



EMC Isilon Scale-out NAS for Cisco Videoscape: Unified Storage for “Video Everywhere”

Executive Summary

Cisco Videoscape combines a vast array of content and applications from any source into an immersive, personalized experience powered by IP technologies. It lets service providers combine live and on-demand video, online content and applications, social media, and video communications into a unified experience, and extend that experience to any screen or device.

EMC® Isilon® Scale-out network-attached storage (NAS) is designed for simplicity, value, and best-in-class performance. Isilon Scale-out NAS can scale up to support more than 20 petabytes of storage capacity, more than 100 GBps of throughput, and more than 1.6 million file operations per second in a single file system.

Ideally suited to the demands of data-intensive, high-performance computing environments, Isilon Scale-out storage delivers the requisite performance and scalability needed in Cisco Videoscape environments, all while simplifying data management, providing robust data protection, and lowering operating costs.

You can easily combine Cisco Videoscape and EMC Isilon storage to support numerous critical media processing and delivery functions that require substantial data throughput and storage capacity while supporting varying workload characteristics, including acquisition and preparation storage, origin storage, and archival storage.

To validate the interoperability and performance of the integrated Cisco Videoscape and EMC Isilon solution, Cisco and EMC performed tests designed to measure the performance of Isilon NAS for video-on-demand (VoD) acquisition and preparation and origin storage for Cisco Videoscape deployments.

Based on the testing described in this overview, Cisco concluded that an EMC Isilon Scale-out NAS solution met the storage I/O requirements of a typical Cisco Videoscape Video Everywhere deployment, and validated the underlying NAS storage architecture for unifying Videoscape™ components into a scalable video-delivery solution.

Introduction

Fueled by the proliferation of Internet-based content and the popularity of smartphones and large-screen tablets, consumers now expect “Video Everywhere” services on devices of all types. Large-screen high-definition televisions (HDTVs) are no longer the sole viewing platform for premium subscription and TV programming, as over-the-top (OTT) services, such as Netflix and Hulu, and service provider-based Video Everywhere offerings are competing for the consumer’s time and discretionary spending.

These trends - more devices and more online video services - are changing the media-delivery landscape as we know it. Service providers face new and pressing challenges such as how to differentiate their offerings by delivering more personal, social, and interactive media experiences, making media delivery simpler and more intuitive in a video-delivery model that is fragmented across devices, screens, and interfaces, and preserving the value of their content while delivering to new screens and platforms.

Supporting this multiscreen environment creates new challenges for media and entertainment organizations’ infrastructures. Providers must now transcode movies, television shows, and other videos that would previously have been distributed on disc into multiple formats suitable for multi-device viewing.

When supporting a multiscreen environment, media companies must be prepared to store a rapidly growing volume of data and an increasing number of large video files. Typically, these files must remain available online for lengthy periods of time in order to satisfy customers’ desires for on-demand access.

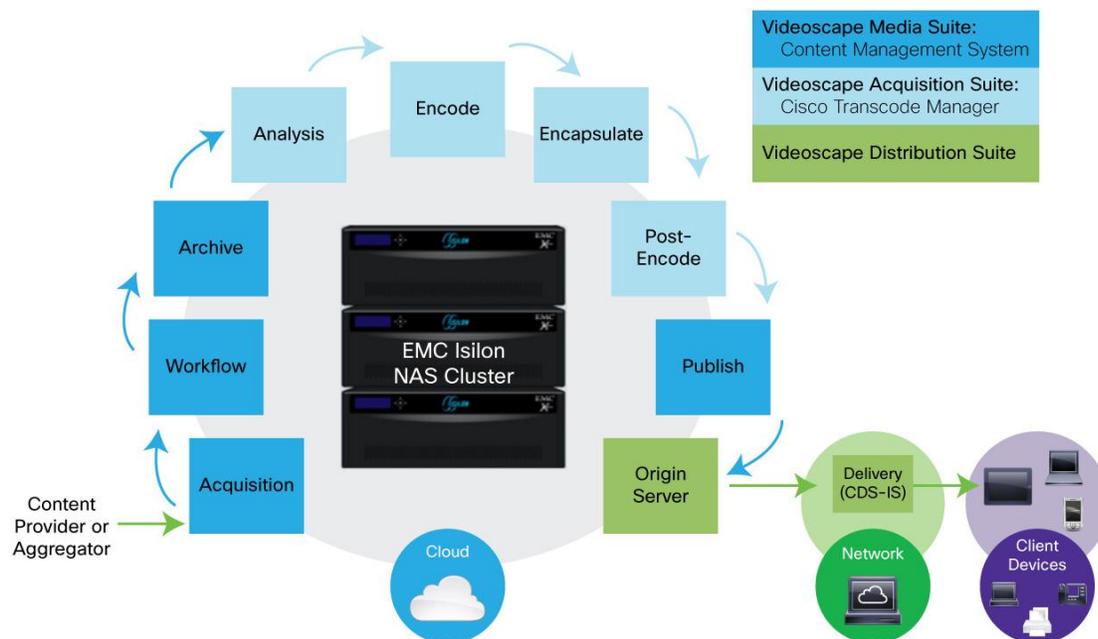
The Cisco Videoscape provides a cloud-based infrastructure to scale the ingest, preparation, recording, management, and delivery of any type of content, over any network, to any device. With this flexibility, service providers can support linear and VoD content delivered to managed devices, as well as to unmanaged consumer devices (tablets, smartphones, and game consoles), whether delivered on-net or off-net - all from a single infrastructure.

EMC Isilon Scale-out NAS is a compelling storage platform for Cisco Videoscape environments. Isilon solutions are already used in some of the most demanding and leading-edge organizations in the media and entertainment industry. Every Isilon solution can transparently scale in real time, enabling Cisco Videoscape environments to add hundreds of terabytes of storage or expand performance within minutes.

Cisco Videoscape Overview

The Cisco Videoscape combines a vast array of content and applications from any source into an immersive, personalized experience powered by IP technologies. It allows service providers to combine live and on-demand video, online content and applications, social media, and video communications into a unified experience, and extend that experience to any screen or device. The solution draws on Cisco IP intelligence in the cloud, network, and clients to provide a premium quality of experience that best-effort online video services cannot match.

Figure 1: Cisco Videoscape Media Suite: Allows Cloud-Based Configuration of Content Recording, Playback, and Management for Video Everywhere Services



Although several alternative solutions for Video Everywhere service delivery incorporate some cloud-based capabilities (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. The Cisco Videoscape forms a cloud-centric linear workflow consisting of best-in-class components from Cisco Videoscape Media Suite, Acquisition Suite, and Distribution Suite, all connected with EMC Isilon scale-out NAS. The Cisco Media Suite Content Management System and Publisher drive 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.



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

- Provides a platform built for cloud services: With an open and extensible software-centric approach, the Cisco Videoscape System 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 Video 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, 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 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: The Cisco Videoscape solution 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.

EMC Isilon Scale-out Storage for Cisco Videoscape

EMC Isilon Scale-out NAS has long set the standard for addressing the challenges of managing large, rapidly growing file-based and unstructured data. EMC Isilon is an ideal storage platform for Video Everywhere environments that require a storage infrastructure that is highly scalable in capacity and performance.

EMC Isilon Scale-out storage provides unimaginable room for VoD storage needs—from 18 terabytes to more than 20 petabytes of capacity per cluster in a single file system and volume. EMC Isilon is a powerful yet simple scale-out NAS solution for organizations that want to invest in managing their data, not their storage. EMC Isilon storage systems are simple to install, manage, and scale at virtually any size. Every EMC Isilon solution can transparently scale in real time, enabling you to add hundreds of terabytes of storage or expand capacity and performance within minutes. And, unlike traditional NAS storage, EMC Isilon solutions stay simple no matter how much storage is added.

To support demanding, large-scale content workloads for Video Everywhere, the EMC Isilon OneFS® operating system delivers more than 100 gigabytes per second of system throughput. EMC Isilon is the world's fastest NAS platform, with the world-record performance of 1.6 million SPECsfs2008 CIFS operations per second ("All SPEC SPECsfs2008_cifs Results Published by SPEC", October 3, 2012).

To help organizations minimize costs, EMC Isilon delivers more than 80 percent utilization with a single pool of shared storage. Its industry-leading storage efficiency, combined with a simple, easy-to-manage approach, can help you reduce capital expenditures (CapEx) as well as ongoing operating costs. You can further optimize resources with EMC Isilon SmartPools™ software to provide automated storage tiering that continually optimizes your EMC Isilon storage environment for performance and economy. You can easily set policies to automatically move inactive content to more cost-effective storage, streamlining workflows for your most current data while remaining completely transparent to users and applications.

Additionally, Cisco Videoscape environments can mix and match various EMC Isilon hardware elements, depending on specific needs. For example, EMC Isilon S-Series nodes deliver the performance needed for IOPS-intensive applications; Isilon X-Series nodes are ideal for high-concurrent and sequential throughput workflows; and Isilon NL-Series nodes provide economical storage, enabling organizations to keep data online and available for longer periods. At the same time, EMC Isilon modular architecture and intelligent software make deployment and management simple.

To safeguard VoD content data and deliver the high availability required, EMC Isilon is highly resilient and provides robust data protection including data backup and provisions for disaster recovery. EMC Isilon SyncIQ® software allows local and remote data replication, and provides push-button failover and failback simplicity, thereby helping you increase the availability of your content.

Cisco Videoscape and EMC Isilon Scale-out NAS: Validating Performance and Scalability for VoD

The Cisco Videoscape solution uses EMC Isilon storage for numerous critical media-processing and delivery functions that require throughput, latency, and capability scalability with varying workload characteristics.

Acquisition and preparation storage provides the underlying storage support for encoding, grooming, encryption, and staging for content ingest as well as concurrent access. The workload is primarily read-intensive, making it highly complementary to the combination of EMC Isilon's intelligent caching and storage efficiency technologies, which provide a unique approach to automated storage tiering. EMC Isilon Scale-out NAS promotes hot data to performance storage in real time without moving the data, allowing scaling performance and capacity while achieving the industry's highest level of storage efficiency.

Origin storage is the authoritative content repository that is massively scalable to provide concurrent access to a range of devices. Its use cases include transient and semi-permanent storage for VoD content. EMC Isilon NAS scalability in performance and capacity complements its use as Videoscape Origin Storage. You can configure the EMC Isilon NAS to deliver consistent on-demand content retrieval regardless of popularity as required by origin storage serving a downstream CDN, while also scaling throughput and capacity independently as the workflow evolves.

Archival storage provides long-term storage of content master or "gold copy" as well as content retrieval in the face of catastrophic failures and new content reencoding requirements. To deal with the large and growing data archival volumes that must be maintained over long periods, the EMC Isilon storage solution provides simplified data management, in particular a combination of a robust file system and data migration, data availability, and data protection technologies. EMC Isilon Scale-out storage systems provide the necessary scalability while helping rein in operating costs. Isilon Scale-out NAS is highly efficient and provides more than 80 percent storage utilization thereby reducing CapEx as well as lowering operating expenses (OpEx). These benefits result from a smaller data center footprint, ease of management, and lower power consumption, meaning that fewer devices are needed, thus further lowering management requirements.

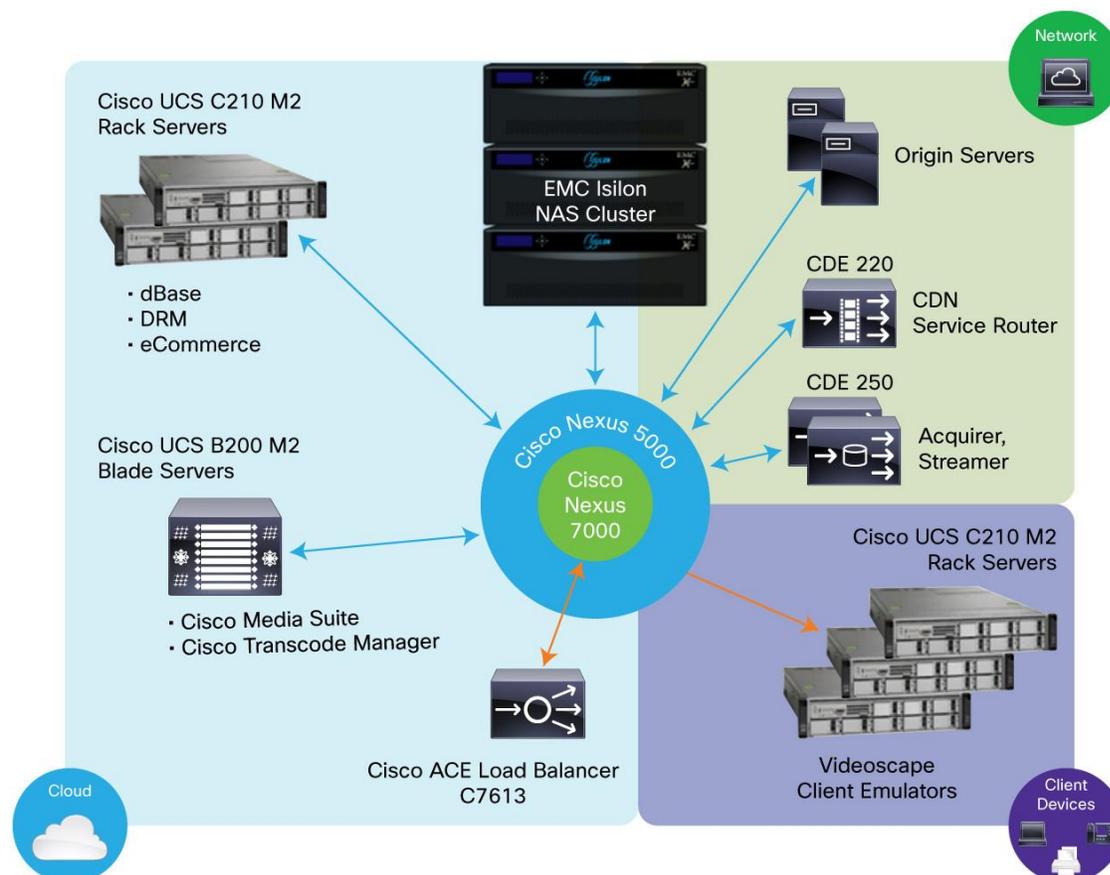
Interoperability and Performance Testing

To validate the interoperability and performance of the integrated Cisco Videoscape with EMC Isilon Scale-out NAS solution, Cisco and EMC performed tests designed to measure the performance of EMC Isilon NAS as VoD acquisition and preparation and origin storage for the Cisco Videoscape solution. 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 1,600 unique streams delivered simultaneously from the origin server to the CDN, representing 10,000 simultaneous client streams delivered to end users assuming typical CDN cache hit rates.

Test Infrastructure and Configuration

The workflow depicted in Figure 2 was implemented on Cisco Unified Computing System™ (Cisco UCS®) B200 M2 Blade Servers and Cisco UCS C210 M2 Rack Servers and interconnected through a Cisco Nexus® 5000 or Cisco Nexus 7000 Switch hierarchy, as shown in Figure 2. Cisco Videoscape Media Suite and Cisco Videoscape Acquisition Suite components were supported on the B200 blade servers, with 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 (database, 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 Cisco Videoscape Client Emulators, also operating on Cisco UCS C210 Rack Servers. Core NAS storage was provided by the EMC Isilon S200 storage solution.

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



EMC Isilon NAS Test Configuration

A three-node EMC Isilon S200 Scale-out NAS platform provided shared storage for the Cisco Videoscape test deployment. Each S200 node had the following hardware and software configuration:

- 13.2-TB hard disk drive (HDD), 48-GB RAM, and 400-GB solid-state drive (SSD)
- Two 10 Gigabit Ethernet and two Gigabit Ethernet network connections
- EMC Isilon OneFS v6.5 Operating System software

Performance Testing Model

Cisco developed the storage I/O calibration workload as a realistic benchmark to exemplify acquisition and 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 unique streams simultaneously delivered from origin to the CDN
- 10,000 simultaneous streams delivered to end-user clients

Adaptive Bit Rate 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

Performance testing validated that the EMC Isilon S200, three node cluster configuration delivered satisfactory performance and capacity for the Cisco Videoscape VoD configuration under test, and there were no interoperability problems supporting each of the Cisco Videoscape components in the workflow. The EMC Isilon storage system easily supported the offered ingest load, with headroom remaining from network throughput and CPU capacity standpoints. From a storage perspective, the selected capacity was adequate for the offered daily throughput, but would require expansion to support 5000 assets.



Conclusion

Although this system and unified storage test effort is relatively focused in scope, it does serve to validate the foundational tenants that place EMC Isilon Scale-out storage as the workflow glue that unifies the family of Cisco Videoscape components. It also validates the interoperability of Videoscape and EMC Isilon technology and the accuracy of the Cisco Videoscape Storage Model in computing system-level storage and bandwidth requirements.

Although tested workloads were modest and scaled down, the validated Videoscape storage model strongly suggests linear growth of storage workloads, which should be satisfied by directly scaling the EMC Isilon system, offering scaling predictability and maintaining a single point of storage control and management. As business needs grow and Videoscape workloads scale up, Cisco UCS-based compute and Cisco Nexus Switch-based network infrastructures, along with EMC Isilon Scale-out Storage can be easily and predictably extended to ensure business productivity.

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