Medianet:
An Optimal Foundation for Digital Media Production

INSIDE

File-based media production is poised to transform the industry. Find out how medianet technologies – including a Media Data Center platform designed specifically for media workflows – can help broadcasters innovate, collaborate, and deliver a new generation of media experiences.

Setting the Stage for Medianets

It's an exciting time to be in media. Groundbreaking changes in technological innovation and consumer behavior are reshaping the industry, transforming the way broadcasters produce and distribute content. Many factors are driving this transformation, including the rise of high-definition (HD) video (with its huge new bandwidth and capacity demands), proliferating delivery channels, and the emergence of bidirectional and multidirectional video experiences. Today, feeding the consumer's insatiable appetite for media means delivering content to the TV over multiple delivery channels, and increasingly, to PCs and mobile devices over the Internet.

This evolution offers broadcasters opportunities to create innovative new content experiences, streamline media production, and exploit new delivery mechanisms to generate revenue from original and archived content in new ways. But it also introduces extraordinary complexity, with more media formats, resolutions, and delivery channels to account for than ever before.

Broadcasters worldwide already recognize the critical first step in adapting to today's media paradigm: a transition to file-based media. In fact, 69 percent of broadcasters are planning to migrate more than half of their production workflows to fully file-based environments by 2011. However, this transition is a major undertaking. It requires a new approach to media production workflows and video distribution. It requires a medianet.

A New World of Medianet Technologies

A medianet is an all-IP Next-Generation Network (NGN) optimized end-to-end for demanding video and rich media services. It allows broadcasters and service providers to create a single, scalable IP architecture that extends from the point of content ingest through every aspect of editing and production, across video contribution and distribution networks, and all the way to the consumer's screen.

By embracing medianet, broadcasters and media companies can:

- **Transform video production and distribution** by enabling stakeholders throughout the media value chain to collaborate in new ways and create new kinds of media experiences
- **Reduce time-to-air** with a streamlined production workflow that eliminates linear tape-based production processes and allows multiple teams and users – post-production, marketing, legal, online distribution – to access content at the same time
- **Reduce costs** by virtualizing resources, consolidating equipment, and converging IT and production functions over a single IP NGN
- **Provide nonstop operation** through a network infrastructure that has been independently tested and proven to deliver ample performance and scalability for HD media services
- **Monetize media more effectively** with the ability to produce and distribute content for any device or platform, rapidly introduce new services, and efficiently access and control media archives

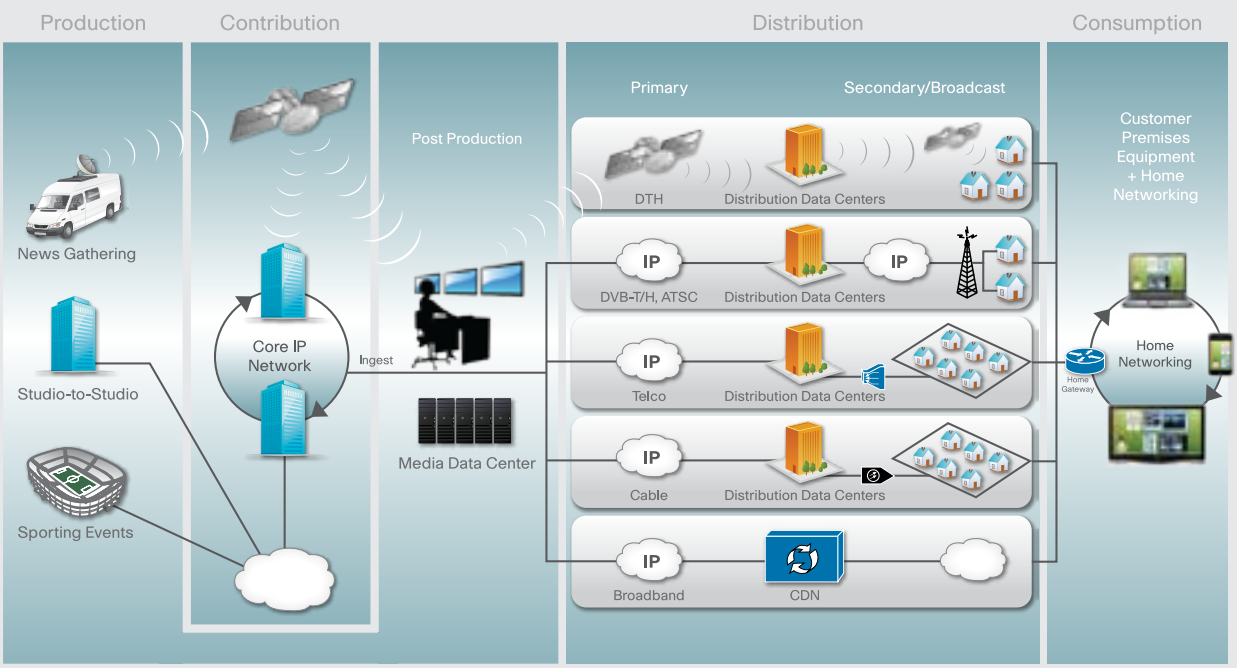
Cisco is leading the way in medianet technologies, and broadcasters worldwide are already using Cisco solutions in demanding HD media environments. Now, Cisco is taking medianet innovation a step farther with the Cisco® Media Data Center (MDC).

A Media Workflow Platform for the Future

The Cisco MDC provides the ideal platform for powering a new generation of file-based media workflows. This advanced, video-optimized data center architecture lets all production entities and business units share a common technology infrastructure and a common file-based storage system. It enables broadcasters to lower capital and operational costs, effectively manage growing complexity and scale, and unleash unprecedented creativity and innovation in media services.

Read on to learn more about how the Cisco MDC provides the ideal medianet foundation for tomorrow's file-based production environments.

Figure 1: Medianet Architecture



A Powerful Platform for Transforming Media Workflows

In media production, creativity has long been bounded by the physical limitations of production workflow processes. Editing and post-production are often shackled to physical editing suites. A reliance on physical tapes means that content must be continually copied and re-ingested at each stage of production, leading to slow, linear workflows – and high costs for storage and archiving. In the analog age, these issues were acceptable inconveniences. In the world of modern media – where broadcasters must serve multiple formats and delivery channels, and where the distance between content creation and content distribution continues to shrink – yesterday's production technologies simply cannot keep pace.

At the root of all of these problems is a production workflow model based on isolated, "siloed" applications – applications hosted on dedicated servers, often supported by dedicated network infrastructures. This model provides the high performance that media production applications require – a level of performance far beyond typical IT applications. But it is also extremely costly, complex, and difficult to scale. To unlock the full potential of file-based media workflows, media companies need a new kind of technology platform to support them.

The Cisco Media Data Center

The Cisco Media Data Center (MDC) is an intelligent, video-optimized network and data center infrastructure that provides the foundation for end-to-end digital media workflows. Instead of running each application in its own silo, it provides a common high-performance, high-capacity architecture for supporting all applications, including both media and IT functions (Figure 2).

At the core of the Cisco MDC is the ability to virtualize resources across the media company – to share computational, storage, and networking resources across different business units and applications, while maintaining the appearance and functionality of physically separate systems. Instead of duplicating equipment and resources for each production and IT function (most of which are rarely used to capacity), the Cisco Media Workflow Platform enables dynamic provisioning of resources wherever and whenever they are needed. The result: improved business efficiency and resource utilization, unbounded collaboration, and lower costs.

With the Cisco MDC, broadcasters can:

Increase collaboration by breaking down the barriers between production teams and business units, and ecosystem partners, letting everyone share a common technology infrastructure and a single file-based storage system.

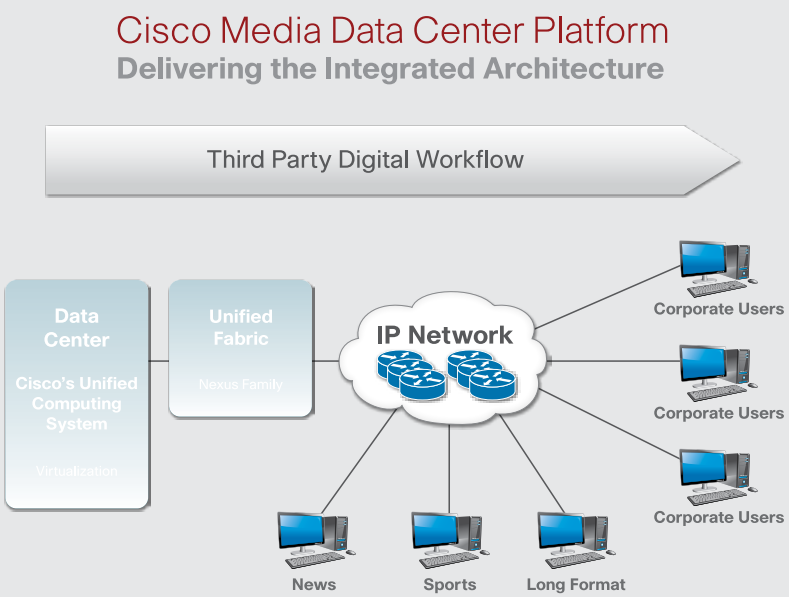
Virtualize content, applications, and resources across the organization, unleashing unprecedented flexibility while lowering equipment costs, power and cooling, and maintenance expenses.

Reduce time to air by streamlining complex production environments, optimizing slow linear workflows, and allowing instant access – from anywhere – to file-based content and archives.

Create a lossless Ethernet-based production environment that has been independently proven to deliver the performance and scalability that HD media applications demand (see the following section).

Accelerate innovation by linking content production systems directly with ecosystem partners, allowing broadcasters to reach new media distribution platforms and customers, and monetize content in new ways.

Figure 2: Integrating Production and IT Functions over a Common IP Infrastructure



Building Blocks of the Cisco MDC

The Cisco MDC is based upon the Cisco Unified Service Delivery architecture and a Cisco IP Next-Generation Network (IP NGN). This standards-based solution fully supports and integrates with a variety of leading third-party digital workflow and production applications, as well as traditional IT and data center functions.

Cisco Unified Service Delivery

The core of Cisco's data center innovation, the Cisco Unified Service Delivery architecture consists of:

Unified Fabric: The Cisco Nexus® Family of switches provides the lossless infrastructure to support all MDC services, including LAN and SAN connections, over Ethernet. This simplifies the data center to a single set of fully virtualized connections, improving resource utilization and lowering costs. The solution also integrates Cisco's MDS Family of storage products.

Cisco Unified Computing System (UCS): Cisco's groundbreaking Unified Computing System provides a fully integrated, pre-engineered solution for the MDC, unifying server, storage, and networking resources into a single system.

Virtualization: Instead of the traditional data center model – in which each application resides on its own server, often utilizing as little as 15 percent of the available hardware resources – the Cisco MDC runs applications on "virtual machines" that share a common pool of hardware. Designed in partnership with VMware, the industry leader in virtualization, the solution simplifies the management of these virtual machines and allows media companies to dramatically improve data center resource utilization and energy efficiency.

Together these solutions provide a powerful foundation for efficiently delivering content and computing resources wherever and whenever they are needed, enabling broadcasters to reap the full benefits of file-based media workflows.

Cisco IP NGN

The second element of the Cisco MDC is the Cisco IP NGN. Here, the entire range of Cisco's industry-leading routing, switching, and video products provides end-to-end delivery of IP services with advanced media-aware features. The IP NGN spans core, edge, and user equipment and provides an intelligent network that is both service- and application-aware – with industry-leading capabilities for assuring scalability and capacity for HD media applications.

Partnering with the Worldwide Leader

For broadcasters and media companies, the future has arrived, and the transition to file-based media workflows has begun in earnest. Cisco is the ideal partner for this industry evolution. Cisco uniquely provides:

A lossless Ethernet data center platform for enabling end-to-end media workflows

Total flexibility, with the ability to support any standards-based hardware and the leading media production applications

High performance, with a proven, independently tested data center infrastructure

Maximum scalability to cost-effectively support evolving HD media production environments

Industry-leading media partners that provide a complete ecosystem of data center, virtualization, and media workflow capabilities

Putting the Cisco Media Data Center to the Test

Cisco designed the Media Data Center (MDC) to provide ample capacity and scalability in lossless media production environments. But how does the architecture perform under the demanding conditions of real-world HD editing applications? Cisco asked VRT-medialab, the research and development arm of Belgian public broadcaster VRT, to find out. The independent laboratory performed a phased test of the MDC to gauge its performance.

Phase 1: Lossless Ethernet

To account for the unique requirements of media environments, any IP-based architecture must feature a storage network that provides robust parallel throughput and high capacity, scalability, redundancy, and availability. Today, many file-based media storage environments use InfiniBand storage network interfaces due to InfiniBand's high link bandwidth. With the introduction of the Cisco MDC, Cisco uses Data Center Bridging (DCB), offered in Cisco Nexus Family switches, which aims to provide lossless transport over Ethernet.

Results of Phase 1:
VRT-medialab tested Cisco Nexus 5000 Series Switches with DCB against InfiniBand in a typical media environment, using both Linux- and Windows-based storage nodes. The results were compelling: In the Linux-based cluster, the Cisco Nexus 5000 Series with DCB delivered comparable performance to InfiniBand. In the Windows cluster the switches delivered as much as five times the throughput of current state-of-the-art InfiniBand solutions.

Phase 2: Accounting for the Unique Behavior of Media Traffic

Some early attempts to transition to file-based environments have been stymied by IP networks that do not behave as expected. Even when networks ostensibly have the capacity to support media services, throughput may decrease and become unpredictable, and transfers may even be lost. The reason for this mysterious behavior is the intrinsic differences between IT and media traffic.

Where IT traffic generally consists of short messages or small files, media traffic consists of bursts of very large files (several GB), which use the link for a long period of time and almost constantly try to use 100 percent of the available bandwidth.

To account for oversubscription and packet loss, any IP-based media storage network must employ egress buffers capable of handling large, bursty media file transfers. The Cisco Nexus Family switches employed in the Cisco MDC were designed specifically to meet this requirement.

Results of Phase 2:
VRT-medialab put this architecture to the test using Avid high-resolution editing clients running multiple streams of HD video over the Cisco Nexus 7000 Series. The results were impressive as traffic passed unhindered through the Cisco Nexus 7000 Series Switch with no oversubscription, no packet loss, and no effect whatsoever on video playout.

Phase 3: MDC as an Integrated Virtual Media Environment

Having completed the first two phases, VRT-medialab is now testing the entire Cisco MDC architecture – including storage, virtualization, and the Cisco Unified Computing System.

The workflow of media production is very complex and requires integration of many different media services. Due to the heavy transport demands of media, most of the services would benefit from a physically close coupling with the clustered storage.

The optimal media workflow architecture should provide an integration of both storage and media services into a storage cluster environment based on a scalable virtual platform such as provided by the DCB-based media WARP cluster, where the Cisco MDC provides a unique solution.

The MDC setup shown in Figure 3 illustrates a complete media workflow consisting of central ingest, rewrapping, transcoding, and editing on the same central MDC storage system. It contains the following features:

- Multiple OS platform, both Windows and Linux, allowing different media services to be integrated and run on the same MDC.
- Complete elimination of almost all data transfers over an external IP network. This allows for lossless, extremely fast, highly efficient and reliable dataflows.
- Virtualization of complete Media Asset Management (MAM) system functionality on a single virtualized MDC computing node. This allows the different media services of the workflow to run side by side on a single computing node and thereby collapse the complete dataflow into the MDC cluster network:
  - Two parallel rewrapping services
  - Five parallel transcoding services
- Optimal utilization of the extensive memory of the UCS-C server node to enable direct internal data transport between the different virtual media services on the same node.
- Editing of the high-resolution material while it resides on the same MDC storage system, completely eliminating the additional time-consuming transfers to local proprietary video storage solutions. Virtualization of these high-resolution gateways allows access for Avid and Apple high-resolution editing clients, connected through different virtual nodes on the same physical MDC computing node.

For more details about the VRT-medialab test, including specific test scenarios and configurations, see the January, February, and March issues of *Broadcast Engineering*.

A New World of Media at the Consumer's Fingertips

The The future of rich media services is here. As new delivery channels and business models proliferate, broadcasters worldwide are building IP NGN-based medianets to bring a new generation of video experiences to consumers. Cisco's Media Data Center stands at the forefront of emerging medianet technologies. But delivering and monetizing new media experiences requires more than a next-generation workflow platform. It requires an end-to-end medianet that is network-aware, media-aware, and device-aware, and extends all the way from the camera to the customer's screen.

Cisco is leading the way in medianet technologies and can offer broadcasters a true end-to-end solution. Working in concert with industry-leading media partners, Cisco provides deep expertise in IP networking, file-based workflow technologies, video transport, and intelligent solutions for the customer home. Cisco can converge all of these solutions into a single, harmonious IP architecture that extends media-aware intelligence through:

Media production with a groundbreaking Media Data Center that eliminates inefficient manual processes and helps media companies reap the benefits of file-based production workflows

Contribution solutions that combine broadcast-grade HD video transport with the flexibility, control, and cost savings of IP networks

Content distribution with an IP Next-Generation Network that can serve multiple platforms and affiliates, rapidly scale new media to a global audience, and maintain the highest quality of experience

Content consumption with revolutionary IP solutions for the consumer home that help broadcasters deliver and monetize more personal, social, and interactive media experiences

Cisco is already working with broadcasters around the globe to transition to file-based media environments and deliver the next generation of media experiences. Only Cisco can provide:

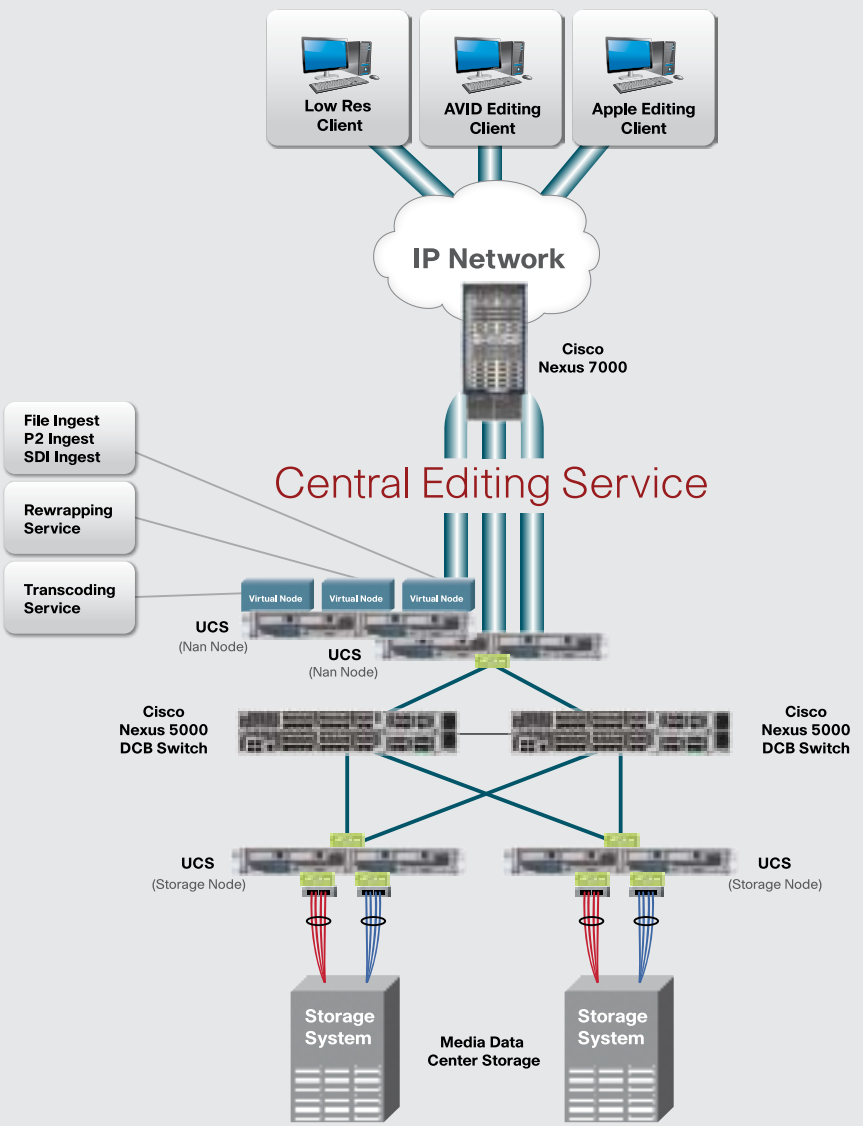
An all-Ethernet media platform that can support any standards-based technology or application

A proven data center platform that has been independently verified to meet the stringent performance and scalability requirements of HD media production

An ecosystem of industry-leading media production, virtualization, and integration partners working hand-in-hand with Cisco to deliver a complete, pre-integrated medianet solution

It's time to unleash a new world of new media experiences for your viewers. Find out how at **www.cisco.com/go/medianet**

Figure 3: Media Workflow Integration on Virtual Media Data Center



Q&A with Luc Andries of VRT-medialab

Luc Andries is a senior infrastructure architect and storage and network expert with VRT-medialab, the research and development arm of Flemish public radio and television broadcaster VRT. He presently leads the media infrastructure team at the IBCN research group at the University of Gent in close cooperation with CandIT-Media, a spin-off company of VRT-medialab specializing in media infrastructure.

What would you say to media companies facing the transition to file-based production systems?

It is important to understand that building an IP network for media is different. Applying the standards-based IT infrastructure to media introduces a number of benefits to media workflow systems, but treating networks as a commodity IP technology in a media environment is a recipe for failure. Taking into consideration the specific media requirements is key for choosing the right equipment and design.

So where should they start?

Media workflows are becoming storage-centric in nature. A high-performance central storage system platform is needed for a successful implementation of a media workflow. Once you have such a unified media data center in place, you are also able to pull media services and applications into the platform. This, along with direct connections to client workstations, simplifies the workflow. If the platform is built correctly, execution is performed in a lossless and guaranteed high-throughput environment.

How do you see the evolution of Ethernet in the data center environment?

With the advances in Ethernet speeds and the enhancements standardized by IEEE (Institute of Electrical and Electronics Engineers) with Data Center Bridging (DCB), Ethernet has become an attractive choice as the technology for convergence in the data center. Our laboratory tests clearly show that DCB provides a compelling media storage solution.

We were able to create an IP network infrastructure that was more than capable of handling media traffic flows over Ethernet, utilizing switches from the Cisco Nexus Family and the Cisco Unified Computing System. I believe that the market is ready for a move toward an all-Ethernet transport, consolidating servers and networks in a standards-based environment.

How does the Unified Computing System (UCS) come into play here?

Cisco's UCS was a natural addition to the Media Data Center environment. We are currently integrating different services such as Media Asset Management into the UCS environment. With UCS's extensive memory and virtualization capabilities, I can envision it being a central piece – serving as a home for different media applications. This will enable media companies to save hardware costs while increasing the simplicity and performance of their Media Data Center.

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