



Service Assurance of a Virtualized Server Environment with nGenius Virtual Agent

Executive Summary

Adoption of virtual server technology is well underway as enterprises and government agencies endeavor to reduce both capital expenses and operating costs associated with server deployments in their data centers. However, this has also had the unfortunate consequence of increasing the complexity and challenges of managing application performance in virtualized environments. This white paper will discuss the need for visibility into the virtualized servers, as well as the use of the nGenius Service Assurance Solution to simplify service delivery management across the physical and virtualized data center.

Introduction

According to the Yankee Group report titled “Anywhere Enterprise – Large: 2008 U.S. IT Infrastructure Survey,” adoption of virtual server technology is well underway. Consider the following survey findings:

- 42 percent of organizations surveyed were already using virtualized servers in their production networks.
- 22 percent had deployed server virtualization in their test and development labs.
- 12 percent were planning to deploy virtual servers in the next year.

A technology that gains this kind of traction in tight economic times is going to attract the attention of most IT executives. As they evaluate the financial implications of embracing the technology, IT management is going to scrutinize performance ramifications as well. The nGenius Service Assurance Solution (Figure 1) offers a simplified manner to extend the service delivery performance management capabilities of the physical network with visibility into virtualized servers.

nGenius Virtual Agent

The nGenius Virtual Agent is a software-based intelligent data source for virtual computing environments that delivers critical visibility into inter- and intra-VM traffic.

nGenius Service Assurance Solution

The nGenius Service Assurance Solution is a unified service delivery management platform providing comprehensive real-time network and application performance intelligence from packet-flow based nGenius Virtual Agents, nGenius Probes and nGenius InfiniStream appliances to enable unified assurance of the network, applications and users.

Benefits of Virtualized Server Technology

There are a number of financially lucrative reasons to invest in virtual server technology. Throughout the majority of the past decade, data center build out has been marked by “server sprawl,” that is, substantial server acquisition and deployment. At the start of the decade, application delivery was predominately client-server based. However, as service oriented architecture (SOA) approaches emerged, a more efficient design for web-based applications lead to a more efficient manner of delivering applications. This introduced added complexity from a management perspective, dictating the need to track, trend, and troubleshoot communications between web servers, application servers, and data base servers in SOA-type physical application networks. The nGenius Service Assurance solution has long provided the capabilities to passively monitoring the packet-flows between the physically disparate web, application and database servers for ongoing performance management analysis.

As server utilization in these systems typically fall in the five to fifteen percent range, organizations have been challenged to uncover ways to better use this under-utilized capacity, which has

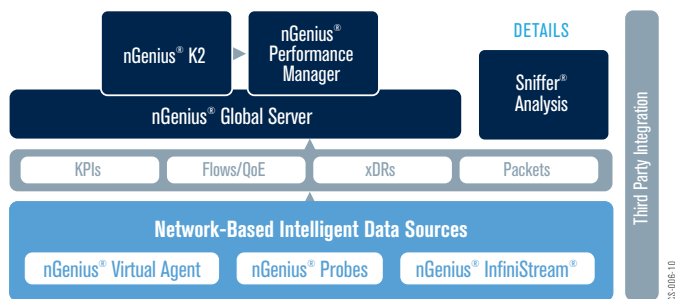


Figure 1: nGenius Service Assurance Solution relies on packet-based data sources, such as nGenius Virtual Agent, for visibility and analysis.

the potential to dramatically alter the financial outlay for data center expansion. Server virtualization has brought with it attractive and compelling benefits:

- Better Overall Performance.** Cross-server traffic within a virtualized environment has better performance than across a physical data center network.
- Efficient Physical Server Capacity.** Lots of available capacity left unused historically is now consumed by multiple virtual servers.
- Cost Savings.** Reduced capital expenditures with fewer physical servers required to perform the same functions. Operating costs are simultaneously lowered with fewer maintenance contracts.
- Green IT Initiatives.** Energy and power consumption, air conditioning demand and real estate footprint are all reduced as a result of fewer servers being required to perform the same basic functions.
- Ease of Administration.** IT staff is able to react to business requirements more quickly and maintenance can be performed within normal business hours.

Success of virtual server migration projects are declared in board rooms with statistics like:

- The tens of thousands of dollars in capital expenses saved by avoiding purchases of more servers
- Reduction of data center power consumption by 20%
- Lowered air conditioning demand
- Cost savings from 10% drop in electric bill dropped
- Thousands of dollars in OPEX spending avoided with the number and scope of maintenance contracts for our servers reduced

As IT organizations leverage application and server virtualization technologies to improve efficiency, reduce costs and ease the environmental impact of compute resources, there is one very real challenge - they lose essential visibility into the behavior and performance of the very applications that have been virtualized. What was once a rack of dedicated servers interconnected via network switches has now been consolidated into a single virtual server hosting many different applications with a virtual switch enabling communications between the virtual machines.

Technology and Business Challenges

The most critical technology challenge to overcome is gaining visibility into the activity within a virtual server platform. This visibility is critical to understanding how services are interacting between virtual servers within a physical device so tools for optimizing, troubleshooting service delivery and performance issues can be leveraged. Additional technology challenges include:

Gaining visibility into multi-tier applications deployed across one physical server or different physical servers. When response time degradations occur in a virtualized server environment, they may be due to multi-tier applications deployed over multiple virtual servers that exist on the same physical server or on separate physical servers. In order to complete the transaction, data needs to exit one virtual environment onto a physical network in order travel to another virtual environment.

Tracking and troubleshooting dynamic reallocation in virtualized environments. A benefit of server virtualization is dynamic reallocation of resources based on business or technology requirements. Applications are easily and quickly moved within the same physical server or from one physical server to another to balance how resources are being consumed. However, this flexibility makes continuous monitoring, tracking and trending of virtualized servers exponentially more tasking. As new servers are added or moved, traffic patterns change, and IT managers are challenged to find and resolve service delivery problems.

Combining Performance Management of Virtual and Physical Server Environments in Data Centers. Once visibility into the virtual server environment is achieved, perhaps the next most important challenge to overcome is how to consistently manage, optimize and troubleshoot virtualized applications alongside the physical network to achieve end-to-end service delivery optimization. In order to gain a clear understanding of application service delivery, IT staff requires visibility both within the virtualized server environment as well as across the physical network.

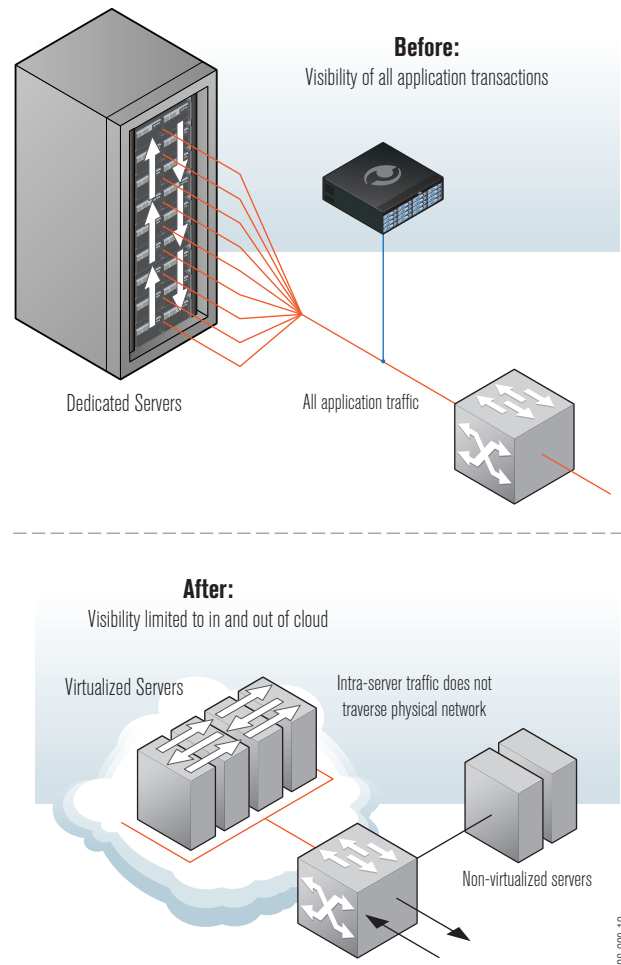


Figure 2: The before and after affect of management in physical networks with racks of dedicated servers versus a virtualized server.

From a business perspective, as finance and facilities managers are tracking metrics and quoting the success of the virtual server roll outs, many network engineers and architects are left challenged to address issues relevant to their business areas:

- Validate changes in performance of the applications in virtualized server environments as compared to performance when delivered via standalone application servers.
- Quantify response time for applications running on virtual servers.
- Develop processes for researching performance degradations in virtualized servers.
- Establish parameters to manage the network before virtualized server movement causes problems.
- Establish management practices for end-to-end performance analysis across the data center and out through the enterprise once a critical mass of the business services are moved to virtual servers.

A unified performance management solution is able to measure response time of business application services delivered via either dedicated servers or virtualized servers to definitively track and prove performance improvements.

Packets Represent the Best Vantage Point

To meet the technology and business challenges described head on, IT organizations need two things: first, visibility into actionable data in the virtualized environment. Second, established processes using that visibility to predict and preempt service degradations and accelerate problem resolution when they do occur. Packet flows represent the best source of visibility for operational intelligence and process-driven performance management. Packet flows within the physical server as well as those coming into and leaving the physical server provide a rich data store of metrics for analysis. To gain an end-to-end view of application performance, IT organizations can leverage this traffic and combine it with metrics from monitoring the packet flows in the physical network between switches, routers, servers, databases, and end-user workstations.

NetScout developed technology to passively monitor the packets traversing the global modern IP networks using nGenius Probe and nGenius InfiniStream data sources, non-intrusive, high performance, real-time and historical monitoring devices. The nGenius Virtual Agent, deployed in virtual machines supporting VMware technology, also leverages packets as the best data source to collect and analyze such metrics as traffic and application utilization, network talkers, conversations, error conditions, response time, as well as perform on-demand packet captures from virtualized computing environments. Packets offer a better, more complete method of application identification of such key applications as web-based services.

USE CASE: Physical to Virtual Machine Conversion

Business Challenge:

A large, highly visible migration was underway. Physical application servers located at remote sites were being moved to a centralized data center. The remote physical servers were being virtualized as part of that migration.

Solution:

To ensure visibility and service availability, NetScout instrumentation was strategically deployed throughout the network. nGenius Probes were in the remote offices and on the a WAN, nGenius InfiniStream appliances were implemented in the core, and nGenius Virtual Agents were deployed in the VMware servers to maintain end-to-end visibility throughout the migration.

Business Result:

End-to-end visibility was seamless during the migration, enabling the team to confirm the presence of newly moved applications to virtualized servers in real time and protect service delivery to users.

nGenius Virtual Agent Delivers Visibility

The nGenius Virtual Agent provides a new, cost-effective software-based intelligent data source that extends the reach of the nGenius Service Assurance Solution to address the needs and challenges of gaining visibility into application performance and behavior inside the virtual computing environment. An extension of NetScout's intelligent data source family, the nGenius Virtual Agent complements existing nGenius hardware instrumentation strategies, delivering the following functionality:

- **Extends core NetScout technology** by applying mature, proven nGenius Probe technology to virtualized environments.
- **Provides packet-flow monitoring of traffic** inside virtualized servers using NetScout's common data model (CDM) format that provides metadata for unified views of services across virtual and physical infrastructure.
- **Monitors the delivery of multi-tier applications** across virtual machines and virtual servers.
- **Enables key performance indicator (KPI) analysis** and alarming within virtualized servers for early warning notification of application response time and error problems.
- **Complements physical network metrics** collected by nGenius InfiniStream appliances with virtualized application data for views, reports and analysis of traffic both within and between virtual machines.
- **Delivers on-demand packet capture** in order to give IT managers a way to gather and analyze actual packets from within the virtual environment.
- **Leverages a simplified, single-package installation** of operating system and nGenius Probe software optimized for the virtual environment to provide an efficient and cost-effective means of gaining visibility into the virtual environment.

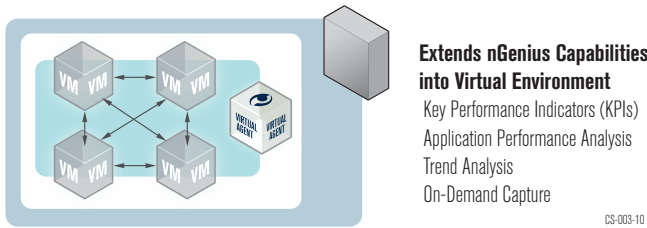


Figure 3: The nGenius Virtual Agent is an extension of nGenius capabilities.

Extending NetScout CDM Technology for Analysis in Virtual Servers

Common Data Model (CDM) technology, originally developed by NetScout for use in the nGenius Probe and nGenius InfiniStream appliances, is a ubiquitous set of metrics such as traffic statistics, hosts, conversations, application utilization, error conditions, and response time, that are used to manage and evaluate performance of key business services from the physical network vantage point. The nGenius Virtual Agent uses this same CDM technology to collect metrics within the virtualized server environment.

CDM directs how data is collected and stored in a common structure regardless of whether data is being analyzed from a physical or virtual environment. In a virtual server, CDM collects statistics by spanning a vSwitch, similar to traditional port spanning of physical switches in a network.

In virtual server environments, the CDM technology in the nGenius Virtual Agent enables it to:

- Monitor and track applications – including well-known application services, complex applications, such as SAP, or customized SOA-based applications – for unique business purposes
- Analyze hosts and conversations by overall utilization and by applications
- Alarm on key performance indicators
- Measure application response times
- Perform on-demand packet captures

With packet-based data collected by nGenius Virtual Agent, as well as nGenius Probes and nGenius InfiniStream appliances, IT organizations can use nGenius K2 Service Delivery Manager and nGenius Performance Manager software to perform real-time analysis and alarming on predictors of degradations. By giving IT organizations the tools they need to focus on what is most important – assuring optimal customer experience – the nGenius Service Assurance Solution breaks through the confusion and complexity that defines the virtualized server technology and complex data center environments. CDM technology takes advantage of the networked packets which offer the best, most complete method of application identification of key applications and services.

Unified Visibility with nGenius Service Assurance Solution

The nGenius Virtual Agent extends the nGenius® Service Assurance Solution into virtualized environments with a unified view of network and application performance across the modern IP data center network. The nGenius Virtual Agent works in conjunction with nGenius K2 and nGenius Performance Manager to report on key performance indicators (KPIs) perform on-demand packet capture, send threshold-based alarms, and provide end-to-end service delivery information for virtualized applications. This enables nGenius users to optimize data center infrastructure investments, protect against service degradations, and simplify operations of complex virtual and physical environments.

The greatest value of the nGenius Virtual Agents are realized when used in combination with nGenius InfiniStream™ appliances positioned to monitor and capture traffic in strategic areas of the data centers. For instance, IT organizations may monitor segments entering and exiting the virtual environment and / or at the point traffic hits the WAN links leaving the data center. Essential metrics are collected that enable the nGenius Performance Manager to provide a unified, end-to-end view to manage all tiers of service delivery from the physical network within and between virtual environments.

Behavioral analytics and alerts in nGenius K2 allow IT managers with the nGenius Virtual Agent deployed in virtual machines to detect new virtual application instances and track dynamic location changes that are challenging to determine. This correlation and visibility into data center services enables unified:

- **Application and Network Performance Management** - View service delivery across virtual and physical environments for a comprehensive, unified view of application and network performance to achieve unparalleled visibility into complex hybrid data centers.
- **Infrastructure optimization and capacity planning** - Recognize usage trends and identify where capacity may be reaching its upper limits, delivering critical insight into how the service delivery environment is growing, which areas need to be addressed from a capacity perspective, or how applications or users can be redistributed to balance the load of virtual applications across physical server farms.
- **Service and policy validation** - Validate new services and adherence to service delivery policies by delivering real-time and historical views of newly implemented virtualized services in order to determine if they are performing as specified.
- **Early warning analytics** - Automatically identify changes in physical location, additions, and unavailability of application virtual machines in order to properly address service delivery issues prior to the end user being impacted.

USE CASE: Customer-Facing Website not Responding

Business Challenge:

An IT organization recently initiated server virtualization for several of their applications. In the first wave, they virtualized all the web servers, all the application servers and some database servers, as well as making some firewall changes. Following the initial transition, issues were reported with the customer-facing web site and these issues were quickly escalated.

Solution:

Although this was not a network problem, a network engineer, as part of the IT SWAT team, was able to use the nGenius Service Assurance Solution to identify the problem for the server team to work further. He collected and analyzed trace files from the nGenius InfiniStream appliances to confirm that the issue was not in the network or firewall. In the process he uncovered some TCP resets on the database servers. The available information pinpointed the virtualized servers as the source of the problem.

Business Results:

The SWAT team deployed nGenius Virtual Agents with on-demand packet capture in the newly virtualized servers. Analysis via the nGenius Service Assurance Solution identified database time out errors which the server team was able to correct. The effort to resolve this problem rapidly demonstrated the value of using a single tool for both the virtualized server environment and the physical network, as well as its ability to foster strong collaboration among the IT staff.

How it Works

The nGenius Virtual Agent technology works much like any other CDM-based monitoring data source for packet flows. VMware virtualized computing environments, the most broadly used virtual server technology, no longer needs to be a black hole because the nGenius Virtual Agent provides an invaluable viewpoint into these environments. The following identifies the logical steps involved in deploying and then using the nGenius Virtual Agent in VMware environments:

1. The nGenius Virtual Agent is deployed within a physical machine that is running server virtualization software.
 - The nGenius Virtual Agent will use a virtual SPAN port on the vSwitch and be configured as a monitoring network port group on that vSwitch to provide visibility to the switch packet flows in the VMware server environment.
 - For VMware ESX and ESXi environments, the nGenius Virtual Agent can be configured in a port group in "promiscuous mode". When promiscuous mode is enabled, all traffic flowing through the vSwitch—including local traffic between virtual machines and remote traffic originating from outside the virtual host—is sent to the port group in promiscuous mode.
2. Packet-flow statistics are created from monitored traffic within the virtualized server using CDM technology for consistency and scalability.
3. The nGenius Virtual Agent leverages the vSwitch that is associated with a physical Ethernet NIC to be used by the nGenius Virtual Agent management port to send data to the nGenius Server where it is made available to a variety of management analysis applications.
4. nGenius Virtual Agent is an integral part of the nGenius Service Assurance solution, comprised of nGenius Performance Manager and nGenius K2 Service Delivery Manager applications, for enterprise-wide analysis.
 - Events identified and alarmed on from the nGenius Virtual Agent and/or the nGenius Performance Manager and nGenius K2 Service Delivery Manager can also be sent industry-leading element management systems (EMS) for consolidated event viewing.
 - NetScout has architected tight integrations between the nGenius Service Assurance Solution and HP NNM/NNMi, HP BAC, and HP Operations Manager; IBM NetCool, IBM Tivoli NetView, IBM Tivoli Enterprise Console; and EMC SMARTS

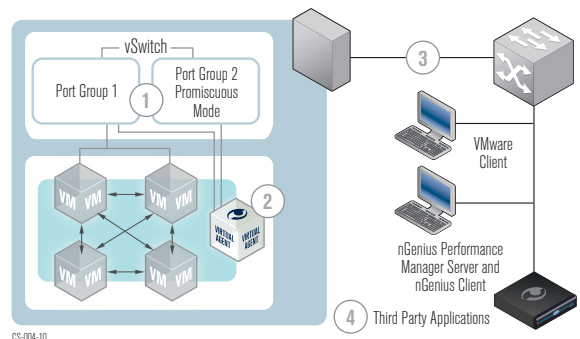


Figure 4: The steps involved in monitoring, recording, data mining, analyzing and reporting on packets by the nGenius Virtual Agent

When Virtual Machines Move

One of the recognized benefits of virtualized environments is ease of movement of virtual servers and applications. Gone is the backbreaking movement of 70 to 100 pound physical servers within data centers. Rather, in a virtualized server environment, virtualized applications can move either within the same server or from one physical server to another with little more than a few key strokes. However, this dramatically increases the complexity in managing performance. When a server or application moves, it can cause a cascade effect of significant and unexpected problems resulting in performance degradations, disruptions and poor users experience.

Leveraging packet data monitored by the nGenius Virtual Agent, nGenius K2 Service Deliver Manager with behavior analytics and alerting capabilities that can detect new virtual application instances and track dynamic location changes that would be otherwise difficult to determine. The ability of nGenius K2 to analyze nGenius Virtual Agent metrics provides the ability to recognize:

- The spawning of new virtualized applications
- Conditions that indicate changes to application location. In the case of VMware, this is called vMotion.
- When virtual services are no longer available or have been removed

These capabilities enable IT to rapidly address service delivery issues prior to end users being impacted.

USE CASE: Impact of Dynamic Application Movement

Business Challenge:

An enterprise experienced a dramatic increase in application response time following a recent server migration utilizing vMotion.

Solution:

The IT organization received a KPI alarm from nGenius K2 indicating an increase in response time for a key business application. Investigation utilizing the nGenius Service Assurance Solution with metrics and packet captures from the nGenius Virtual Agent uncovered that not all VMs were migrated to the new server before the old server was decommissioned.

Business Results:

The network engineers collaborated with the VMware administrator and server team to migrate the remaining VMs to rapidly restore response time to normal levels.

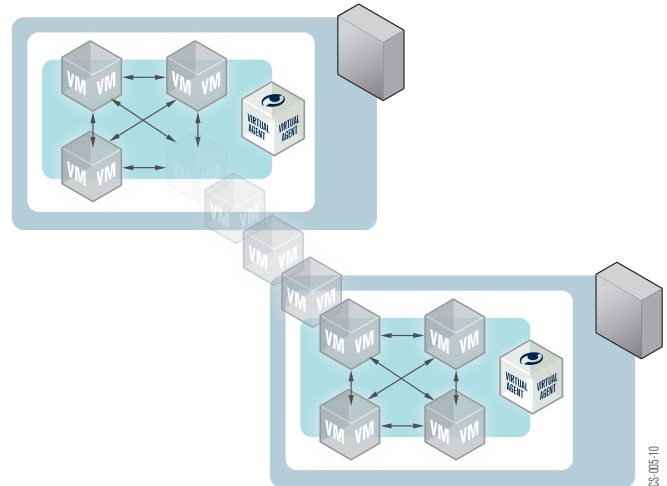


Figure 5: nGenius Virtual Agent provides nGenius K2 with the information necessary to pinpoint dynamic application additions and movements.

Summary

The nGenius Virtual Agent is a cost-effective addition to the nGenius Service Assurance Solution. It extends visibility into service delivery traffic across the vSwitch to provide key metrics that aid in assuring business application availability to the end user. Adding the nGenius Virtual Agent to your nGenius Service Assurance solution will add immediate value:

- Minimize the impact of performance degradations on the business by resolving virtual service delivery issues faster
- Improve end user experience through proactive planning and infrastructure optimization
- Avoid service-impacting service delivery issues stemming from inside the virtual environment with early warning notification of brewing performance problems
- Efficiently locate the root cause of service delivery issues that impact critical business applications using application profiling and back-in-time analysis

In short, the nGenius Virtual Agent increases the value and leverage of the nGenius Service Assurance Solution by extending service delivery management capabilities across the global enterprise – from virtual environments within the data center to branch office located in remote locations.

Conclusion

Organizations implementing virtualized server technologies need a clearer understanding of end user experience of the services they are receiving in today's dynamic virtual environment. Practices around virtualization are significantly changing the way network services and applications are enabled, configured, and managed, particularly in these cost-sensitive times.

The nGenius Virtual Agent has extended the monitoring and analysis technology of nGenius Service Assurance Solution into the virtualized servers. Complete end-to-end views of intra-server activity, inter-server packet flows and data center-wide application traffic is paramount to protect the overall service delivery of essential business applications. This unified transparency and visibility optimizes virtual infrastructure investments, protects against virtualized service degradations, and simplifies operation of complex virtual and physical environments.



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