

Enhance Service Delivery with Cisco Catalyst 4500E and NAM Appliance

Improve operational efficiency with increased network and application visibility

Introduction

Today's businesses face an ever-changing environment. Central to the dynamic business environment are diverse applications designed to meet different business needs. Organizations have learned that the distinct characteristics in diverse business applications place different requirements on a common network infrastructure. Therefore, it is crucial for enterprises to gain visibility into the application delivery to help ensure operation efficiency, and to provide an effective way to troubleshoot and manage the network.

The demand for application visibility calls for intelligent network infrastructure. Networks today have evolved from mere bandwidth pipes into service-rich platforms where many value-added services are delivered. A suite of coherent services working together is required to handle the diverse range of applications, user types, end points, and classes of services that are typical of global enterprises.

Application Velocity is a wholistic network service under the Borderless Networks Architecture with the goal to provide superior application performance - ie., maximized user experience for applications, optimized resource utilization and increased reliability for applications. Application Velocity brings together various technologies and products to provide application visibility & control, application acceleration and optimization, and network and application agility. As key components of Application Velocity, Cisco Catalyst 4500E and NAM appliance work together to provide application visibility, control, and performance troubleshooting.

Cisco Catalyst® 4500E Series Switches provide the underlying network architecture necessary in enterprise networks for application delivery that helps ensure user productivity and information access. The Cisco® Network Analysis Module (NAM) offer operational visibility into the network to facilitate optimized usage of resources and rapid troubleshooting to meet the service deliver challenges.

Together, Cisco Catalyst 4500E Series Switches and NAM appliances provide a best-in-class enterprise solution to improve operational efficiency, simplify manageability, and increase application and performance visibility. With the help of this solution, organizations are positioned to meet the challenges in today's complex application delivery and provide consistent, reliable, high-performance access to all types of information for all users in an effective and scalable manner.

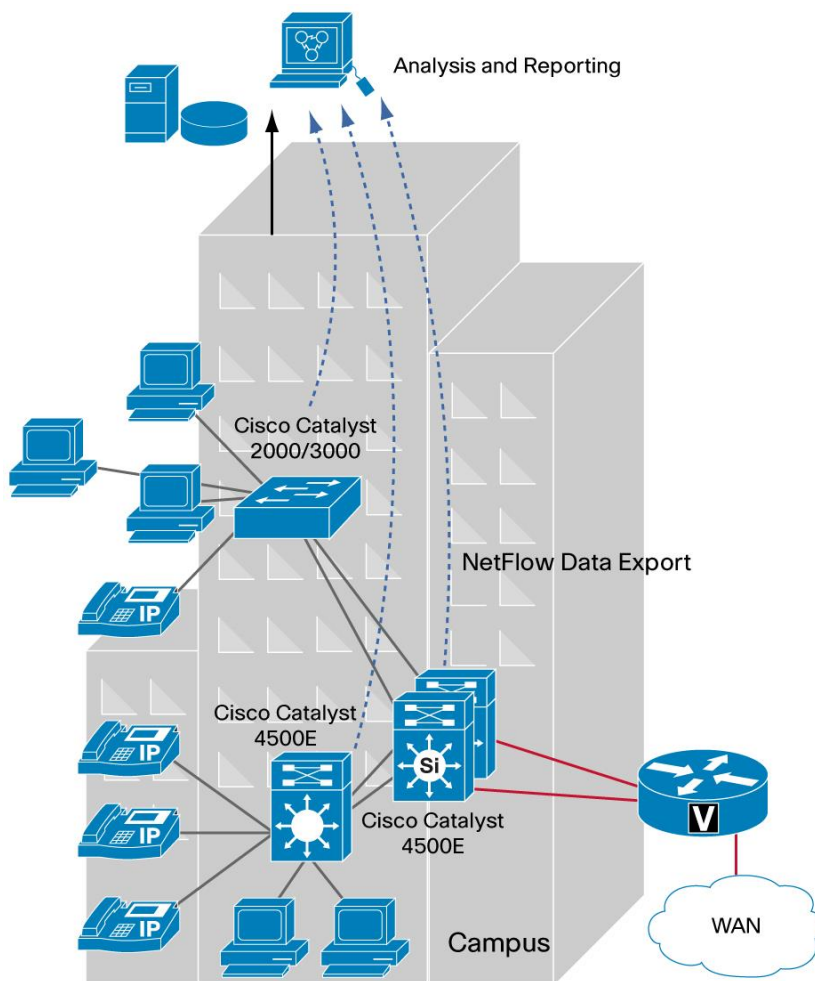
Service Delivery Challenges

As enterprises rely heavily on applications and services to help ensure efficient business operations and processes, IT is challenged with managing application delivery in an environment that is dynamic and distributed. The number of business applications is growing, application architectures are increasingly complex, application traffic is proliferating, and traffic patterns are difficult to predict. Enterprises are also embracing the convergence of voice, video, and data services to streamline business processes and increase productivity. In this dynamic environment, network administrators are responsible not only for troubleshooting application performance issues but also for effectively making use of intelligent network capabilities for efficient delivery of services and applications. These responsibilities demand deeper network visibility and analytics to present meaningful and consistent performance information for network administrators to tackle some of the following service delivery challenges:

- Manage delivery of application and services to anyone, anywhere, and anytime over any device such as PCs, servers, phones, surveillance cameras, and printers.
- Help ensure consistent service levels for the applications and services delivered over the converged network.
- Improve application performance with effective use of intelligent network services such as quality of service (QoS), Cisco Wide Area Application Services (WAAS), etc.
- Analyze network behavior to preempt service performance issues, and perform deep analysis to identify the root cause when a problem arises in real time.

Reduce the network total cost of ownership (TCO) with improved IP operational efficiency and optimal use of network resources.

Figure 1. Catalyst 4500E Series Switch as Network Backbone



Application Visibility and Control Facilitated by Catalyst 4500E Switches

The Cisco Catalyst 4500E Series Switch is designed to be a premium campus network access and aggregation platform, Figure 1. It provides the foundation for Cisco Borderless Networks as Cisco's leading modular wiring closet and price-competitive backbone platform. It delivers key innovations and offers maximum investment protection and is compatible with previous and future versions across generations.

As enterprises seek to maximize network investment, the Catalyst 4500E Switch provides a cost-effective and high-performance vehicle to help ensure intelligent, secure, and optimized delivery of applications. The comprehensive software services available on the Catalyst 4500E Switch deliver unprecedented application and performance visibility over existing infrastructure. Customers are able to take advantage of the offerings without a complete equipment upgrade.

The feature-rich software on Cisco Catalyst 4500E Series Switches enables the delivery of the following value-added services without affecting packet-forwarding performance:

- **Network and Application Visibility:** The Flexible NetFlow supported on Supervisor 7-E offers detailed, highly scalable flow information. By analyzing the data demonstrated in the flow record, such as source/destination IP address, source/destination port number, protocol type, type of service (ToS) byte, and interface, IT is able to answer questions on where, why, when, how, and by whom specific applications are being used and how the usage might affect the network, thus enhancing operational efficiency and saving operational cost. Catalyst 4500E switches also provide detailed interface statistics and MIBs that contain important information such as link utilization, packet/byte count, error statistics, collisions, etc.
- **Application Control:** Catalyst 4500E switches support well-rounded QoS mechanisms to provide differentiated services to mission-critical applications and to guarantee service level. Access Control Lists (ACLs) provide granular control over specific traffic groups by matching certain traffic attributes (TCP/UDP ports, source IP address, destination IP address, etc.) and define actions over them, such as permit, drop, remarking of differentiated services code point (DSCP) value, etc. Together, ACLs and QoS provide an intelligent means of application control on Catalyst 4500E switches. In addition, detailed NetFlow data export and comprehensive sets of MIBs provide the means for an external monitoring device to further validate and tune QoS allocations.
- **Anomaly Behavior Detection and Troubleshooting:** NetFlow provides broad visibility for network trending, and SPAN/RSPAN session provides access to every packet on the wire for targeted and detailed analysis. NetFlow and SPAN/RSPAN work together as complementary technologies. When NetFlow monitoring indicates a problem, SPAN session can be enabled to capture packets on specific segments for drill-down analysis. For example, when the NetFlow analysis shows that there is a station taking a large portion of link bandwidth, and illegitimate use of network resource is suspected, the administrator can configure a SPAN/RSPAN session from the Catalyst 4500E switch to confirm it. The use of SPAN/RSPAN session can be further refined with ACLs or VLAN ACLs (VACLs) to target a specific set of traffic.
- **Performance Visibility:** The packet capturing via SPAN session provides a vehicle for performance analysis and troubleshooting. With this, network operators are able to establish and verify service guarantees, increase network reliability by validating network performance, proactively identify network issues, and boost return on investment for existing and new network-centric applications.

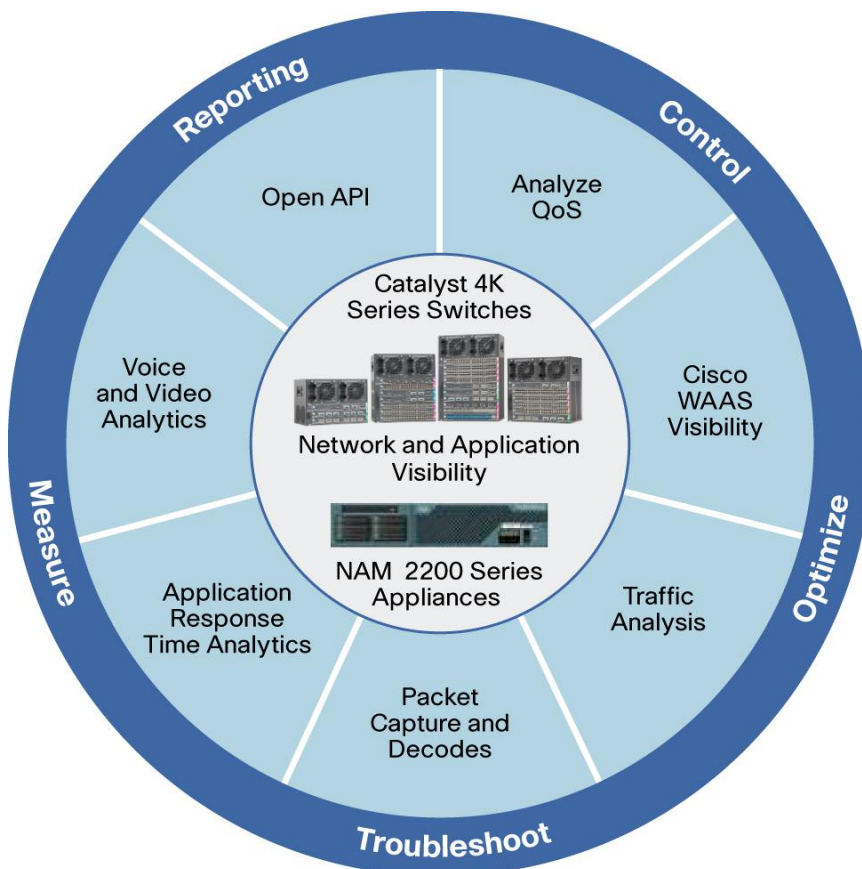
Whether in the wiring closet, or as campus backbone deployment, Cisco Catalyst 4500E Series Switches provide the intelligence needed for IT to gain service visibility into the network and, therefore, help ensure operation efficiency and lower operation costs.

Simplify Service Delivery with NAM Appliance

The Cisco NAM 2200 Series Appliance provides operational insight into the Catalyst 4500E Series Switch deployments to help ensure efficient delivery of network application and services to the end-users, (Figure 2). NAM leverages the rich manageability feature set available on the Catalyst 4500E Series Switch to gather comprehensive application and performance data and produce meaningful and actionable reports. It uses mechanisms such as SPAN and RSPAN to get direct access to packets for deeper analysis. Traffic directed to Cisco NAM using SPAN can also be pre-filtered with VACL for analyzing specific applications, ports, or VLANs. NAM also accepts NetFlow Data Exports from a local or remote switch or router to collect application traffic flow details. NAM can process Flexible

NetFlow exports from Catalyst 4500E Series Switches with Supervisor 7-E to offer valuable insight into who, what, when, where, and how network traffic is flowing.

Figure 2. NAM 2200 Series Appliance Provides Operational Visibility Across Entire Application Delivery Lifecycle



NAM enables operational agility, allowing quick access critical network information to accelerate problem resolution, advance optimization decisions, and help ensure consistent delivery of end-user experience.

Enhance Application Performance Intelligence

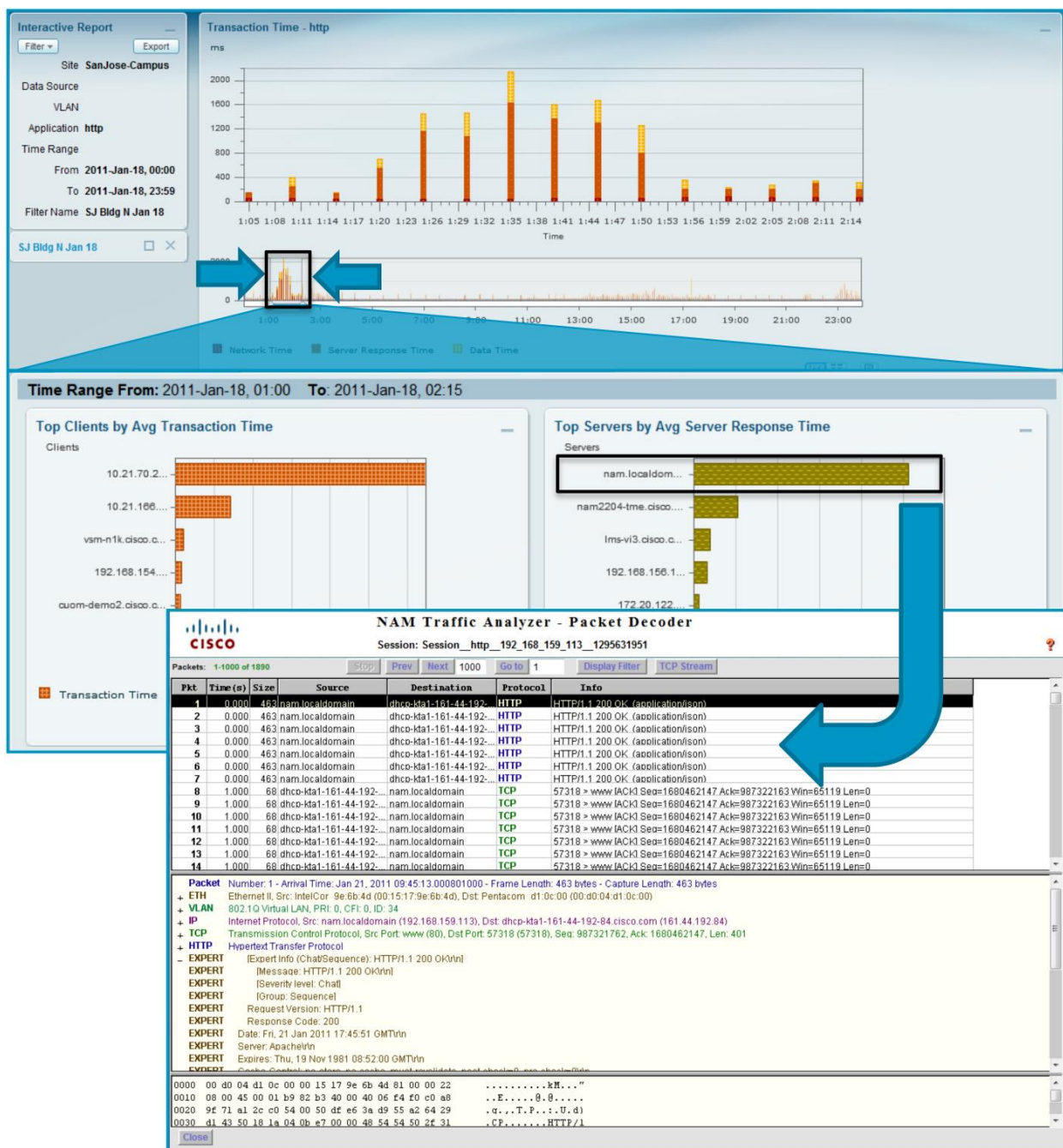
Cisco NAM implements application performance analytics that can not only characterize the end-user experience but also provide performance visibility across the entire application delivery cycle. It offers a comprehensive set of transaction-based statistics such as response time, transaction time, data transfer time, and retransmission time. It allows users to monitor and analyze application performance trends for TCP-based business applications and preempt performance issues by enabling threshold-based proactive alerts. The performance data can be compiled and segregated on the basis of sites mirroring the network topology. Site-based monitoring can not only be used to track service-level objectives tied to specific sites but can also be used to help to quickly isolate and resolve performance issues, minimizing any impact to the end users at the site. Analyzing the metrics also helps to further improve application performance with effective use of control and optimization mechanism such as QoS and Cisco WAAS.

Increase Operational Efficiency

Cisco NAM accelerates problem isolation and root-cause analysis, reducing the time that it takes to resolve a performance issue from weeks and days to hours and minutes. The NAM's graphical user interface (GUI) includes prepackaged dashboards with intuitive features such as interactive reports, contextual navigation, and one-click packet captures that expedite the problem resolution process. The embedded workflows allow users to isolate

application problems to the network, the application, or the server. It identifies the client endpoints being affected by the performance degradation and the servers that could be the cause of response time delay (Figure 3). The network problems can be further investigated using comprehensive traffic analysis views with detailed information on VLANs, Differentiated Services (DiffServ), hosts, conversation pairs, and application usage. Pinpointing the traffic of interest, packet capture, decodes, and filters can be used to perform a “deeper dive” to quickly spot and address issues that affect performance. Operational productivity can be further improved with the use of the Packet Capture Error Scan feature that highlights observed packet-level anomalies, eliminating the cumbersome task of manually analyzing the entire packet capture.

Figure 3. Application Performance Troubleshooting Workflow



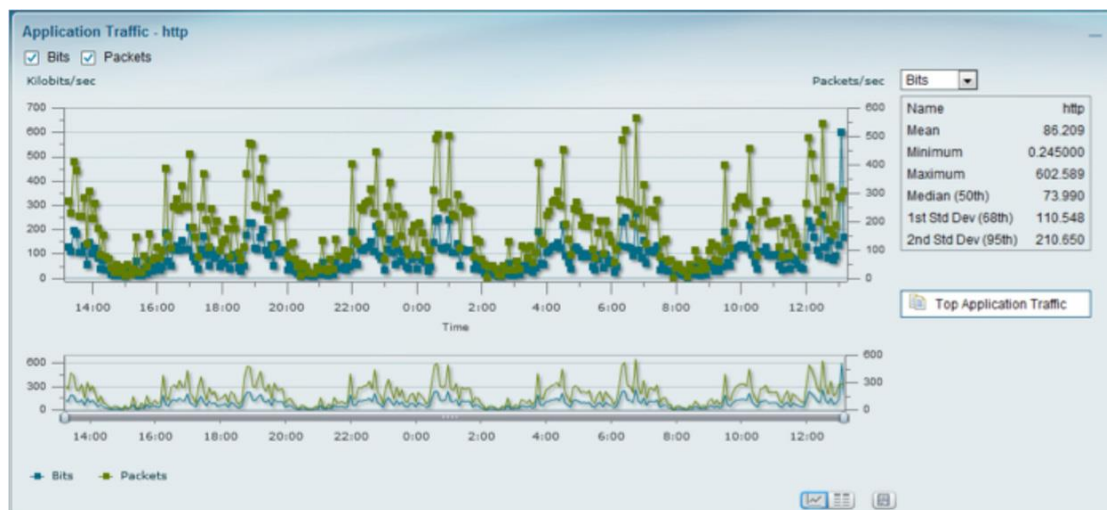
Improve Voice Service Quality

Convergence of voice and data over shared network infrastructure offers a new set of challenges in managing voice quality. Voice is a real-time application and is extremely sensitive to a number of parameters such as packet loss and jitter. Cisco NAM can analyze voice streams in real time to provide critical performance information, including Mean Opinion Score (MOS), jitter, and packet loss to help quickly detect and resolve voice degradation issues. NAM can also quickly identify the sites, endpoints, and RTP streams with the lowest observed voice quality, providing actionable information to further investigate the performance issues.

Gain Visibility into Network and Application Usage

One of the cornerstones of the Cisco NAM Appliances is their ability to look inside the live packet to gather information on applications, hosts, and conversations. NAM can also accept the Flexible NetFlow exports from a Catalyst 4500E series switch with Supervisor 7E to gather detailed network usage statistics. It helps to spot bottlenecks before the network suffers blows to performance and availability. It also helps to improve the consistency and quality of network services, because these metrics reveal usage patterns for users as well as network resources, Figure 4.

Figure 4. Granular Analysis of HTTP Traffic on the Network



Analyze Quality of Service

Even with ample network resources, QoS plays a critical role in controlling application traffic behavior to meet committed application performance levels. Cisco NAM monitors traffic by DSCP allocations defined by QoS policies. The feature helps identify applications, hosts, and conversations participating in each grouping of DiffServ classes. The information can be used to validate and tune planning assumptions and QoS allocations and to detect incorrectly marked or unauthorized traffic.

Monitor Switch Port Statistics

Monitoring the ports on a Catalyst 4500E series switch is a good place to start investigating application performance issues and how network traffic is being utilized. The NAM appliance can monitor all ports on the switch designated as the managed device. Monitored statistics include packet and byte counts, port utilization and error statistics such as cyclic redundancy check (CRC)/alignment errors, oversized and undersized frames, fragments, jabbers, and collisions. It also includes information on broadcast and multicast activity. In addition, NAM can be configured to provide notification of any of these values should they exceed the thresholds defined for them.

Conclusion

The service-rich, high-performance Catalyst 4500E Series Switches gather a comprehensive application view while forwarding application traffic. Deploying a NAM appliance with Catalyst 4500E series switches in the campus enhances operational manageability of network and allows IT to take full advantage of their switching infrastructure investments. The granular real-time visibility and historical analysis offered by Catalyst 4500E and NAM enables IT to enhance service levels, improve operational efficiency, and reduce operational cost. When deployed together, Catalyst 4500E and NAM offer a cost-effective solution that combines application performance visibility and traffic analysis and troubleshooting, which are essential to managing delivery of converged network services in the campus.

For more information, visit <http://www.cisco.com/go/catalyst4500> and <http://www.cisco.com/go/nam>.



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