Video Assurance Management: Maintain High-Quality Video Across IP Networks

Executive Summary

The Cisco® Video Assurance Management Solution (VAMS) delivers robust fault-management capabilities for the IP transport layer of an IP-based video service. Highly scalable, with integration among modular application components and support for multivendor networks, this extensible framework is designed to facilitate rapid video service fault detection across very large IP video networks.

Challenges

In the broadcast television industry, the foundation of success is consistently excellent video quality. When broadcast video services are delivered over an IP network, quality of experience is measured by packet loss. One IP video packet contains approximately 1,400 bytes of information, and each IP packet contains multiple MPEG encapsulated video packets. The loss of one IP packet can lead to video impairments that can last half a second or more. A single dropped packet can cause “tiling”; many dropped packets can lead to full-screen freezes—and complaints from customers.

Video service providers need network management systems that help them detect, isolate, troubleshoot, and resolve most video quality issues without unnecessary support calls. An effective video fault management system helps providers to catch and resolve quality issues before customers notice and call technical support. Help desk calls cost money as operators diagnose and resolve quality issues. Customer calls also demonstrate customer dissatisfaction. Too many calls may result in customer turnover—and reduced profits. Some providers estimate that the average cost of dealing with a single customer case equals or exceeds the profitability of that customer for an entire year.

Video is a complex, performance-sensitive service that requires a network to provide excellent quality of experience to customers. To assure excellent service quality, service providers delivering broadcast television services over IP networks need powerful end-to-end, vendor-neutral fault management systems. These systems must meet several requirements:

- Identify faults (primarily packet loss) in unique video programs
- Support visibility into operational domains (such as core, aggregation, or access) for fault isolation
- Integrate with the network infrastructure and operations support systems (OSS)
- Share common information pools and automation scripts for fault isolation, identification, and resolution
- Present information in language familiar to both network operations and video operations personnel
- Support all devices related to the service, from any vendor

IP Broadcast Video Architecture Overview

The video fault management system helps operators monitor and troubleshoot video quality throughout the IP transport network, from the headend, through the core, to distribution and aggregation, and eventually, the last mile to the customer premises (Figure 1).

Figure 1. IP Broadcast Video Network Architecture

The broadcast video network is comprised of equipment from many vendors. The IP network is primarily comprised of optical routers and switches. Headends and hubs have specialized equipment that captures or encodes video signals for insertion into the network and transport to the customer premises. An effective video assurance management system can view, map, and communicate with every component of this network. It must offer multivendor support and be flexible to accommodate additions, changes, and upgrades to the network. For example, this flexibility would recognize the addition of last-mile drop points to support new subscribers; understand software upgrades in switches and routers; and accommodate new bandwidth-management schemes over time.

Solution: Cisco VAMS

In response to the challenges of IP video assurance services, Cisco offers the Video Assurance Management Solution (VAMS), a modular, extensible fault management architecture designed for broadcast TV services over multivendor IP networks. This standards-based solution enables real-time, centralized monitoring and management of multivendor, multitechnology backbone, regional, and aggregation networks for broadcast video transport.

Cisco VAMS provides extensive topology-based fault analysis capabilities for rapid and extensive fault detection, isolation, and root-cause correlation. Its Manager of Managers feature helps operators focus on important network events, offering a combination of alarm reduction rules, filtering, customizable alarm viewing, and partitioning.

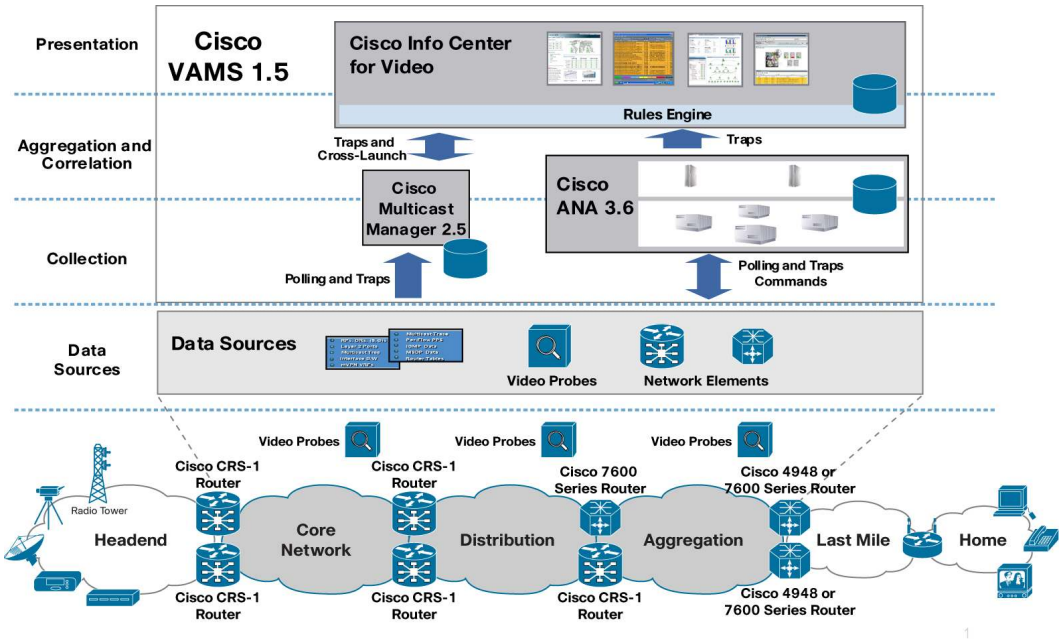
This solution is comprised of the following components:

- Cisco Active Network Abstraction (ANA) is the abstraction and mediation layer between the IP network and OSS applications that collects an end-to-end view of the broadcast network and enables fault correlation for rapid root-cause analysis.
- Cisco Multicast Manager monitors and troubleshoots the video transport layer and multicast pathways, collecting event and fault information from network elements and video probes distributed throughout the network.
- Cisco Info Center is the Manager of Managers from which operators view video service status, collecting traps from all Cisco VAMS applications and components.
- Third-party video probes are placed at demarcation points throughout the network. Information from probes enables the Cisco VAMS to identify, isolate, and troubleshoot video quality problems. Upon testing and validation, the extensible Cisco VAMS can receive data from and communicate with any RFC 4455-compliant video probe in the market.

The business benefits of Cisco VAMS include the following:

- Accelerate troubleshooting and problem resolution with visibility, integration, and automation capabilities
- Improve the user's quality of experience by isolating and fixing issues before customers call to complain
- Reduce support calls through effective isolation of problem domains
- Reduce customer turnover through increased customer satisfaction
- Accommodate future growth and new technologies
- Protect profit margins and revenues by reducing operational expenses and maintaining customer satisfaction

Figure 2. VAMS Operational View



The following sections provide an overview of the primary components of Cisco VAMS.

Cisco Multicast Manager

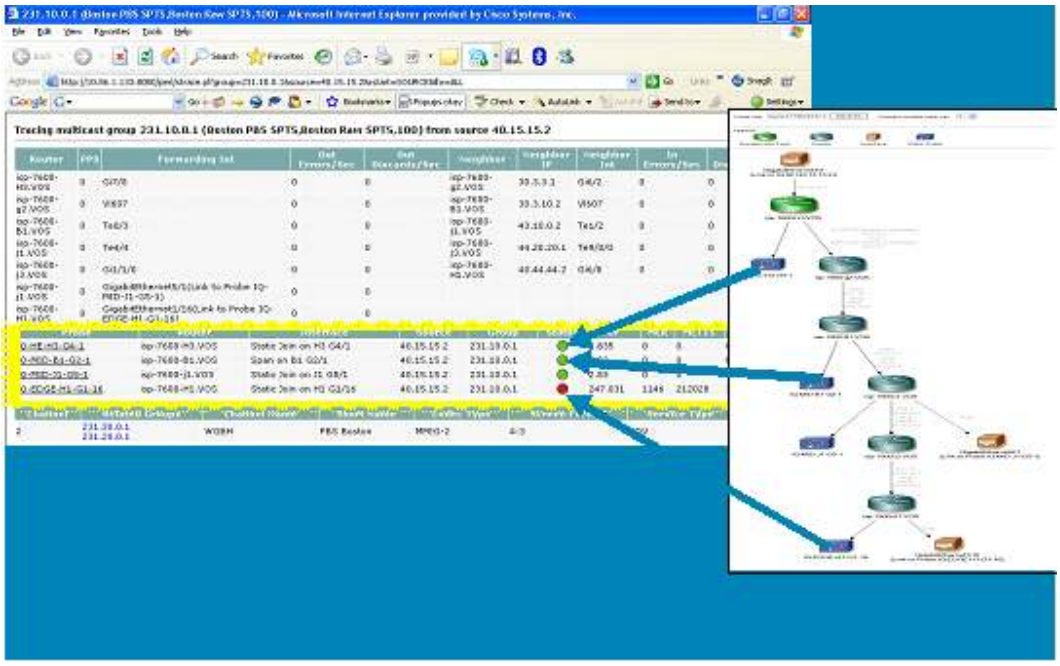
Cisco Multicast Manager is a Web-based network management application that simplifies the holistic discovery, visualization, monitoring, and troubleshooting of IP multicast networks. It enables both network managers and video operators to know what is going on everywhere in the network in real time. It also supports dynamic modeling of multicast pathways through the network.

Cisco Multicast Manager includes:

- Automated multicast discovery
- Proactive polling engine
- Real-time multicast diagnostics
- Alerting and reporting

- Constant Bit Rate (CBR) video flow monitoring
- Video flow path tracing
- Correlation of multicast flows to video programs

Figure 3. Multicast Path Trace Screen in Cisco Multicast Manager



Within Cisco VAMS, Cisco Multicast Manager collects data from video probes and from multicast MIBS in Cisco routers and switches and presents the data in a visual manner for rapid fault isolation. It tracks convergence and re-convergence of multicast trees, and most importantly, associates individual multicast addresses with unique programs. This association allows Cisco Multicast Manager to present information to Cisco ANA and Cisco Info Center in the language of both network managers (who think about IP and multicast addresses) and video managers (who think about programs). This facilitates communication between the two groups, and delivers information to Cisco Info Center in comprehensible language for help desk personnel.

Cisco Multicast Manager supports RFC 4445 video probes, which collect data about each multicast stream (carried in MPEG transport headers) for each multicast flow and forward the data to Cisco Multicast Manager. This capability allows Cisco Multicast Manager to report video quality issues to Cisco Info Center for specific multicast groups while identifying the video programs that those groups support. Integration for IP Video Management System (iVMS) from Ineoquest Technologies enables real-time alerts to assist rapid fault isolation of customer-impacting video events.

Some Cisco customers use Cisco Multicast Manager to support a “probeless” management environment. The software can monitor multicast flows on a tree, branch, or device level for thresholds measured by packets per second (PPS) or bits per second (BPS). This capability allows Cisco Multicast Manager to monitor CBR video flows, correlate them to video programs, and send northbound alerts when a threshold is violated.

Cisco Active Network Abstraction

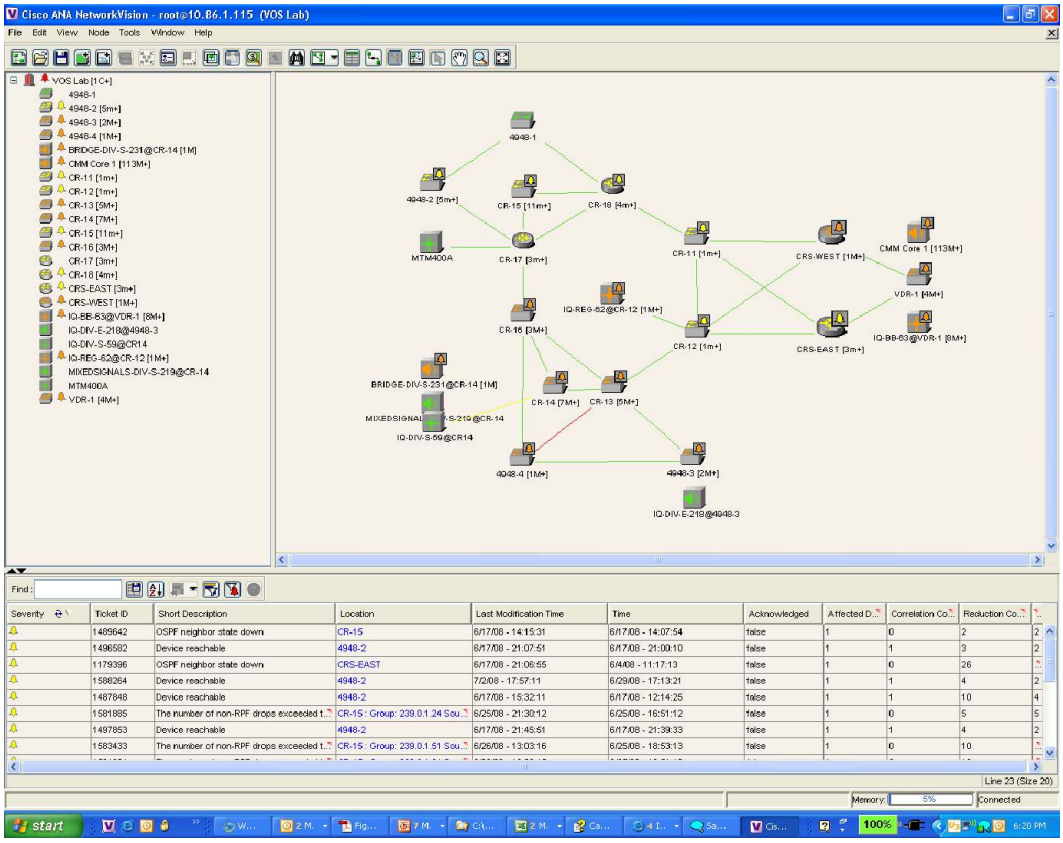
As the foundation of Cisco VAMS, Cisco ANA is a flexible, vendor-neutral network resource management solution for a multitechnology, multiservice network environment. It dramatically reduces the need for traditional systems integration, reducing time to market and lowering deployment and ongoing maintenance costs.

Cisco ANA offers service providers:

- Simplified integration of OSS applications with network information
- A flexible, common infrastructure for managing network resources
- Consistent procedures and interfaces for all network elements

Operating between the network and the OSS layer, Cisco ANA creates multiple virtual network elements (VNEs) and aggregates them into a software-based virtual network, much as real network elements create the real-world network. Cisco ANA dynamically discovers network components and tracks the status of network elements in near real time (Figure 4). Cisco ANA also provides platform and network mediation services for both Cisco applications and value-added applications from Cisco partners.

Figure 4. Cisco ANA Network View



Cisco ANA delivers three types of functionality:

- Vendor-neutral network resource management: Using its OSS-to-network mediation and distributed management platform features, Cisco ANA provides consistent, vendor-neutral network resource management functions for network elements from Cisco and other networking vendors. Northbound APIs integrate Cisco ANA with IBM Netcool, Cramer6

OSS Suite, and HP OpenView. Southbound APIs support more than 320 devices from Cisco, Alcatel-Lucent, Juniper, Redback, and other vendors.

Cisco ANA allows service providers to implement a flexible, common network resource management infrastructure. Within Cisco VAMS, Cisco ANA delivers fault monitoring capabilities including: distributed network element and alarm surveillance and processing, network element fault analysis, and features enabled for network topology-based fault correlation by advanced applications such as Cisco Info Center. Cisco ANA collects and aggregates data collected through Cisco Multicast Manager and directly from IP network elements.

- Enabling platform for value-added network and service management applications: Using its OSS-to-network mediation and distributed management platform features, Cisco ANA facilitates value-added management applications such as Cisco Info Center from Cisco and Cisco partners.
- Standards-based access to near-real-time network element and network information: Cisco ANA provides Cisco VAMS with standards-based access to real-time information on the network, network elements, and connectivity information. Information access enables service providers to use Cisco ANA to ease the integration burden associated with traditional network management systems through standards-based APIs. For Cisco VAMS, Cisco ANA offers real-time, distributed alarm surveillance and device-abstraction.

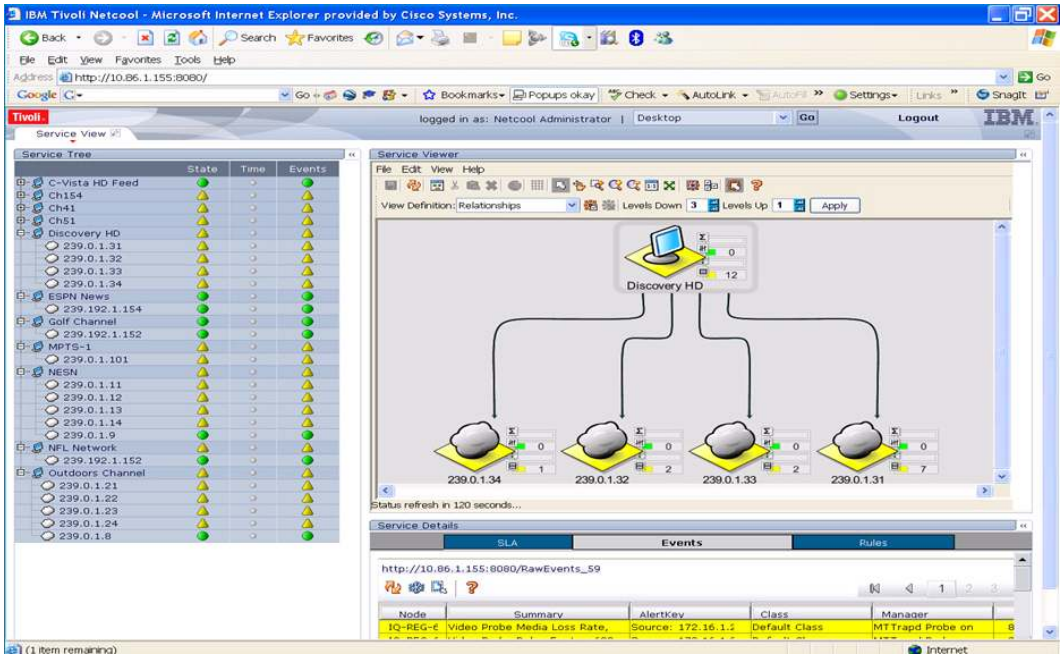
Cisco Info Center

Proactive management of network events allows service providers to maintain video service uptime and quality. With a service dashboard view of the entire IP video network, Cisco Info Center provides a single pane of glass for real-time monitoring, management, and event de-duplication for rapid fault management within all Cisco VAMS components.

Cisco Info Center supports the reliability and performance of multivendor, multitechnology IP broadcast television networks. Its well-earned reputation for breadth of coverage, rapid deployment, ease of use, high scalability, and performance makes it a popular Manager of Managers for Cisco VAMS.

Within Cisco VAMS, Cisco Info Center collects, consolidates, and correlates events from Cisco Multicast Manager and Cisco ANA, and presents this information in a meaningful, intuitive, visual format. Administrators can monitor the real-time severity of events through color-coded Cisco Info Center Event Lists. The customizable Cisco Info Center Dashboard offers service-level views for rapid fault identification and impact assessment.

Figure 5. Cisco Info Center Video Service Dashboard View



Accepting correlated data from Cisco ANA and providing cross-launch capability into Cisco Multicast Manager, Cisco Info Center reduces alarms, decreasing troubleshooting time with the following benefits:

- Quickly resolve problems and improve help-desk operations: Cisco Info Center enables video operations teams to quickly isolate problems and automatically communicate them to the help desk. Cisco Info Center integrates fault management and trouble-ticketing systems, such as Clarify, Peregrine, Remedy, and Siebel, to automatically open trouble tickets for faults, enabling help-desk personnel to proactively manage support operations.
- Reduce alarms and improve service availability: Cisco Info Center delivers scalability to routinely process millions of alarms per day. Its own basic correlation and de-duplication capabilities exponentially reduce the number of alarms presented to operators. Using the advanced analysis and automation functions of Cisco Info Center Impact can help determine an alarm's effect on video programs and subscribers, helping staff to prioritize resolution efforts.

Cisco VAMS in Action

To understand the value of Cisco VAMS within a service provider environment, let us consider a customer service scenario.

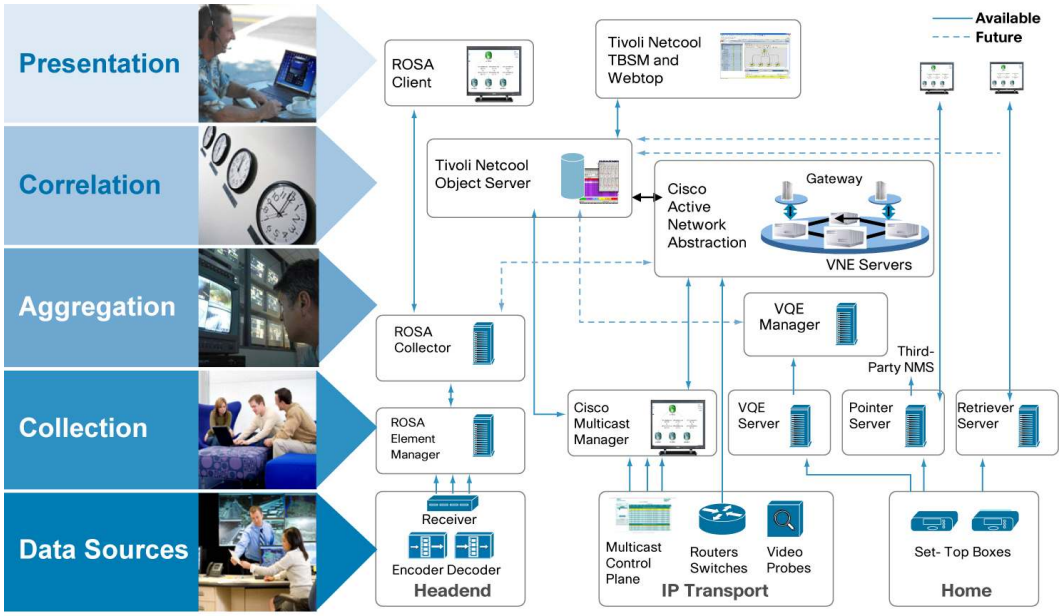
- A customer in Boston (and 10 of his closest friends) is watching the local sports team in a playoff game at St. Louis. In the middle of the game, the program freezes and goes black.
- Cisco Multicast Manager detects a threshold violation below the expected PPS for this video flow and alerts Cisco Info Center.
- The network automatically generates alarms:
  - Video probes detect the anomaly and report to Cisco ANA and Cisco Multicast Manager.
  - Cisco Multicast Manager detects a threshold violation below the expected PPS for the video flow and traps to Cisco ANA (or directly to Cisco Info Center).

    - Cisco ANA detects faults related to transport network elements (such as CPU overload or link flaps) and escalates them to Cisco Info Center.
- Cisco Info Center correlates alarms to impacted channels—the operator sees on the service dashboard that the channel showing the playoff game is in error.
- Operator filters to the alarms associated to this channel and cross-launches Cisco Multicast Manager to trace the network path for the individual channel from the ballpark in St. Louis back to Boston.
- The trace indicates that somewhere in the local Boston area the multicast tree is affected, affecting about 1400 subscribers.
- The operator uses Cisco ANA to analyze the status of routers serving the local Boston area.
- Cisco ANA detects routing protocol issues and isolates the affected router.
- The operator resets the router either through Cisco ANA or through direct interaction. The multicast route rebuilds in less than one second, and service quality returns to normal standards.
- In parallel with this repair process, the operator sends a message to the help desk about the incident and the affected channels, and informs the help desk when the problem is fixed.
- Using Cisco VAMS, the event is reported, correlated, isolated, and fixed before the subscriber in Boston has time to call the provider to complain, and the playoff party resumes.

Cisco VAMS: An Extensible Framework

Cisco VAMS offers service providers the comprehensive, integrated fault management system they need to manage video quality in IP broadcast television networks. The scalable, extensible platform accommodates network growth and easily integrates new technologies, giving Cisco VAMS both longevity and a strong return on investment. Cisco continues to extend the platform capabilities over time to meet the IP transport management requirements of its video service provider customers as they compete for ad revenues and subscribers in the lucrative television industry.

Figure 6. Cisco VAMS and Future Integrations



For More Information

To learn more about Cisco VAMS, please visit: http://www.cisco.com/go/vams.

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