# Enhance Service Availability and Performance in the Next-Generation Data Center with Cisco Nexus 7000 and NAM Appliance

Improve application visibility, accelerate operational efficiency, and preserve IT investment.

## Introduction

Modern data centers power businesses through a new generation of applications and services. The number of business applications is growing, application architectures are increasingly complex, application traffic is proliferating, and traffic patterns are difficult to predict. Virtualization, cloud computing, high-performance computing, data warehousing, and disaster recovery strategies, among others prevalent in the current environment, are prompting a whole new set of requirements for intelligent network infrastructure in data centers. It is also demanding new techniques and best practices in managing network and application delivery. A coherent set of embedded intelligent network services and management capabilities working together is essential to handle the diverse range of applications, user types, endpoints, and classes of services that are typical of global enterprises.

Cisco Nexus® 7000 Series Switches provide the data center-class platform, which is designed for outstanding scalability, continuous system operation, operational manageability, and transport flexibility. It offers the foundation necessary in an enterprise network for service delivery to help ensure information access to move today's businesses forward. The Cisco Network Analysis Module (NAM) Appliance offers operational visibility into this platform to help ensure rapid troubleshooting, optimal use of network resources and consistent application performance visibility to meet the service delivery challenges. Together, Cisco Nexus 7000 Series Switches and NAM Appliances provide a best-in-class solution for the next-generation data center to improve service availability, and simplify operational manageability.

## Service Delivery Challenges

As enterprises rely heavily on applications and services to help ensure efficient business operations and processes, network administrators are responsible not only for troubleshooting 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 analysis to present meaningful and consistent performance information to tackle service delivery challenges:

- Manage service availability and performance to consistently meet stringent service levels expected from next-generation data centers
- Scale cost-effectively to support many thousands of client endpoints, network devices, and virtual machines
- Reinforce the elasticity in the infrastructure to efficiently support virtual computing, network, and storage needs

- Improve application performance with effective use of intelligent network services such as quality of service (QoS), Cisco Wide Area Application Services (WAAS), and so on
- 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

## Solution Overview

To meet these challenges, data center architects must employ the next generation of networking equipment, oriented toward addressing today's requirements while laying the foundation toward future needs. This section describes many of the features of Cisco Nexus 7000 in conjunction with the NAM Appliance to help you enhance service availability and performance in the data center.

The Cisco Nexus 7000 Series of switches is a modular data center-class product line that is designed for highly scalable 10 Gigabit Ethernet networks with a fabric architecture that scales beyond 15 terabits per second (Tbps) and provides future support for 40 Gbps and 100 Gbps Ethernet. This new data center-class platform is designed for outstanding scalability, continuous system operation, operational manageability, and transport flexibility. The Cisco Nexus 7000 Series is powered by Cisco NX-OS, a state-of-the art operating system.

Next-generation architectures offer unprecedented computing power densities. The Cisco Nexus 7000 offers scale beyond traditional architectures while saving capital expenditures (CapEx) and operating expenses (OpEx). Migrating existing designs from 1 Gigabit Ethernet downlinks and 10 Gigabit Ethernet uplinks over to 10 Gigabit Ethernet downlinks, with uplinks of 40 Gigabit Ethernet and 100 Gigabit Ethernet uplinks, increases the bandwidth by an order of magnitude while saving significant power. Unifying the fabric in the data center also reduces the number of devices needed while driving the volume toward 10 Gigabit Ethernet. These synergies ultimately lower the cost of 10/40/100 Gigabit Ethernet, lowering CapEx while at the same time lowering power and administrative requirements and thus lowering OpEx as well.

Beyond speeds and feeds, fundamental changes in architectures need to occur. Using virtualization and mobility of applications helps build the most fault-tolerant, highly efficient architectures. To achieve this level of virtualization and mobility, applications must be virtualized, and Layer 2 architectures must be made very flat and very scalable. With FabricPath running on the Cisco Nexus 7000, Layer 2 networks can now be made larger. This is important because the virtual machine (VM) gains mobility when it's able to keep its IP address. Large Layer 2 domains offer greater VM mobility, and Cisco FabricPath facilitates the scale of Layer 2 networks.

Beyond application virtualization, the Cisco Nexus 7000 delivers switch virtualization through the use of Virtual Device Contexts (VDCs). Each configured VDC presents itself as a unique device to connected users within the framework of that physical switch. The VDC runs as a separate logical entity within the switch, maintaining its own unique set of running software processes, having its own configuration, and being managed by a separate administrator.

When multiple VDCs are created in a physical switch, inherently the architecture of the VDC provides a means to prevent failures within that VDC from affecting other VDCs. So, for instance, an Open Shortest Path First (OSPF) process is isolated locally to that VDC. Process isolation within a VDC thus plays an important role in fault isolation and serves as a major benefit.

**Figure 1.**    NAM Appliance Deployment with Cisco Nexus 7000 Series Switches
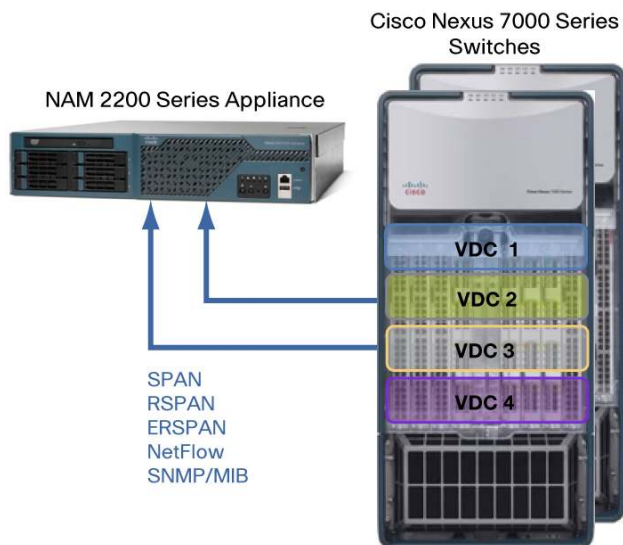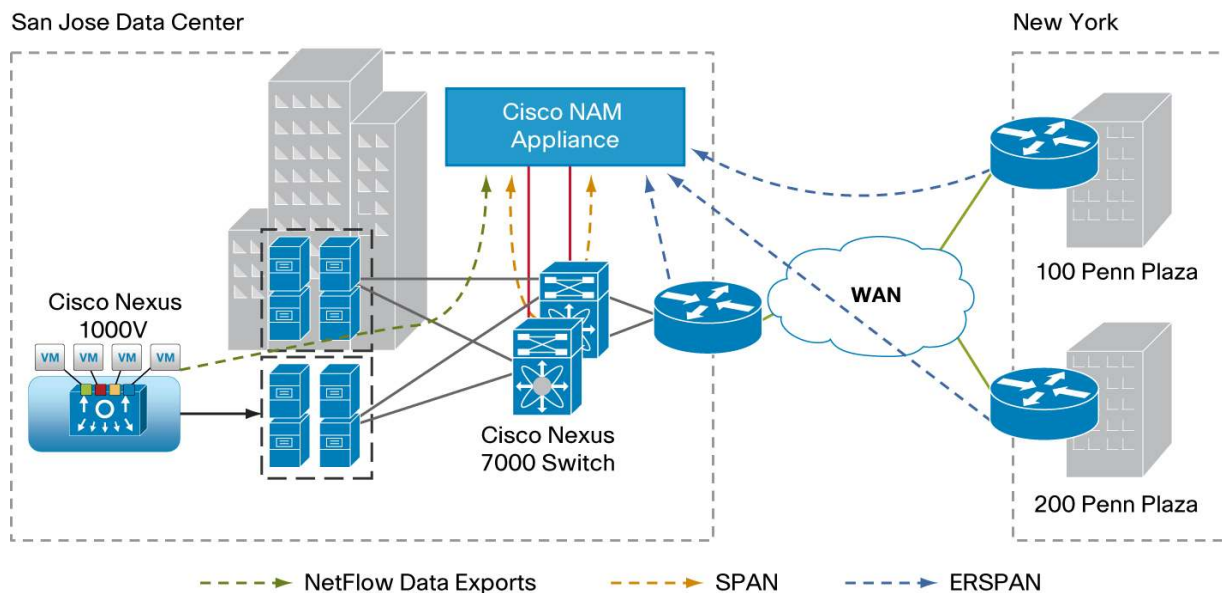


### Enhance Service Availability and Performance with NAM Appliance

Deployed with Cisco Nexus 7000 Series Switch, the Cisco NAM 2200 Series Appliance simplifies operational manageability in the data center by enhancing application visibility, accelerating performance troubleshooting, and offering comprehensive traffic analysis (Figure 1). The NAM Appliance allows you to manage each VDC independently. Multiple interfaces of the NAM appliance can be used to connect to one or more VDCs on the same chassis or multiple Nexus 7000 chassis, resulting in operational savings and offering flexibility to monitor specific traffic of interest.

NAM uses the rich embedded manageability features available on the Cisco Nexus 7000 Series Switch to gather comprehensive performance data and produce meaningful and actionable reports. It uses mechanisms, namely Switched Port Analyzer (SPAN), Remote SPAN (RSPAN), and Encapsulated RSPAN (ERSPAN) to get direct access to packets for deeper analysis. Traffic directed to Cisco NAM using SPAN can also be prefiltered with VLAN access control lists (VACLs) for analyzing specific applications, ports, or VLANs. The traffic can also be forwarded to NAM using passive taps when SPAN is not a viable option. With multiple Cisco Nexus 7000 Series Switches, taps offer a cost-effective, reliable, and flexible mechanism to monitor traffic and accurately characterize performance with NAM appliance.

NAM also accepts NetFlow Data Exports from a local or remote switch or router to collect application traffic flow details. NAM can process NetFlow exports from Cisco Nexus 7000 Series Switches to offer valuable insight into who, what, when, where, and how network traffic is flowing. In addition, the same NAM appliance can extend visibility into the VM network with Cisco Nexus 1000V deployment in the data center. NetFlow provides broad visibility into the network traffic to detect anomalous behavior, and a SPAN/RSPAN/ERSPAN session provides access to every packet on the wire for targeted and detailed analysis. Multiple traffic data sources help enable you to get the end-to-end visibility essential for troubleshooting performance issues and advancing optimization decisions across your physical or virtual machine network (Figure 2).

**Figure 2.** Extend visibility with NAM appliance from remote site to virtual data center

San Jose Data Center

New York

Cisco NAM
Appliance

Cisco Nexus
1000V

Cisco Nexus
7000 Switch

WAN

100 Penn Plaza

200 Penn Plaza

- - - → NetFlow Data Exports      - - - → SPAN      - - - → ERSPAN

NAM enhances operational agility, allowing quick access to critical packet-level and flow-level information in the data center to accelerate problem resolution, advance optimization decisions, and help ensure consistent application performance delivered to remote sites.

### Increase Operational Efficiency

Cisco NAM Appliance 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.

The network problems can be 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 captures and decodes can be used to perform a "deeper dive" to quickly spot the cause of performance degradation. Packet captures can also be triggered automatically resulting from violation of preconfigured performance thresholds. This powerful feature helps enable you to tackle complex performance issues using captured packet data for root-cause analysis, in real time or after the fact.

Historical analysis using the embedded database allows you to confront unanticipated performance issues. You can look back in time to when a performance-affecting event occurred, discover the facts, analyze the data to solve the problem fast, and also take corrective steps to prevent recurrence.

### Analyze Network and Application Usage

One of the cornerstones of the Cisco NAM Appliances is their ability to look inside the live packet to gather network usage information for applications, hosts/VMs, and conversations. Application monitoring identifies every application observed on the network, reports bandwidth consumed by each application, and detects which hosts are using which applications. Host and conversation monitoring provides bandwidth consumption per host/VM and shows which hosts or VMs are talking to each other along with the amount of traffic they are generating. It helps to spot bottlenecks before the network suffers blows to performance and availability. It also helps to improve resource allocation decisions to support committed services levels for the applications.

### Extend Operational Insight into the Virtual Machine Network

As mission-critical workloads migrate to virtual servers, visibility into the virtual switching infrastructure becomes critical to manage end-to-end service delivery. In addition to monitoring local traffic using SPAN from the Cisco Nexus 7000 Switch, the Cisco NAM Appliance can extend visibility into Cisco Nexus 1000V switch traffic to simplify manageability of the next-generation data center. Analyzing application traffic profiles and network usage behavior helps to troubleshoot and improve effectiveness of the network to support events such as dynamic resource allocations and virtual machine migrations. With NAM, you can also monitor a virtual machine even as it migrates from one host to another across the virtual switch domain. It helps to assess the impact of VM migration on network traffic and application response times.

### Enhance Application Performance Intelligence

Cisco NAM implements advanced analytics and high-precision time-stamping capabilities to characterize performance of TCP-based applications hosted in the data center. It includes a comprehensive set of transaction-based statistics such as response time, transaction time, data transfer time, and retransmission time. The performance data can be compiled and segregated on the basis of sites mirroring the network topology. The capability is essential when tracking service-level objectives tied to specific sites and quickly troubleshooting performance issues, minimizing any impact to the end users at the site. Analyzing the metrics also helps to improve application performance with effective use of control and optimization mechanism such as QoS and Cisco WAAS.

### 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.

## Conclusion

Deploying a NAM Appliance with Cisco Nexus 7000 Series Switches in the data center enhances the operational manageability of the network and allows IT to take full advantage of their switching infrastructure investments. Comprehensive real-time traffic and performance visibility combined with historical analysis help enable IT to enhance service levels, improve operational efficiency, and reduce operational cost.

For more information, visit http://www.cisco.com/go/nexus7000 and http://www.cisco.com/go/nam.

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