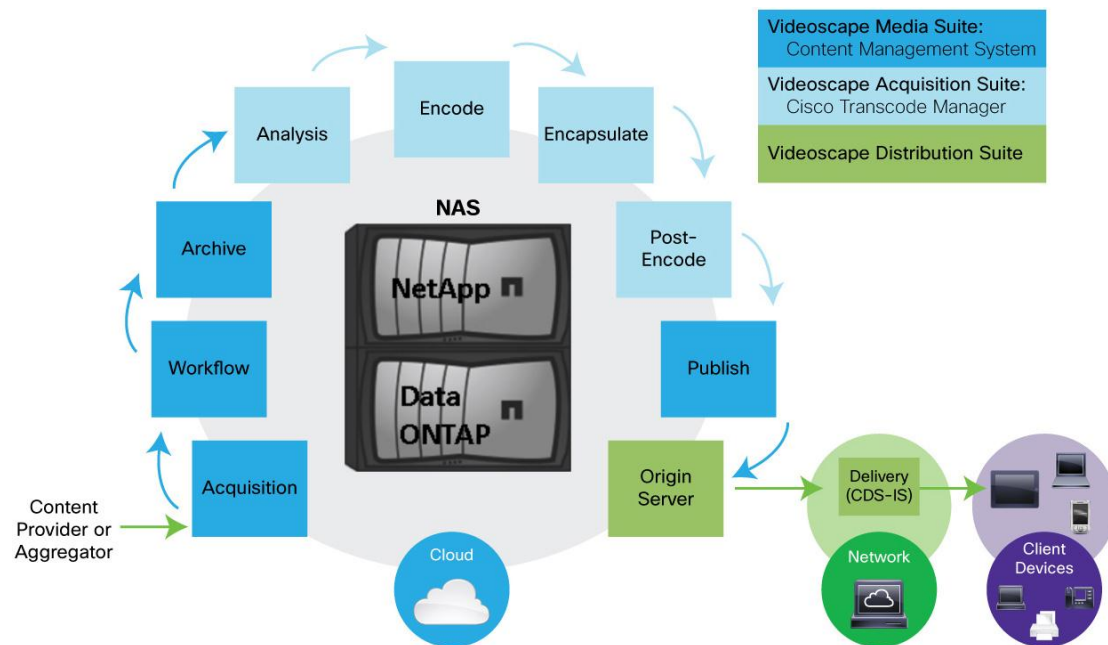
The Cisco Videoscape System along with the Cisco Unified Computing System™ (Cisco UCS®) Compute Platform and NetApp Unified Storage directly addresses these scale-out challenges with industry-leading data center-aligned solutions that can efficiently scale to meet the challenges of a growing video marketplace.

Cisco Videoscape System

The Cisco Videoscape System provides a systematic, solutions-based approach to video delivery in the 21st century, where expanding individualized TV experiences, service velocity, and the drive for operating expenses (OpEx) containment are of paramount interest. The System is designed to allow service providers to migrate to next-generation TV services in a phased, incremental approach that builds on existing infrastructure every step of the way.

The Cisco Videoscape solution helps service providers minimize risk and investment by providing a pre-integrated, end-to-end TV-everywhere solution that integrates best-in-class components from the deep portfolio of Cisco video products. A cloud-based network-attached storage (NAS) architecture unifies all of the video elements and provides the foundational "glue" for the solution by interconnecting all of the workflows, as can be seen in Figure 1.

Figure 1: Cisco Videoscape Cloud-Based Workflow: Supports Video Transformation Scale-Out Demanded by Rapidly Expanding “TV Everywhere” Services



Although several alternative solutions for “TV Everywhere” service delivery incorporate some cloud-based storage (for example, cloud-based recording of content), they do not fully capitalize on cloud capabilities to scale and optimize the full video workflow, from ingest, transcoding, and encapsulation to recording, management, and multiscreen delivery. Cisco Videoscape forms a cloud-centric linear workflow consisting of best-in-class components from Cisco Videoscape Media Suite, Cisco Videoscape Acquisition Suite, and Cisco Videoscape Distribution Suite, all connected through unified storage from NetApp. The Cisco Media Suite Content Management System and Publisher direct video ingest and final publication, the Cisco Transcode Manager performs all video transformations, and Cisco Origin Server and Cisco Content Delivery Network (CDN) provide delivery.

The Cisco Videoscape solution provides the ideal platform for delivering a more personalized and differentiated TV Everywhere experience, and delivers the following advantages:

- Provides a platform built for cloud services: With an open and extensible software-centric approach Cisco Videoscape is powered by application programming interfaces (APIs) that allow it to interoperate with existing back-end or third-party systems or software, and unlock unprecedented flexibility and innovation.
- Enables cloud-based content management: Cisco Videoscape for cloud-based TV Everywhere allows service providers to centrally configure content recording, playback, and management with a platform designed for multiscreen services. As a result, service providers can:
 - Unify content management for live, video-on-demand (VoD), and time-shifted services
 - Enable common search, recommendation, and discovery of content across multiple services and screens
 - Implement flexible policy controls to manage license windows, trick plays (for example, pause, rewind, and fast forward), and blackouts
 - Employ a single, universal cloud-based entitlement system to allow consumers to transparently access entitled content across all services and screens

- Extends content distribution networks (CDNs) to scale cloud-based delivery: Today's service providers typically use separate distribution networks for each type of service (for example, using entirely separate CDNs for VoD and online video services). Cisco Videoscape bridges the gap between separate CDNs and allows service providers to:
 - Scale content ingest and storage for real-time recording of live content
 - Simplify and consolidate adaptive bitrate origin and management, and support for on-demand content encapsulation (transformation and packaging for multiscreen delivery)
 - Support multiscreen and multiprotocol content streaming to multiple devices, over multiple networks
- Allows flexible management of operator-initiated scheduling and recording: Cisco Videoscape provides unprecedented policy-based control, allowing service providers to specify granular business rules associated with service policies, licensing windows, entitlements, billing tiers, and devices. The rules let operators easily scale scheduling and recording of TV content, and optimize resource allocation for TV recording and sessions.

NetApp Clustered Data ONTAP: Agile Data Infrastructure

To deliver new television anytime, anywhere services, you want a storage solution that eliminates planned downtime, scales non-disruptively as your television services grow, and quickly adapts to changing business environments - all while being easy to manage and allowing you to stay ahead of your competition.

NetApp Data ONTAP is the world's number 1 operating system for storage. Its unified architecture supports all major protocols and scales from a few terabytes to tens of petabytes. It has been developed and battle-tested in shared IT and media processing and distribution workflows for 20 years.

Clustered Data ONTAP adds to this industry-leading unified storage platform massive scalability, improved management for large-scale deployments, and, most importantly, non-disruptive operations. Non-disruptive operations mean that you can essentially eliminate planned downtime, even during servicing and upgrades. This agile data infrastructure for large-scale transcoding and distribution workflows provides specific benefits to the operation. By simply adding disk shelves supporting serial-attached SCSI (SAS), Serial Advanced Technology Attachment (SATA), or high-performance solid-state disk (SSD) drives, you can scale vertically to address growing capacity requirements.

Clustered Data ONTAP extends the storage domain across a cluster of controllers. Your storage is virtualized across as many as 24 controllers, managed as a single logical pool of resources and name space; for instance, separated into independent pools of storage to provide firewall protection between the ingest server and the origin server. Virtualizing your storage across multiple pairs of controllers provides nearly limitless scalability for even the most performance- and capacity-intensive television distribution operations, regardless of network protocol, storage area network (SAN), or NAS. Clustered Data ONTAP offers the first massively scalable unified storage platform with support for Fibre Channel (FC), Fibre Channel over Ethernet (FCoE), Small Computer System Interface over IP (iSCSI), NFS with Parallel NFS (pNFS), Network File System (NFS), and Common Internet File System (CIFS).

Because NetApp FAS running clustered Data ONTAP is flexible, you need fewer storage systems, and you get more from each system deployed. Ultimately, this storage and management approach delivers a reduction in storage management overhead in addition to reducing data center floor space, power, and cooling.

A Unified Solution: NetApp and Cisco Videoscape

Both the "ingest" server and storage and the "origin" servers and storage are integral parts of the delivery chain for adaptive bitrate streaming video. The ingest server and storage must support the ingestion of dozens of live encoded VoD and adaptive bitrate files for dozens of television channels. They also support the file-ingest and transcode operations of contributed material. Generally the portion of the storage systems supporting these ingest operations must be configured for many random write events.

The origin-server portion of the storage is the source of content for the CDN or the end devices on the downstream. If the origin-server volumes are separated from the ingest server volumes for protection and data security, then all files created by the encoders and transcoders in the ingest stage must be copied over to the origin-server volume for distribution to the CDN.

VoD service implementations or live streaming with archiving uses a multitier storage with a first tier based on a fast SSD or memory-based cache and the second tier based on multiple spindle disks in a clustered Data ONTAP file system.

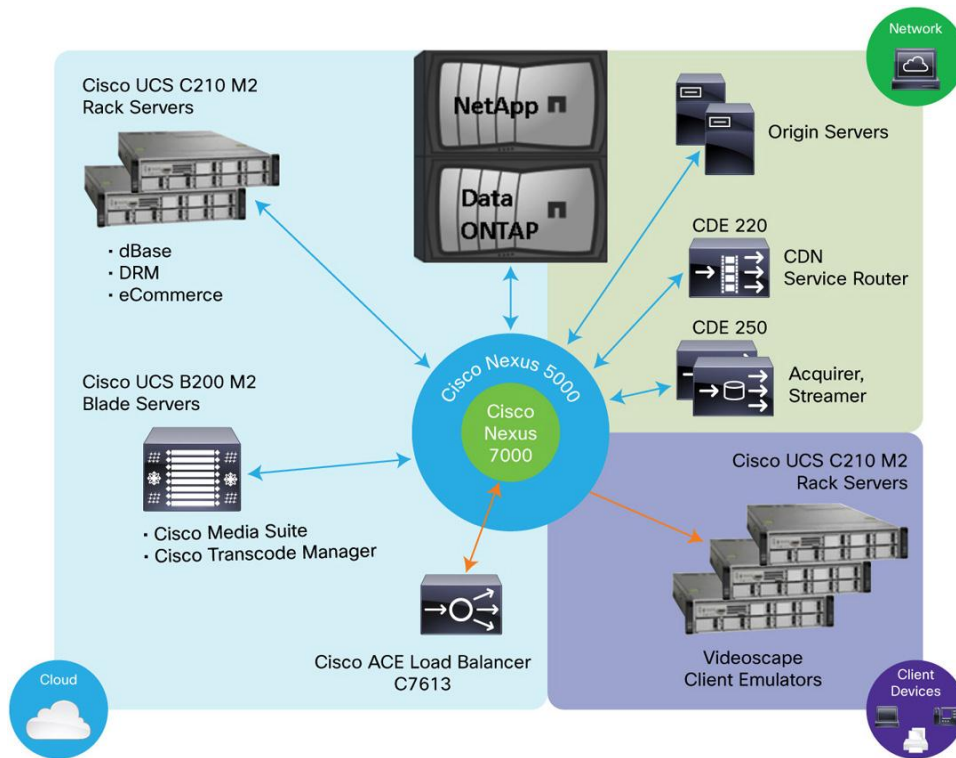
Integrated Systems Testing: Cisco Videoscape System and NetApp Clustered Data ONTAP

To validate the interoperability and performance of the integrated Cisco Videoscape with NetApp NAS solution, Cisco and NetApp performed tests designed to measure the performance of the NetApp NAS storage operating as VoD acquisition, preparation, encoding and encapsulation, and publishing for the Cisco Videoscape System. The VoD Ingest and Storage test was scaled to match the needs of a modest service provider requiring an ingest rate of 100 video assets per 24-hour period. A separate play-out test was also performed to validate interoperability; however, a 20 percent of scale model was selected with 1600 streams delivered simultaneously from the origin.

Test Infrastructure and Configuration

The workflow depicted in Figure 2 was implemented on Cisco UCS B200 M2 Blade Servers and Cisco C210 M2 Rack Servers and interconnected through a Cisco Nexus[®] 5000 or Nexus 7000 Switch hierarchy. Cisco Videoscape Media Suite and Cisco Videoscape Acquisition Suite (VAS) components were supported on the B200 blade servers, with Cisco Videoscape Media Suite operating as 14 virtualized machines across 8 server blades and Cisco Transport Manager components operating bare-metal across 15 server blades. Other support functions (dBase, eCommerce, etc.) were operated directly on Cisco UCS C210 Rack Servers and do not share the NAS storage. All play-out testing was driven by the Videoscape Client Emulators, also operating on Cisco UCS C210 Rack Servers. Core NAS storage was provided by the NetApp agile data infrastructure.

Figure 2: Cisco Videoscape with NetApp System Testing Infrastructure (Key Videoscape Component Families Color Coded)



NetApp NAS Test Configuration

- The Videoscape 4.5 test was performed with NetApp's popular midrange platform, the FAS3200 series.
- A four-node cluster of FAS3270s was implemented.
- Ten Gigabit Ethernet links were used to interconnect all nodes to the switching infrastructure.

Videoscape Storage and Performance Testing Model

Cisco developed the storage I/O calibration workload as a realistic benchmark to exemplify acquisition, preparation, and origin-storage applications for a modest VoD deployment. The model assumes a set of VoD parameters that may be scaled based on the workload specifics of a given service provider environment. The test scenario assumed the following VoD system capacity parameters:

Acquisition and Preparation

- Catalog size: 5000 assets
- Catalog refresh rate: 2 percent per day
- VoD ingest test rate: 100 assets and 218 content hours per day

Origin and Play-Out

- 1,600 streams simultaneously streaming in an all-cache miss scenario, representing the streaming load of the origin server when supporting 10,000 simultaneously active streaming clients at normal cache hit rates

Adaptive Bitrate Formats

- Aggregate number of output HTTP Smooth Streaming (HSS) profiles: 8
- Aggregate number of output HTTP-Like Streaming (HLS) profiles: 8
- Total unique profiles produced per day: 1,600
- Throughput range of output profiles: 0.4-4.5 Mbps

Performance Testing Results

The evaluation of NetApp storage and the series of performance tests were designed to demonstrate that the NetApp FAS3200 series can perform and scale to meet the storage requirements of the Videoscape VoD infrastructure. The NetApp FAS3200 series with clustered Data ONTAP successfully proved in all accounts to be capable of delivering strong performance characteristics.

The storage platform is also proven to scale performance and capacity to handle the typical workloads generated by Videoscape VoD configurations. NetApp's easy-to-maintain unified storage architecture can be configured with multiple drive types, (SAS, SATA, and SSD) in conjunction with virtual storage tiering technology to address specific performance and capacity demands.

The thorough testing of the NetApp FAS3200 series with clustered Data ONTAP and the Cisco Videoscape VoD collaboratively designed solution assures interoperability between components, thus minimizing deployment risk and accelerating time to market. This validated solution reduces the complexity of architecting and implementing NetApp technologies with Cisco. Based on the successful performance of the NetApp platform, Cisco will test future releases of the Videoscape suite on higher-end NetApp platforms.

Conclusions

Although this Videoscape Systems Test with unified storage is relatively focused in scope, it provides foundational validation to Videoscape and NetApp Clustered Data ONTAP interoperability, the use of unified NAS storage for the Cisco Videoscape workflow "glue", and the scaling predictability represented in the Videoscape storage model along with the scaling ability of the NetApp FAS3200 storage system. Although tested workloads were modest and scaled down, the validated Videoscape storage and performance model strongly suggests linear growth of storage workloads that should be satisfied by directly scaling the NetApp system, offering a predictable growth path and maintaining a single point of storage control and management.

NetApp creates innovative products - storage systems and software that help customers around the world store, manage, protect, and retain one of their most precious corporate assets: their data. NetApp is recognized throughout the industry for continually pushing the limits of today's technology so that its customers never have to choose between saving money and acquiring the capabilities they need to be successful.

As next-generation video-delivery service demands and workloads grow, Cisco Videoscape driven by Cisco UCS compute and Cisco Nexus Switch-based networking, and continuous innovations from NetApp - including enterprise FAS storage platforms, and clustered Data ONTAP - will easily and predictably scale to help ensure service provider success.



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