

# THE VALUE OF ROUTER- INTEGRATED VIDEO ANALYSIS

Integrating Deep MPEG Monitoring and Analysis into Routers to Improve Scale, Performance, and Efficiency

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## Executive Summary

Service providers and cable operators often deploy a mix of IP and video monitoring appliances at key network locations in an approach that can be difficult to cost-effectively scale, and one that also leaves gaps in the video monitoring environment.

To help address this challenge, Juniper Networks® has partnered with Triveni Digital, a leading vendor of advanced digital television (DTV) solutions, to create StreamScope eRM, a high-performance, router-integrated video monitoring and analysis solution that benefits from the performance, reliability, and scale of Juniper Networks MX Series 3D Universal Edge Routers.

This white paper outlines the benefits that router-integrated video analysis offers over traditional appliance-based approaches. Readers will learn how Juniper's unique integrated approach ensures maximum performance for both routing and video monitoring; and how they can benefit from using a monitoring and analysis solution that is deployed within the routed infrastructure.

## Introduction

Monitoring and analyzing video traffic is a key requirement for service providers and cable operators who transport video services over an IP network. Monitoring the quality of a video stream in real time helps operators quickly identify and resolve issues—ideally before customers are even aware of a problem. Despite the importance, service providers are often challenged to find solutions that meet today's requirements for scalable, cost-effective, and comprehensive monitoring and analysis.

Part of the challenge lies in the way video is transported across the IP network. Video traffic is often compressed and encapsulated into MPEG packets, which are then encapsulated in IP. This layered transport approach means that traditional IP-layer service assurance techniques and monitoring tools, which work for the majority of IP services, are insufficient, as there could be errors at the MPEG layer that IP-layer performance monitoring would not detect.

For this reason, service providers often deploy specialized video monitoring appliances that can detect errors in the MPEG layer. Unfortunately, these appliances typically have limited system capacity and interface support, so scaling requires purchasing additional appliances. Furthermore, because they are deployed as separate, standalone devices, they add complexity to the network architecture, and require additional power, space, and interconnect resources.

The lack of scale and the inherent inefficiencies that come with a standalone appliance mean that service providers are reluctant to deploy these appliances throughout their network—which leads to an incomplete approach to video monitoring (since MPEG packets can only be monitored where appliances are deployed). Finally, without meaningful integration between the appliance and the network, troubleshooting and repairs become challenging.

Juniper Networks, in conjunction with Juniper Networks Junos® SDK partner Triveni Digital (a subsidiary of LG Electronics), has developed a better approach to video monitoring. As a result of the partnership with Triveni, Juniper is delivering StreamScope eRM, a router-integrated, multilayer video monitoring and analysis solution which dramatically improves the efficiency and scale of video monitoring, as contrasted with standalone appliance-based approaches.

By integrating video analysis into the routing infrastructure, StreamScope eRM allows service providers and cable operators to implement a comprehensive approach to video monitoring and analysis—while at the same time simplifying the network and reducing costs.

In the following sections, this paper will outline these benefits in more detail, and examine how Juniper's unique approach to router integrated applications is key to enabling these benefits. First, we will provide an introduction to StreamScope eRM.

## StreamScope eRM Overview

StreamScope eRM is an optional Junos Ready Software application for the MX Series router family that provides “always-on” remote multilayer video monitoring and analysis at both the network (Media Delivery Index or MDI) and the application (MPEG) layers. This comprehensive video monitoring solution helps service providers and cable operators quickly identify and isolate video quality issues at multiple layers in both IPTV and radio frequency (RF) video networks. It also provides the network and the video operations teams with a common reference model for monitoring and analyzing video services, which helps reduce the duration of service impairments and consequently reduces service calls and expensive truck rolls.

### Multilayer Monitoring and Analysis

MDI monitors IP-layer performance and integrity, including issues such as packet loss and packet delay, to measure how reliably and consistently the network is delivering IP encapsulated video streams. MDI monitoring is most useful at transit nodes where the video traffic remains encapsulated.

MPEG-layer stream analysis identifies and isolates deeper layer issues, such as causes for loss of synchronization between audio and video tracks, noncompliantly encoded components, incorrect input configurations, and incorrect/inconsistent metadata; these issues are transparent to MDI analysis conducted at the IP layer. MPEG stream analysis is most useful at network locations where video is encoded, transcoded, or otherwise manipulated, including locations where advertisements are inserted.

An Intelligent Services Edge Application, StreamScope eRM is flexibly implemented on Juniper Networks MX Series 3D Universal Edge Routers via the Multiservices Dense Port Concentrator (MS-DPC). The MS-DPC is a dedicated hardware acceleration module that enables StreamScope eRM to benefit from the scalability, performance, and reliability of the MX Series, while concurrently eliminating the costs and complexities associated with qualifying and maintaining appliance-based video monitoring solutions.

Many of the benefits discussed in the following sections are a result of the MS-DPC and Juniper’s unique approach to delivering router-integrated applications that don’t compromise the performance or scale of either the host router or the router integrated application.

## Juniper Networks Router-Integrated Architecture

In recent years, routers have evolved far beyond the basic Layer 3 routing and forwarding devices; in fact, routers today commonly integrate applications and functionality which was originally delivered on standalone appliances. Juniper Networks is leading this trend in many ways—with many advanced and innovative router-integrated services available today—but even the most basic routers now incorporate features such as firewall capabilities, which were once standalone devices.

There are many good reasons for integrating features into routers. Inherently, fewer devices lead to a simpler network design, with fewer points of failure, and many management and operational benefits. Since routers are a ubiquitous and essential component of any network, and every packet that crosses the network traverses a router, they are a logical place to consolidate functionality.

Despite the well-founded rationales for consolidating network functionality, historically there have been concerns about the performance implications of doing so. There was a fear that placing too much functionality on a single platform would degrade the performance of the function the device was first intended to perform (i.e., routing and forwarding) as well as the applications it was integrating—the networking equivalent of a “jack of all trades, master of none.” This concern was not entirely unfounded, as some routing platforms share resources between traditional routing tasks and additional services, resulting in resource contention that negatively impacts scale, performance, and reliability as services are added.

Juniper Networks' approach to router-integrated services avoids these potential pitfalls with a unique architecture, one which ensures that router-integrated applications never impact the router's primary role: routing and forwarding Layer 3 traffic. Services are hosted on the MS-DPC, which offers powerful processing capabilities dedicated to the additional (and optional) services, and ensures that as customers add applications, the performance of the router's other tasks is not compromised.

This unique approach also ensures maximum performance and scale for the applications themselves by providing them with dedicated processing resources. For many applications—such as StreamScope eRM—Juniper has partnered with companies that are leaders in their respective areas of technology, ensuring that Juniper router-integrated applications are truly best in class—even in areas that are not directly within Juniper's sphere of expertise.

Hosting applications on dedicated processing resources within the router, and tight integration with Juniper Networks Junos operating system, provides significant benefits, including superior scale, reliability, and performance, increased operational efficiency, and a tighter alignment between applications and the network. These advantages apply to nearly any Juniper router-integrated application—including video monitoring and analysis.

### **Advantages of Router-Integrated Video Analysis**

Router integration, when accomplished according to the principles outlined above, provides significant operational and cost advantages over standalone appliances. At a high level, many of the benefits are features inherited from Juniper's routing platforms—advantages such as higher performance, carrier-class reliability (which traditional appliances lack), as well as the advantages that come with a simplified network architecture: fewer devices and fewer interconnects.

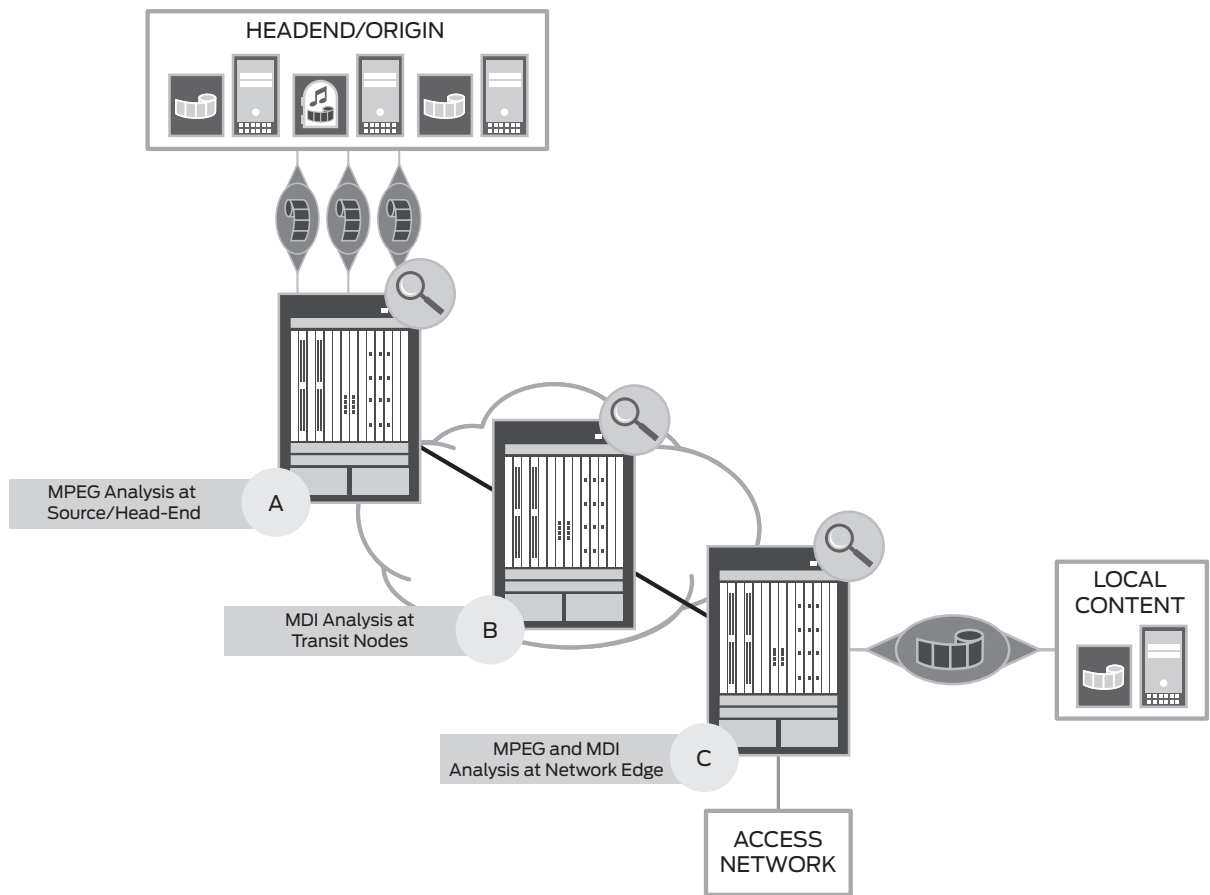
Video analysis and monitoring is exactly the type of application that can benefit most from router integration because of the challenges outlined above. Traditionally accomplished via specialized standalone appliances, video monitoring and analysis have added complexity and scaling limitations—both of which can be avoided through integration on a high-performance routing platform such as the MX Series. In the following sections, we will outline many of the benefits of router-integrated video analysis, and StreamScope eRM specifically.

### **Router Location and Ubiquity**

As mentioned above, routers are a necessary and ubiquitous component of the network infrastructure, and IP encapsulated video content will likely pass through multiple routers on its way from its origin to the end user. Routers are therefore a logical place to analyze video streams.

The ubiquity of routers allows service providers tremendous flexibility in the placement of monitoring and analysis. Juniper Networks routers are commonly deployed everywhere from the edge to the core of the network, so service providers can choose to monitor video at any or all of these locations.

When combined with StreamScope eRM's ability to monitor for both MDI and MPEG issues, this provides a powerful solution. The diagram in Figure 1 illustrates a possible deployment scenario. StreamScope eRM can perform deep MPEG analysis at the headend to ensure that the incoming video stream is "clean" and unaffected by encoding, multiplexing, or splicing. In the core of the network, MDI analysis checks for packet loss, jitter, and delay, measuring its potential impact on video service. At the edge, the video is checked again for both MDI and MPEG issues to ensure the integrity of the video before it is inserted into the access network.



**Figure 1: The ubiquity of routers allows StreamScope eRM video monitoring and analysis to be performed at multiple network locations, while avoiding appliance proliferation.**

### Reduced External Devices and Uplinks

The example in Figure 1 shows how the broad deployment of routers enables router integrated video analysis to be performed in multiple network locations. An important advantage of the router integrated video analysis approach is that this level of extensive, network-wide monitoring can be accomplished without requiring any new appliances. Instead, customers only need to deploy an MS-DPC in their existing MX Series routers (or perhaps even just purchase a software license, if they already use MS-DPCs for other services).

This is important because each additional appliance deployed in the network has an impact beyond just the initial capital expenditure. For each device added to the network, multiple areas of a service provider's business operations are affected—everything from the physical infrastructure, to the operating budget, to the training of staff. Additional elements all require rack space, power and cooling resources, and interconnecting cables and interfaces. New types of equipment may require technicians to undergo training, or new or adapted management systems. On an individual basis, the costs of each of these may be minimal, but when multiplied across many points of presence and many different appliances, the impact is quite significant.

In today's operational environment where service providers are focused on tightly controlling costs, reducing the number of devices in the network is an important step towards this goal. Integrating video analysis into the routers enables a more comprehensive and universal approach to video monitoring, while also reducing the number of devices in the network. This reduces operational complexity, and also pays a handsome green dividend by reducing the amount of power and cooling required.

## CapEx and OpEx Savings

Reduced network complexity and improved efficiency translates directly into reduced costs. Operational costs are lower because of the savings in power, space, and cooling, and because router-integrated video monitoring means not only fewer devices to manage, but also a single operating system and single management interface—enabling operators to reduce the costs associated with training and operations personnel, maintenance, and upgrades.

Capital expenses are likewise reduced because a service provider saves not only the cost of the appliance itself, but also the costs of related router interfaces which would otherwise be required to mirror traffic to standalone appliances.

## High Scale

One of the drawbacks of appliance-based video analysis solutions is their inability to scale effectively. As high speed access technologies such as Data over Cable System Interface Specifications (DOCSIS) 3.0 and fiber to the home (FTTH) increase the bandwidth delivered to consumers, and as market penetration of LCD, plasma, and LED TVs continues to grow, consumers are consuming more content in HD. Growing amounts of high-definition video content will require more network capacity, and will require monitoring systems that can handle this increased capacity—driving a need for video monitoring solutions that can continue to scale into the future.

Appliance-based solutions often are limited both in terms of total system capacity and in terms of interface support. Juniper Networks StreamScope eRM, on the other hand, is integrated on the highly scalable MX Series router, and therefore inherits the router's scalability advantages and interface flexibility. A video stream from any interface can be mirrored to the MS-DPC hosting the StreamScope eRM solution, so the StreamScope effectively works with any interface speed supported on the MX series—from 1 Gbps to 10 Gbps all the way up to 100 Gbps when available<sup>1</sup>. Today, StreamScope eRM can monitor up to 800 SDTV or 275 HDTV channels per MS-DPC, and scaling the video monitoring capacity involves simply adding another MS-DPC to the existing MX Series, rather than adding an entirely new appliance (along with the associated power, interconnect, and rack space infrastructure).

## Single OS

In addition to the scalability advantages offered by Juniper routers, there is a significant benefit that comes with having StreamScope eRM video monitoring integrated into the Junos OS. Junos OS is the single, consistent operating system used across Juniper routing, switching, security, and network services. This integration enables consistent management across all Juniper platforms and services. Having video monitoring integrated with Junos OS eliminates the need for additional operating systems for the video monitoring appliances, which further improves operational efficiency. Furthermore, with StreamScope eRM, this tight integration is validated by Juniper "out of the box."

## Simplified Management

Since StreamScope eRM leverages the Junos OS, programming and provisioning tasks use the same command-line interface (CLI) structure and syntax as Juniper's routers. This minimizes the time needed to train operational personnel, and it also reduces provisioning time, since both routing and video monitoring functionality can be managed from the same user interface.

Furthermore, user management security policies—such as password lengths and security protocols for managing the routers—are consistent. Therefore, to access StreamScope eRM, one needs to access a user defined in the router itself, a very difficult task for unauthorized users, as the routers are built with tight security mechanisms to prevent this from occurring. This does not mean that a person who manages video quality only will be given access to other critical configurations hosted on the router or to the routing processes themselves. Instead, administrative privileges are context sensitive and can restrict users to a subset of the services offered by a routing device.

## Flexible Hardware

Much the way Junos OS provides a single operating system for multiple devices and services, Juniper's MS-DPC offers a consistent service card that can optionally support multiple router-integrated features. The MS-DPC can flexibly support all Juniper router-integrated solutions—including session border control (SBC), Dynamic Application Awareness, and intrusion prevention system (IPS). And for maximum capital efficiency, applications can be purchased individually via specific software licenses.

Because the same service card is consistently used for all services, inventory and sparring costs can be reduced, and the same cards can be reused for different services—in very stark contrast to service-specific appliances.

<sup>1</sup> For more information, please refer to the press release Juniper issued on October 29, 2009: [www.juniper.net/us/en/company/press-center/press-releases/2009/pr\\_2009\\_10\\_29-12\\_04.html](http://www.juniper.net/us/en/company/press-center/press-releases/2009/pr_2009_10_29-12_04.html)

## Multiple Service Integration

The flexibility of the MS-DPC and MX Series also enables service providers to integrate multiple services on a single router. In a cable environment, for instance, operators can use StreamScope eRM to ensure the quality of broadcast video traffic. They can also use Juniper's DOCSIS-aware MX Series routing capability (developed in conjunction with Junos SDK partner Active Broadband Networks) to enable dynamic IP service treatment based on subscriber information (such as identity, service type, service tier, subscriber usage metrics, and device). The ability to integrate multiple services on a single router saves the cost of separate devices, and it also provides a more elegant and efficient solution that replaces multiple devices with a single service delivery platform. Once again, Juniper validates the integration of all these applications—so that no additional coding or integration testing is required.

## Single Support Contact

Deploying Juniper router-integrated services has the added benefit of a single help line that is there to support and troubleshoot any problem that may occur over time. This single point of contact for all support-related issues eliminates finger pointing and reduces the time it takes to resolve problems. Video monitoring, in particular, benefits from a single support contact, because issues identified by StreamScope eRM can be resolved with a single point of contact with visibility into both the issues identified and the underlying network.

A unified solution delivered on a single platform and a single operating system, all supported by a single vendor, can also virtually eliminate interoperability difficulties and multivendor troubleshooting complexity throughout the service lifetime. Furthermore, a solution that is designed for “out-of-the-box interoperability” will not experience the difficulties that frequently occur when a service provider is forced to integrate multiple vendor products, and when separate vendors try to resolve a single problem.

## Ability to Influence Network Behavior

A key benefit of integrating video quality analysis with the network infrastructure is the ability to both detect and resolve problems in a single platform. While we have emphasized MDI and MPEG-layer error detection in this paper, tight integration with the Junos OS and the MX Series router permits dynamic, automated corrective actions based on StreamScope eRM identified service behavior and operator defined triggers. For instance, based on a StreamScope eRM identified impairment, a Junos OS script can trigger the MX Series router to switch from the primary to an alternate video stream source. In this way, the MX Series router uses actual feedback from StreamScope eRM's real-time video analysis to make a network-layer decision that improves the DTV service quality, before a customer calls or a truck rolls.

## Conclusion

Video monitoring and analysis is a critical function for today's service providers and cable operators, but traditional approaches to video monitoring have presented challenges in terms of scalability and efficiency. By integrating this key functionality into its MX Series routers, Juniper Networks StreamScope eRM application delivers video monitoring and analysis capability with dramatically improved scalability, performance, and efficiency. With StreamScope eRM, service providers and cable operators can ensure the quality of video services, while keeping operational and capital expenditures at a minimum.

## About Juniper Networks

Juniper Networks, Inc. is the leader in high-performance networking. Juniper offers a high-performance network infrastructure that creates a responsive and trusted environment for accelerating the deployment of services and applications over a single network. This fuels high-performance businesses. Additional information can be found at [www.juniper.net](http://www.juniper.net).

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