

# The 2016 Guide to SDN and NFV

## Part 7: The SDN and NFV Ecosystem

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## Introduction

Over the last couple of years the hottest topics in networking have been Software Defined Networking (SDN) and Network Functions Virtualization (NFV). While both enterprises and service providers have shown great interest in these topics, the vast majority of organizations are still either on the sidelines or in the analysis stage of adoption. The primary goals of **The 2016 Guide to SDN & NFV** (The Guide) are to eliminate the confusion that surrounds SDN and NFV and to accelerate the analysis and potential adoption of these new architectural approaches.

The Guide will be published both in its entirety and in a serial fashion. This document is the seventh of the serial publications. It will focus on the SDN and NFV ecosystem. Below is a listing of all of the publications that comprise The Guide:

1. [A SDN Status Update](#)
2. [The Use Cases and Business Case for SDN](#)
3. [The Operational Impediments to Implementing SDN](#)
4. [A NFV Status Update](#)
5. [Architectural Considerations and Use Cases for NFV](#)
6. [The Operational Impediments to Implementing NFV](#)
7. The SDN and NFV Ecosystem
8. An Executive Summary of The Guide

The Guide is based in part on [The 2015 Guide to SDN and NFV](#) (The 2015 Guide). To limit the size of The Guide, some of the introductory material, such as a description of the basic SDN architecture that was contained in The 2015 Guide has been eliminated. The 2015 Guide, however, is still available online.

Even though there is a lot of overlap in the SDN and NFV ecosystems, they are presented in this chapter as if they are separate ecosystems. An exception to that is the open source and other industry-wide communities that are driving the evolution of SDN and NFV.

## The SDN Ecosystem

One measure of the extent of the SDN ecosystem is that there are approximately 130 full time members of the Open Networking Foundation ([ONF](#)) along with 32 startup members. This subsection of The Guide identifies the major categories of organizations that are part of the SDN ecosystem and briefly discusses the value proposition of each of the categories. This subsection of The Guide also identifies representative members of each category of organization that are part of the SDN ecosystem. The representative members that are identified either currently provide the indicated functionality or can be expected to provide the indicated functionality in the near term.

### Merchant Silicon/Chip Vendors

**Value Proposition:** These vendors are in a position to provide hardware support in switching chips for protocols such as OpenFlow and VXLAN. This will have the effect of increasing the speed and scalability of solutions. Longer term there is also the possibility of at least some of these vendors developing cost-effective switch silicon that is optimized for OpenFlow and other controller/switch protocols.

**Representative Members:**

- Broadcom
- Intel
- Marvell
- Mellanox

### HyperScale Data Centers

**Value Proposition:** Part of their value proposition is that these high-profile vendors either already are or are likely to be early adopters of SDN. As a result, these vendors are having a significant indirect impact on the development of SDN. In addition, vendors such as Google, Yahoo and Facebook are board members of the ONF. As such, these vendors directly influence the work of the ONF in general and of the evolution of the OpenFlow protocol and the northbound API in particular.

**Representative Members:**

- Yahoo
- Google
- Facebook

### Telecom Service Providers

**Value Proposition:** Part of the value proposition of this class of vendors is similar to the value proposition of hyper-scale data center providers. For example, these vendors either already are, or are likely to be early adopters of SDN in order to support their cloud offerings. In addition, vendors such as Deutsche Telekom, NTT Communications and Verizon are also board members of the ONF.

A preceding chapter of The Guide ([The Use Cases and Business Case for SDN](#)) discussed the interest that IT organizations have in either using SDN in the WAN or in acquiring a service from a WAN service provider that is based on SDN. Responding to that interest, vendors like [Pertino](#) (recently acquired by Cradlepoint) are currently using SDN and Network Function Virtualization (NFV) to enable them to offer a new generation of WAN services. AT&T has announced its interest in using both SDN and NFV to change how it offers services to its [customers](#) and [Masergy](#) has implemented a number of SDN-based services.

Representative Members:

- Pertino
- Deutsche Telekom
- NTT Communications
- Verizon
- AT&T
- Masergy

## Switch Vendors

Value Proposition: Relative to SDN, the majority of these vendors take at least some of the control functionality that has typically resided in their switches and now rely on that functionality being provided by a SDN controller. In addition, these vendors implement protocols in their switches that enable those switches to communicate with an SDN controller. These vendors are increasing reliant on merchant silicon as the basis for major portions of their switching product lines.

Most of the vendors in this category represent traditional switch vendors. An exception to that is Pica8. Pica8 provides a switch that is comprised of its network operating system loaded onto commodity white box, bare-metal switches.

Representative Members:

- Alcatel-Lucent
- Cisco
- Dell
- HP
- NEC
- PICA8

## Network and Service Monitoring, Management and Automation

Value Proposition: Most, if not all of the providers of SDN solutions will provide at least some ability for the consumers of those solutions to manage the solutions that they provide. The members of this category of the ecosystem don't provide SDN solutions themselves. The vendors listed below either currently provide, or soon will provide management functionality that isn't offered by the providers of SDN solutions and/or they integrate the management of these solutions into a broader management structure.

Representative Members:

- NetScout
- QualiSystems
- EMC
- CA

## **Providers of Network Services**

Value Proposition: The members of this category provide network services such as security and optimization that are part of the overall SDN/NFV solution.

Representative Members:

- A10
- Radware
- Sonus
- HP
- Riverbed
- Citrix
- Cisco

## **Testing**

Value Proposition: The members of this category either provide products that enable equipment manufacturers and others to test SDN solutions or they provide the testing themselves.

Representative Members:

- QualiSystems
- InCNTRE
- Ixia
- Spirent

## **Providers of SDN Controllers**

Value Proposition: These vendors provide the controllers that are part of any SDN solution.

Representative Members:

- NEC
- Nuage Networks
- HP
- Cisco
- Sonus
- Open Daylight Consortium
- ON.Lab
- VMware/Nicira

## **Providers of Telcom Service Provider's Infrastructure/ Optical Networking**

Value Proposition: These vendors are providing the infrastructure that enables telecom providers to leverage SDN in their service offerings.

Representative Members:

- ADVA Optical Networking
- Ciena
- Cyan (Recently acquired by Ciena)
- Infinera
- ZTE Corporation

## **Server Virtualization Vendors**

Value Proposition: These vendors provide the vSwitches and the hypervisor vSwitch APIs for third party vSwitches that are a key component of SDN and Network Virtualization solutions.

Representative Members:

- Citrix
- Microsoft
- VMware

## The NFV Ecosystem

This subsection of The Guide identifies the major categories of organizations that are members of the NFV ecosystem and briefly discusses the value proposition of each of the categories. This subsection of The Guide also identifies representative members of each category of organizations that are part of the NFV ecosystem. The representative members that are identified either currently provide the indicated functionality or can be expected to provide the indicated functionality in the near term.

As a point of reference, an extensive list of NFV-related acronyms can be found in [Network Functions Virtualization \(NFV\): Use Cases](#).

### Telecom Service Providers

**Value Proposition:** Service providers are interested in NFV as a means of improving their ability to deliver services to their customers in a timely, cost-effective, and reliable manner. NFV, possibly in conjunction with SDN, has the potential to enable a new generation of services spanning a wide range of Virtual Network Functions (VNFs) that can generate new revenues from other service providers, enterprises, and residential customers.

**Representative Members:**

- AT&T
- Cablelabs (representing the cable industry)
- France Telecom S.A.
- Telefonica S.A.
- Masergy
- NTT Corporation

### Virtualized Network Service and Cloud Service Vendors

**Value Proposition:** The members of this category provide VNFs that can be hosted on either the customer's server platforms or provided in the form of a Virtual Network Function as a Service (VNFaaS). Most of these organizations are focused on the communications service providers either as end users or as providers of services to enterprise and residential end users.

**Representative Members:**

- Sonus
- Allot Communications Systems Ltd
- Mavenir Systems UK Ltd
- NetNumber Inc.
- Virtela Technology Services Inc.



## SDN Controller Software Vendors

SDN can be employed by service providers as a means of implementing a Network Functions Virtualization Infrastructure (NFVI) for cloud IaaS services and as a NFVI within their access and core networks. Some SDN implementations provide flow mapping functions that steer traffic flows to VNFs in the proper sequence.

Representative Members:

- Adara Networks Inc
- ConteXtream Inc.
- NEC

## NFVI Providers

Value Proposition: The members of this category provide the virtual networking infrastructure including Virtual Switching (Open vSwitch, Linux Bridge), Virtual Networking (IP Forwarding, Virtual Routing, Filtering, NAT, Link Aggregation, etc.), and Overlays such as VXLAN, VLAN, GRE, etc. for multi-tenancy. The NFVI also includes physical NIC poll mode drivers for outside communication and virtual NIC host drivers (such as Virtio) for communication with VMs.

Representative Members:

- 6Wind
- BTI Systems
- Wind River

## Orchestration Software Vendors

Orchestration generally involves the assembly of various software components (e.g., VNFs) and hardware components of the end-to-end infrastructure to deliver and manage a defined service. Orchestrators often employ layers of abstraction that facilitate the automation of provisioning, configuration, optimization, and other repetitive operational tasks. Orchestration is another potential solution for mapping flows through VNFs and can be deployed either in conjunction with SDN or independently of SDN.

Representative Members:

- Anuta Networks Inc.
- Cadzow Communications
- CENX Inc.

## Network Monitoring, Management and OSS/BSS Vendors

Value Proposition: The members of this category of the ecosystem will provide management functionality that extends to virtualized infrastructures and VNFs and integrates that functionality into a broader management structure.

Representative Members:

- NetScout
- Amdocs Software Systems Ltd
- Comptel Corporation
- Comverse Network Systems Europe B.V.
- EMC
- MetraTech Corp

## Hypervisor Vendors

Value Proposition: These vendors provide the VMs, vSwitches, and the hypervisor vSwitch APIs for third party vSwitches that are a key components of SDN and NFV infrastructure solutions.

Representative Members:

- Citrix Systems Inc
- Oracle
- Virtual Open Systems

## Test Equipment Vendors and Test Services

Value Proposition: The members of this category either provide products that enable equipment manufacturers and others to test NFV solutions, or they provide the testing as a service.

Representative Members:

- QualiSystems
- European Advanced Networking Test Center
- JDSU Deutschland GmbH
- Spirent Communications
- Tektronix GmbH Co KG
- Yokogawa Europe B.V.

## Open Source Communities

Value Proposition: These organizations create working prototypes of key SDN and NFV functionality. Part of the value proposition of these communities is that the prototypes that they develop help to better define the underlying technological challenges. Another part of their value proposition is that the prototypes they create are often used as the basis of commercial products which because they are based on open source solutions can potentially be brought to market more quickly and more cost effectively.

As referred to earlier, the open source community is also very active in the development of SDN.

Representative Members:

- OpenSwitch

- OPNFV
- OpenStack
- OpenDaylight
- ON.Lab

## **Standards Bodies and Related Communities**

Value Proposition: Some of the members of this category develop use cases, architectures and drive POCs. Other members of this category create standards for protocols such as OpenFlow or VXLAN. These standards form the basis for enabling products from disparate vendors to interoperate.

As was also referred to earlier, many members of this category are also very active in the development of SDN.

Representative Members:

- ETSI
- 3GPP
- MEF
- ATIS
- IETF
- TM Forum

## Key Vendors

Below is a profile of the sponsoring vendors that focuses on where they fit in the ecosystem, the value add that they provide and the proof points of that value add.

### NetScout

#### Where do you fit in the SDN and/or NFV ecosystem?

NETSCOUT fits into the SDN and NFV ecosystem as a leading real-time service assurance solution provider. According to NETSCOUT, while many of the traditional application and network performance management vendors claim to offer solutions for virtualized and hybrid environments, the reality is that most have just repackaged their existing solutions without the ability to monitor traffic within complex virtual environments. As a result, they have many blind spots when it comes to understanding the root cause of service performance issues. Monitoring traffic into and out of a virtual environment is “table stakes,” but falls well short of meeting the needs of the IT department or service provider. NETSCOUT believes that in order realize the full potential of SDN/NFV CapEx and OpEx efficiencies, organizations need a comprehensive service delivery monitoring solution that expands visibility within virtualized infrastructures and between virtual machines.

Truly managing and understanding the user experience in physical, virtual and hybrid infrastructures requires the ability to have an end-to-end view of the network and services. NETSCOUT stated their belief that using traditional monitoring tools will not suffice as these tools do not provide a common situational awareness. Consequently, users pay the penalty for this as service availability and performance are compromised.

NETSCOUT believes that by extending service assurance to SDN/NFV ecosystems, enterprises and service providers can accelerate digital transformation initiatives. The best way to do that is by proactively collecting, organizing and contextually analyzing traffic data in real time. By reducing service downside risk through continuous monitoring of traffic-based data and real-time analysis, it's possible for organizations to compete and innovate with confidence.

#### What is your value add?

NETSCOUT believes that its' value add in virtualized and SDN/NFV environments is exactly the same as in physical environments, magnified by the extent and breath of the new challenges.

That value add includes:

- Adaptive Service Intelligence™ (ASI) technology to understand the interrelationships and dependencies of the physical and virtual service delivery environment
- Reduced MTTR with proactive service triage
- Enhanced IT efficiencies through a common operational view
- Scalable service assurance architecture

NETSCOUT stated that their solution unlocks the power of traffic-based data to gain real-time insight and to deliver service assurance for the most demanding physical, virtual and hybrid

networks. NETSCOUT justifies that statement by pointing out that today ASI technology runs on NETSCOUT's physical and virtual Intelligent Data Sources. This enables NETSCOUT to extend the monitoring of both enterprise and carrier-scale service delivery infrastructure into both virtual and hybrid environments. NETSCOUT added that their solution provides a holistic view of the entire data center – including VMware NSX resources. These environments include physical and virtual application workloads that exchange greater volumes of traffic between themselves and that also experience a higher risk of service degradations. In both a physical and virtual environment, service degradation often results in a lower quality of end-user experience and may result in increased churn for service providers.

In a virtual environment, there is an additional challenge of collecting management data while having minimal impact on compute and networking resources. This puts significant pressure on service assurance solutions to be as efficient as possible with consuming both compute and networking resources while exchanging monitoring information. NETSCOUT stated that they excel in this area with their ASI technology and the ability to capture, process, and create highly scalable metadata in real time as IP traffic traverses physical or virtual links.

#### What are the proof points?

NETSCOUT stated that their extensive customer base combined with its integration with VMware's NSX environment means that the company is uniquely positioned as a service assurance leader in the virtual and hybrid environments. A 2015 survey of NETSCOUT customers conducted by [TechValidate](#), a leading "voice of the customer" researcher, revealed the following:

- Four out of five customers cut Mean Time to Knowledge (MTTK) by 80% or more and reduced operational expenses
- 91% of customers get real-time, actionable traffic-based intelligence with ASI technology
- 100% of customers surveyed improved the identification of network issues

In the service provider space, NETSCOUT's nGeniusONE™ Service Assurance platform provides wireless, cable, and wireline network operators with end-to-end network and service performance management. The nGeniusONE platform provides both enterprises and operators a single monitoring infrastructure for hybrid environments of today and the all virtual environments of tomorrow. In addition, NETSCOUT has been at the forefront of working with operators as they test and trial virtual infrastructure.

## Cisco

### Where do you fit in the SDN and/or NFV ecosystem?

Cisco believes it is a leader in the SDN and NFV ecosystem. Cisco markets an array of SDN solutions, addressing the requirements and use cases of a broad spectrum of customers across a wide range of markets. Cisco has stated its extensible environment includes a broad and growing number of ecosystem technology partners including compliant network, security and services devices, monitoring, analytics and DevOps solutions, as well as cloud automation platforms.

### What is your value add?

According to Cisco, their SDN solutions offer a complete portfolio providing choice in automation and programmability for customers. Cisco stated that their solutions are based on open APIs, standards and a broad ecosystem for three approaches: programmable networks, programmable fabrics and a turnkey approach with Cisco Application Centric Infrastructure (ACI). Cisco believes that this approach enables customers to choose the implementation option that best meets their IT and business goals by extending the benefits of programmability and automation across the entire Cisco Nexus switching portfolio.

**Cisco ACI:** Based on an application centric policy model, ACI provides automated, integrated provisioning of both underlay and overlay networks, L4-7 services provisioning across a broad set of ecosystem partners, and extensive telemetry for application level health monitoring.

**Programmable Fabric:** Cisco stated that it is providing scale and simplicity to VXLAN Overlays with a standards based approach, based on a Multipoint BGP EVPN Control Plane, on Nexus switches to scale out VXLANs, and simplified provisioning and management of these switches via an overlay management and provisioning system called Virtual Topology System (VTS).

**Programmable Network:** Cisco is offering programmability and accessibility to the Nexus switches to enable them to automate provisioning and configuration, as well as integrate with orchestration tools.

### What are the proof points?

#### Customer Case studies

- Bowling Green University <http://www.cisco.com/web/about/success-stories/docs/bowling-green.html>
- Du: <http://www.cisco.com/web/about/success-stories/docs/du.html>
- KPIT Technologies: <http://www.cisco.com/web/about/success-stories/docs/kpit.html>
- Qatar University: <http://www.cisco.com/web/about/success-stories/docs/qatar-university.html>
- More case studies here: <http://www.cisco.com/c/en/us/solutions/data-center-virtualization/application-centric-infrastructure/customer-case-study-listing.html>

ROI Case Studies / Analyst reports

- IDC: Pulsant Delivers Agile and Cost-Effective Hybrid Cloud Services with Cisco ACI
- IDC: Symantec Delivering on Its Strategic Vision with Next Generation secure Data Center powered by ACI
- Forrester Report: The Total Economic Impact TM Of Cisco Application-Centric Infrastructure (ACI)

#### Industry Awards

- 2015 Best of Interop | Category SDN - Cisco APIC:  
[http://www.networkcomputing.com/interop/prizewinning-it-products-best-of-interop-2015-/d/d-id/1320139?image\\_number=8](http://www.networkcomputing.com/interop/prizewinning-it-products-best-of-interop-2015-/d/d-id/1320139?image_number=8)  
<http://www.interop.com/lasvegas/special-events/best-of-interop-awards.php>
- 2015 Winner Excellence in SDN – Cisco APIC  
<http://www.nfvzone.com/topics/newsfeed/articles/400677-winners-the-2015-sdn-excellence-award-announced.htm>
- 2014 Winner infoTECH Spotlight Data Center Excellence Award  
[infoTECHhttp://news.tmcnet.com/news/2014/12/18/8128268.htm](http://news.tmcnet.com/news/2014/12/18/8128268.htm)
- 2014 Best of Interop 014 | Category: Data Center - Cisco Nexus 9516  
[http://www.interop.com/lasvegas/special-events/best-of-interop-awards.php?itc=we\\_ilv\\_le\\_ilv\\_drp\\_text](http://www.interop.com/lasvegas/special-events/best-of-interop-awards.php?itc=we_ilv_le_ilv_drp_text)
- 2014 Best of Interop Tokyo – Cisco ACI and Nexus 9000 Best of Interop Tokyo 2014 – Cisco ACI and Nexus 9000

#### Tech Review/ Articles Customer Business Outcomes

- InfoWorld Tech Review: “Cisco ACI shakes up SDN” – Nov 2015  
<http://www.infoworld.com/article/3003903/sdn/review-cisco-aci-application-centric-infrastructure-shakes-up-sdn.html?nsdr=true>
- Networkworld Article – Oct 2015: Cisco outpacing VMware 2:1 in SDN  
<http://www.networkworld.com/article/2989946/cisco-subnet/cisco-outpacing-vmware-2-1-in-sdn.html>
- Forbes Insight Article – Sep 2015  
[http://www.forbes.com/forbesinsights/cisco\\_aci/index.html](http://www.forbes.com/forbesinsights/cisco_aci/index.html)

#### Supporting information

- Blog Dec 2015 : <http://blogs.cisco.com/news/executing-on-our-vision-and-strategy-the-future-of-networking-for-an-application-centric-world>
- Blog Nov 2015 : <http://blogs.cisco.com/news/co-innovating-with-ecosystem-partners-to-deliver-truly-integrated-solutions-for-our-customers>
- <http://blogs.cisco.com/news/danske-bank-our-1000th-cisco-aci-customer>
- Blog Sep 2015: <http://blogs.cisco.com/datacenter/dc-sdn-strategy>
- Cisco Ustream channel Oct 2015: Cisco Global Editors Conference on October 6, 2015  
<http://www.ustream.tv/recorded/74933464>

#### Websites

- Cisco ACI [www.cisco.com/go/aci](http://www.cisco.com/go/aci)
- Cisco VTS [www.cisco.com/go/vts](http://www.cisco.com/go/vts)
- Cisco Developers / Open NXOS <https://developer.cisco.com/data-center>

## Masergy

### Where do you fit in the SDN and/or NFV ecosystem?

Masergy is a network service provider offering cloud services, virtualized network functions, network monitoring and management capabilities

### What is your value add?

Masergy is a 15-year-old company that designs, implements and manages private wide area networks for global enterprises. Masergy has evolved its offerings to include secure Internet and cloud connectivity services as well.

According to Masergy, they have been applying the principals behind software defined networking for a decade - - even before SDN became a widely accepted architectural concept and much-used acronym. Masergy stated that they designed their network fabric to be programmable and adaptable so that it can deliver a customized solution to each customer.

All of Masergy's offerings are built upon its [Software Defined Platform](#). Their goal in making their network programmable is to reduce complexity for their customers relative to the management of their global networks.

Masergy stated that they provide software controls that lets customers make changes to their networks in real time. One such capability is bandwidth on demand, which lets companies increase or throttle back network capacity as application processing requirements change. According to Masergy, this is becoming a critically important issue as enterprises introduce new, bandwidth-intensive applications into their environments.

An example of the use of bandwidth on demand comes from one of Masergy's customers - PRGX. The company is a leading provider of accounts payable recovery audit services to more than three quarters of the top 20 retailers. PRGX is a global company that also works with enterprises in the oil, gas, pharmaceutical, manufacturing and construction industries. Much of its business involves applying big data analytics on its 3,000 terabytes data to help customer recover unrealized revenue.

Network scalability and flexibility is essential for the company's 1,400 employees operating in 30 countries. A high performance network enables PRGX to apply bandwidth at locations that are doing some serious number crunching. When these tasks are complete, bandwidth can be dialed down to handle routine application processing requirements. Network administrations can make these changes on-the-fly from their Masergy-provided web portal and [mobile app](#) using Masergy's [Intelligent Service Control](#). The availability of such network flexibility enabled PRGX to roll out a new analytics service to customers that never would have been possible with its previous network and its inherent performance limitations.

Masergy has implemented NFV in its managed network services as a way to deliver routing, firewall and session border control as cloud services, on-premises in their network interface device (Masergy Intelligent Bridge) and in software that can be pushed down to the MIB without any technician involvement. According to Masergy, this is a boon for remote offices that often lack on-site IT personnel. New routing tables can be pushed down to the local device rather than having to ship a piece of equipment and a technician to install it at the site.



### What are the proof points?

Masergy's customers also include Amgen, Brocade, Cornell University, Dolby, E\*Trade, Panavision, Pepsico, Tesla Motors, and W.R. Grace and other global brands. Masergy worked with its hardware provider Overture Networks (now part of ADVA Optical Networking) on an NFV proof of concept project in 2015. The effort resulted in the Global Telecoms Business 2015 Innovation Award.

Other awards include:

- Masergy's Cloud f(n) Router Takes Gold In The 7th Annual 2015 Golden Bridge Awards
- Masergy's Cloud f(n) Router Receives 2015 Internet Telephony TMC Labs Innovation Award
- Masergy Named 2015 Light Reading Leading Lights Finalist For Most Innovative SDN Deployment Strategy
- Masergy's Cloud-Based Router Selected as NFV Pioneer Award Winner
- Masergy's Network Sensor Honored With SDN Award

## Sonus

### Where do you fit in the SDN and/or NFV ecosystem?

Sonus' primary focus is on migrating real-time communications into the NFV ecosystem. From past experience, one might conclude that Sonus is a Session Border Controller (SBC) company and therefore their primary focus would be on delivering a SBC VNF, but Sonus views that as being insufficient. The Sonus vision encompasses multiple dimensions including virtual session border control, signaling and policy functions, global licensing models, cloud-based toolchains, lifecycle management of VNFs, microservices architectures for NFV applications, and integration with software-defined network intelligence.

For Sonus, NFV represents a new architecture that unlocks powerful new capabilities. Their strategy for NFV includes:

- Ensuring the ability to dynamically instantiate applications based on business triggers, requiring VNFs to be delivered using fully automated, elastic scaling models backed by licensing based on network capacity versus one tied to instances.
- Recognition that the NFVI will provide new capabilities that can be taken advantage of for increased VNF efficiency such as resilient, scalable cloud-DBs and storage models, dynamic VM scaling capabilities and health monitoring.
- Recognition that as applications move from a static hosting model to a dynamic model the toolchains supporting the VNF become just as important as the VNFs themselves as customers make vendor decisions.

According to Sonus, with their solutions it will be possible to assess VNF performance, troubleshoot, and monitor application SLAs in a cloud environment without increased effort compared to the classic method of attaching to a static node. This is critical because if this is not done right, there is a risk of having innovative VNFs that are too difficult to deploy.

Another key part of the Sonus NFV transformation strategy is recognition that SDN and more specifically programmable IP transport goes hand-in-hand with this transformation. According to Sonus, this creates a unique opportunity for them to drive collaboration between the real-time session control layer and the IP transport layer via SDN. They envision the industry moving from a model of independent application, session and transport to a model where the session layer can now broker the wants and needs (i.e. the SLA) of the application. By integrating session layer intelligence with network intelligence, data center network connectivity and cloud-based service delivery will be optimized. As an example, integration between Sonus, SBC VNF and Sonus SDN enable an end-to-end delivery strategy for mission critical real-time applications which are coincidentally most sensitive to IP transport performance.

Sonus has chosen to partner with market-leading orchestration and NFVI vendors to facilitate VNF implementations. To date, this includes SBC NFV validation testing with Juniper, Overture, Alcatel-Lucent, HPE, and Dorado. Sonus also participated in the recent Light Reading/EANTC interop evaluation event, the world's first independent interoperability evaluation of NFV infrastructure, focused (in Phase 1) on multivendor NFV infrastructure-to-virtual network function (VNF) interoperability.

### What is your value add?

Sonus has a long history in the management and delivery of one of the most demanding segments of network applications - real-time communications. From there it has been a very logical step for them to broaden the scope of their service delivery architecture to include the IP transport and non-voice applications. This is what Sonus believes that they have architected by including SDN as part of their NFV strategy.

While voice, and real-time communications in general, are obvious beneficiaries of an SDN-managed solution, there are certainly multiple applications that an enterprise may consider as mission-critical to their business success. While it will vary by enterprise, some examples are Salesforce or customized CRM, customer portals and web-based retail applications, license servers, or accounting and billing applications.

Sonus' strategies to optimize the user experience for real-time communications are equally applicable to these mission-critical applications. For Sonus this means that they take a holistic view of how their technology allows "one network" – rather than having a voice, video, and data networks, where that one network intelligently optimizes packet flows based on application prioritization.

### What are the proof points?

The following are examples of customer deployments:

- Tier 1 service provider using SBC SWe to offer a virtual CPE solution to their Enterprise customers
- Cloud-based Unified Communications provider deploying SBC SWe in the Amazon cloud, enabling extremely rapid, low-cost instantiation without the need for on premise deployments
- A Fortune 500 financial corporation using SBC SWe for SIP trunking
- Telstra International (SE Asia regional service provider) has deployed VelloS (Sonus software-defined cloud exchange network solution) to optimize their data center interconnections and leverage that infrastructure into a revenue generating Network-as-a-Service.
- Internet Solutions (South Africa) is using VelloS to optimize their data center interconnections and simplify the management of data center connectivity
- State Street Bank, a global financial services company, is using VelloS to optimize data center connectivity and ensure business services continuity and security compliance

Awards in 2015:

- Information Week Elite 100 List of Top Technology Innovators across US
- Computer Technology Review Most Valuable Networking Product for VelloS
- Internet Telephony Unified Communications Product of the Year for SBC SWe

## Radware

### Where do you fit in the SDN and/or NFV ecosystem?

[Radware SDN](#) applications improve application security, performance and availability by integrating ADC and security intelligence with the SDN to collect data and optimally forward traffic to enhance network services. The native component of the new network stack introduced by SDN includes the data plane networking devices and the control plane SDN controllers. The Radware SDN applications integrate with the SDN application control plane and interact with the SDN controller using dedicated SDN drivers to work together with the Radware technologies by using the Radware API to use specific data collection drivers throughout the application infrastructure.

According to Radware, with their SDN solution, applications such as ADCs and security services transform from device-based solutions requiring a static traffic forwarding configuration to network wide services that intelligently divert traffic to service engines. The company states that network services can scale to support larger networks at a lower capital and operational cost. Radware also stated that by building SDN applications that continuously interact with the SDN control plane and program the network by leveraging the Radware Virtual Application Delivery Infrastructure ([VADI](#)) architecture – which enables pooling of dispersed resources to operate uniformly, Radware enables an EveryWare, applications available anywhere and everywhere, network service paradigm.

### What is your value add?

According to Radware, key benefits of their SDN network service infrastructure include:

- **More intelligent application delivery and security decisions** throughout the network break existing network barriers when developing business applications. Every application under all network conditions is entitled to advanced services.
- **Simpler implementation** of network services allows improved operational efficiency of network management improving application agility. Not every project needs to become a networking project.
- **Lower overall network service solution costs** – as network service delivery is partially offloaded to the SDN, there is no need to invest in excess network service appliances and capacity. Deploy network services as needed, and use by many tenants and applications throughout the datacenter.
- **Greater scalability** – scale your network services throughout the network. No more limited areas that are protected or load balanced. Offer uniform services throughout the SDN to enable an elastic application-centric infrastructure.
- **Easier operational control** – changing and managing security and ADC functionality becomes simpler through centralized operational deployment models. Not only does SDN streamline network operations, but Radware SDN applications streamline network service operations. Open Radware APIs allow orchestration systems to improve the overall control and automation of network services.

## DDoS Protection as a Native SDN Application

Radware's [DefenseFlow](#) is an SDN application that enables network operators to program the network to provide DDoS protection as a native network service. DefenseFlow features an adaptive, behavioral-based DoS attack detection engine and a traffic steering mechanism that utilizes the programmable characteristics of the software defined network elements for attack mitigation. Designed as part of the Radware SDN application framework, DefenseFlow delivers a security control plane and operates in traditional network environments while enabling customers to migrate to the customer's future, SDN-based networks.

According to Radware, legacy DDoS protection solutions that make use of scrubbing centers are costly: they need hardware detectors in every network location, BGP for traffic diversion, and GRE tunnels to forward the traffic to its designated network service destination. With SDN, a DDoS protection solution turns into a software application that adds intelligence to the network and does not require additional hardware, BGP, or GRE operations.

Radware stated that DefenseFlow equips network operators with the following key advantages:

- Unprecedented coverage against all type of network DDoS attacks
- Best design for attack mitigation
- Attack detection is always performed out of path (OOP)
- During an attack only suspicious traffic is diverted through the mitigation device
- Most scalable mitigation solution – [DefensePro](#) mitigation devices can be placed in any location, DefenseFlow diverts the traffic to the nearest appropriate mitigation device.
- Centralized security control plane including control as part of Radware's Attack Mitigation Network (AMN)

## **SDN & NFV for a Scalable Application Delivery Network**

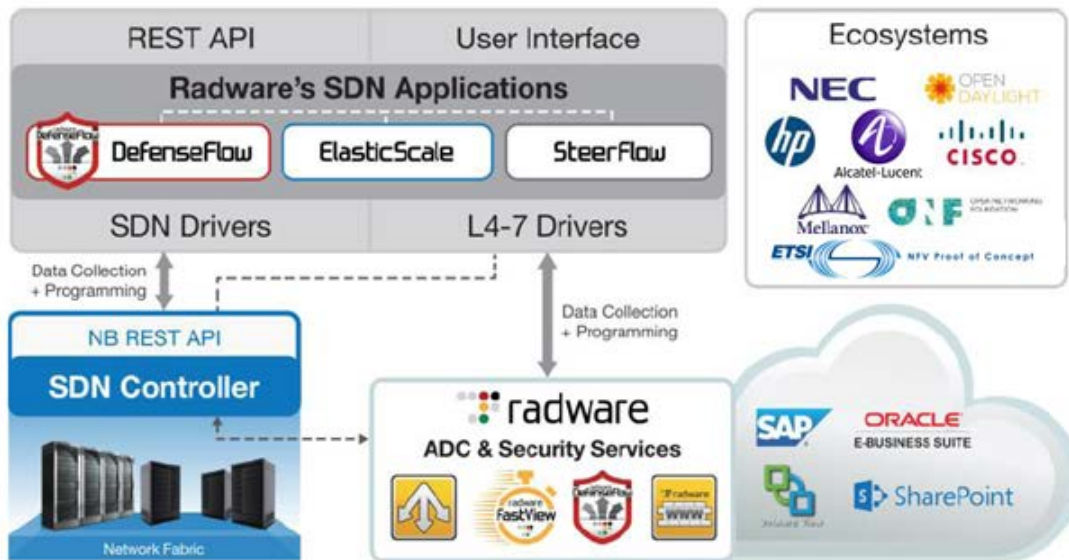
The NFV initiative was formed in order to enable the standardization of network services by leveraging commercial off-the-shelf (COTS) hardware and running advanced network functions software on them. Towards that end, Radware offers [Alteon VA for NFV](#), which according to Radware is the industry's first and highest performing ADC designed from the ground up to run in NFV environments. Targeted mainly at carriers but also towards large enterprises looking to leverage the NFV architecture, Alteon NFV provides a unique value proposition consisting of CAPEX/OPEX reduction, vendor agnostic technologies, high performance, enhanced scalability, orchestrated elasticity, and improved network service agility.

Radware's ElasticScale is an SDN application that wraps existing network service virtual appliances, including Alteon NFV, and provides provisioning and traffic distribution logic to consistently deliver network services in an elastic network environment. ElasticScale can be utilized for service provider internal services, managed services to end customers, and can help providers adopt network functions virtualization paradigms.

According to Radware, ElasticScale offers network operators the following key features and benefits:

- Ultra scalable traffic steering solution (80Gbps-1Tbps and beyond)
- Based on industry leading, carrier grade Alteon ADC product line
- Support for leading hypervisors (Xen/KVM/Hyper-V/ESXi)
- Compatible with leading SDN controllers; OpenDaylight, Cisco XNC, NEC pFlow & HP Flare

- Seamless integration with OpenStack and vCloud Director
- Runs over any physical SDN network solutions



#### What are the proof points?

The SDN eco-system is a critical focus for Radware. Through partnerships with the industry's leading SDN consortiums and vendors, Radware ensures customers that our application delivery and security solutions integrate successfully into target architectures.

Radware is an active contributor in the following industry and vendor SDN initiatives: Cisco Application Centric Infrastructure (ACI), HP Virtual Application Networks, NEC, Mellanox, Alcatel Lucent, ETSI, Open Daylight Project, and the Open Networking Forum (ONF). Radware is also a member of VMware's NSX partner ecosystem for network functions virtualization (NFV).

To learn more about how Radware's SDN solutions can enable you to get the most of your business and IT investments, email us at [info@radware.com](mailto:info@radware.com) or go to [www.radware.com](http://www.radware.com).

## About the Webtorials® Editorial/Analyst Division

The Webtorials® Editorial/Analyst Division, a joint venture of industry veterans Steven Taylor and Jim Metzler, is devoted to performing in-depth analysis and research in focused areas such as Metro Ethernet and MPLS, as well as in areas that cross the traditional functional boundaries of IT, such as Unified Communications and Application Delivery. The Editorial/Analyst Division's focus is on providing actionable insight through custom research with a forward looking viewpoint. Through reports that examine industry dynamics from both a demand and a supply perspective, the firm educates the marketplace both on emerging trends and the role that IT products, services and processes play in responding to those trends.

Jim Metzler has a broad background in the IT industry. This includes being a software engineer, an engineering manager for high-speed data services for a major network service provider, a product manager for network hardware, a network manager at two Fortune 500 companies, and the principal of a consulting organization. In addition, he has created software tools for designing customer networks for a major network service provider and directed and performed market research at a major industry analyst firm. Jim's current interests include cloud networking and application delivery.

For more information and for additional Webtorials® Editorial/Analyst Division products, please contact [Jim Metzler](#) or [Steven Taylor](#).

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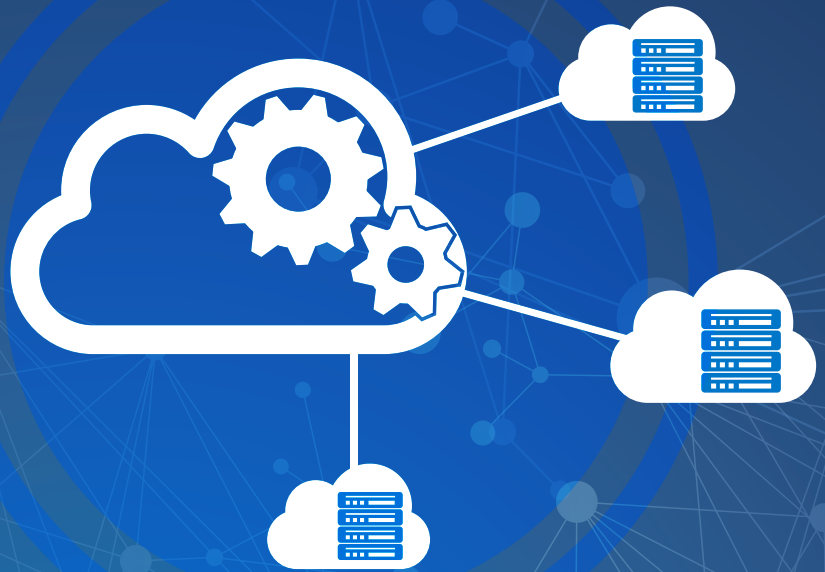


# **AUTOMATE YOUR CLOUD WITH** **aCLOUD SERVICES ARCHITECTURE**

Integrate dynamic  
services into your  
Cloud Data Center

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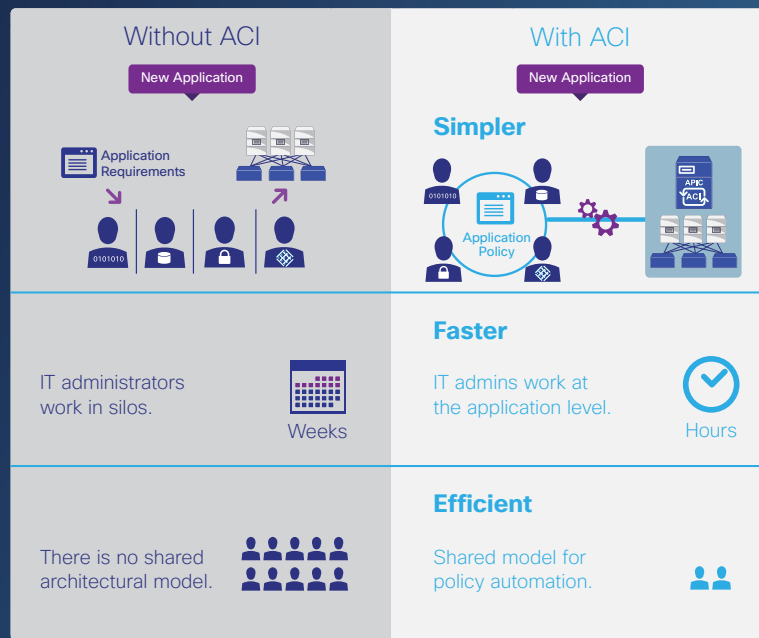
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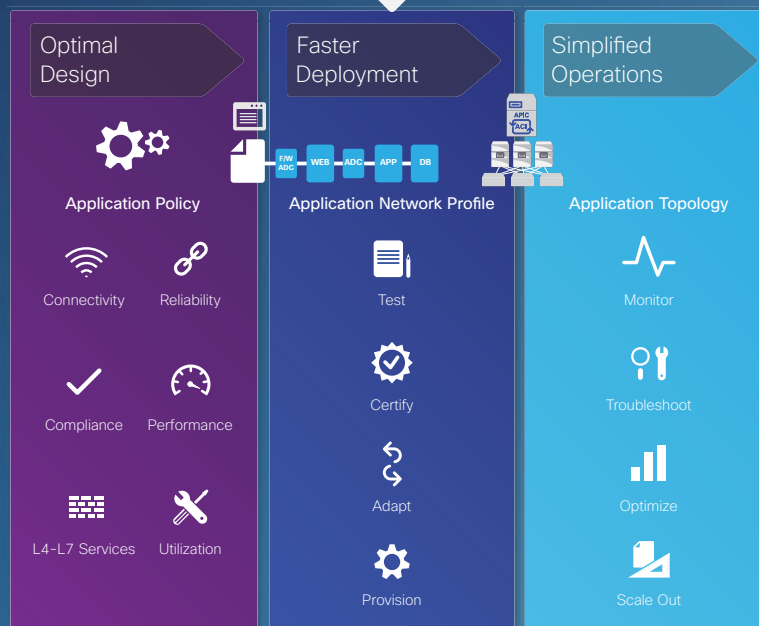


# Why Choose Application Centric Infrastructure (ACI)?

Application Deployment at the Speed of Business



ACI cuts deployment time and effort.



What does ACI deliver?



Automation and Visibility



Performance and Scale



Security



Openness



Redefine the Power of IT with ACI

Learn more at [www.cisco.com/go/aci](http://www.cisco.com/go/aci)



# Masergy's Software Defined Platform Delivers the Flexibility Enterprises Require

The enterprise WAN is fast becoming the source of serious innovation. Consider it the central nervous system of corporations and their ability to support even the most advanced and demanding business-critical applications. A modern network should be agile enough to adapt to your rapidly changing business needs.



This WAN innovation is being enabled by a Software Defined Networking (SDN) architecture, which enables administrators to rapidly change configurations as performance requirements demand.

Putting theory into practice, Masergy's Software Defined Platform accelerates IT transformation by providing the foundation for an open, automated and programmable network fabric. Our Software Defined Platform is the foundation for our three essential solutions: hybrid networking, managed security and cloud communications.

SDN enables us to build intelligent analytics, automation and service control into all of our solutions.

## Here are some of the many benefits of our Software Defined Platform:

- A high-availability, highly resilient hybrid network environment that provides an optimal client and application experience
- A secure, hybrid WAN architecture that permits dynamic traffic engineering across both private and public domains, delivering seamless performance and consistent manageability
- Administrators are afforded full visibility into business-critical applications and the ability to prioritize traffic based on performance, security and business policy needs
- Remote sites and branch offices can be added to the corporate network quickly and with little-to-no on-site administration



## VIRTUALIZATION

Network Function Virtualization (NFV) as a central tenant of our Software Defined Platform. NFV is poised to transform the world of networking as part of a larger shift from rigid, legacy networks where hardware and software are proprietary and tightly integrated, to modern networks that are software-driven and programmable. This gives network architects and administrators a new way to design, deploy and manage network capabilities.

Masergy has implemented NFV in its recently introduced Managed Network Functions f(n). We offer a family of fully managed, distributed network functions that can be delivered in the way that best suits your needs, whether that's on premises, in the cloud, or virtualized via software.

The solution offers Virtual Functions f(n) that lets companies add routing and firewall capabilities in software on their existing Masergy network interface device, eliminating the need for proprietary network appliances and on-site administration.

Our Premise Function f(n), is a complete lifecycle management solution for enterprises, which covers essential on-premises networking functions, including routers, firewalls and session-border controllers. And a third component, Cloud Functions f(n), help companies deliver essential network functions as cloud services over the Masergy network.

*"Masergy was able to custom design our hybrid network to meet our unique application performance requirements. It's outcome-based approach and ongoing superior support have convinced us we selected the right partner for our needs."*

Patrick Tisdale, CIO – McKenna, Long & Aldridge, LLP

## FLEXIBLE BY DESIGN

SDN transforms enterprise networks into modular, scalable assets that can be assembled and rearranged as business needs require. It also reduces IT complexity through automation.

Masergy is helping customers accelerate their IT transformation efforts, providing the foundation for an open, automated and programmable environment. This, in turn, frees up IT staff to focus on strategic, business-driven innovations and less time "keeping the lights on."



For more information, please visit <https://www.masergy.com>

### Compared with legacy approaches, Masergy's NFV offers three compelling advantages:

- 1. Extended Flexibility:** Masergy's Managed Functions f(n) gives enterprises complete control over their distributed network resources—plus the ability to scale up new services and decommission outmoded network capabilities as business needs change.
- 2. Rapid Deployment:** NFV lets organizations add, remove, configure and modify network services in real time. Rather than ordering and shipping network appliances to branch offices and remote locations, it lets you take advantage of innovative new services and deploy them over your network via software updates.
- 3. Lower Costs:** Our managed Network Functions f(n) reduces CAPEX because an organization no longer needs to purchase specialized hardware in many instances. And OPEX drops because of the way NFV lowers the need for dedicated hardware, support personnel and equipment maintenance.

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## Extending Service Assurance into SDN and NFV Environments

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### SOLUTION BENEFITS

NETSCOUT's Adaptive Service Intelligence™ (ASI) technology empowers enterprises and service providers to fully realize the benefits of SDN and NFV CapEx and OpEx efficiencies by reducing deployment risk.

- Accelerates migration to virtualized infrastructures with confidence.
- Provides service visibility without compromising user and customer experience.
- Protects and enhances performance of traditional, non-SDN/NFV, deployments.

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### Solution Core Functionality

NETSCOUT's nGeniusONE™ Service Assurance platform and ASI technology deliver real-time, actionable traffic-based intelligence capabilities.

- Holistic end-to-end visibility into physical, virtual, and hybrid service delivery infrastructure.
- Rapid service triage helps resolve problems in real time and assure positive customer/user experience.
- Comprehensive service assurance platform for voice, data, and video services.
- Ultra-high scalability assures service delivery across any size of service provider and enterprise infrastructure.

### Challenges

While the strategic importance of delivering IP-based services is constantly increasing, enterprises and service providers are being pressured to find ways to deliver these services faster, with higher quality, and lower cost. To achieve these goals, enterprises and service providers are gradually migrating their data center workloads onto a virtual infrastructure.

To realize the full potential of SDN and NFV CapEx and OpEx efficiencies, enterprises and service providers need a comprehensive service delivery monitoring capability which offers end-to-end visibility across physical, virtual, and hybrid environments. To be truly beneficial, the tool needs to offer rapid service triage capabilities to reduce the mean time to resolution (MTTR), by identifying the root-cause of service degradations and outages in real time.

Unfortunately, the traditional bottom-up triage methodology based on multi-vendor silo-specific Network Performance Management (NPM) and Application Performance Management (APM) tools is ineffective. It does not offer service-level triage capabilities to IT and Operations teams, and lacks the ability to provide an end-to-end view of the overall service.

The bottom-up triage methodology relies on disparate sets of data collected from multiple silo-specific tools, which makes it virtually impossible to gain an end-to-end holistic view of the service performance. Furthermore, these disparate datasets lack the insight on the interrelationships and dependencies between service delivery components and therefore inhibit service triage activities. The overall result of relying on the bottom-up triage methodology is significantly increased mean time to resolution, drastically extended service outages, reduced quality of end-user experience or loss in worker productivity.

### Solution Overview

NETSCOUT® offers rapid service triage based on pervasive end-to-end visibility across physical, virtual, and hybrid service delivery environments. The triage is performed proactively by detecting service degradations in real time using one cohesive, consistent set of metadata, based on packet flow data, for service provider and enterprise services. This metadata is generated by the patented Adaptive Service Intelligence technology running on NETSCOUT's physical and virtual Intelligent Data Sources, and offers meaningful and contextual view of all interrelationships and dependencies across all service delivery components in physical, virtual, and hybrid environments.

NETSCOUT's pervasive and scalable data collection is established by instrumenting strategic points across the service delivery infrastructure using physical and virtual appliances. The packet flow data collection and aggregation is passive and nonintrusive and can scale to collect any required volumes of data across physical, virtual, and hybrid environments.

The nGeniusONE Service Assurance platform aggregates, correlates, and contextually analyzes the metadata gathered from NETSCOUT's physical and virtual Intelligent Data Sources. It then creates real-time holistic views of service performance, establishes performance baselines, and facilitates service-oriented troubleshooting workflows.



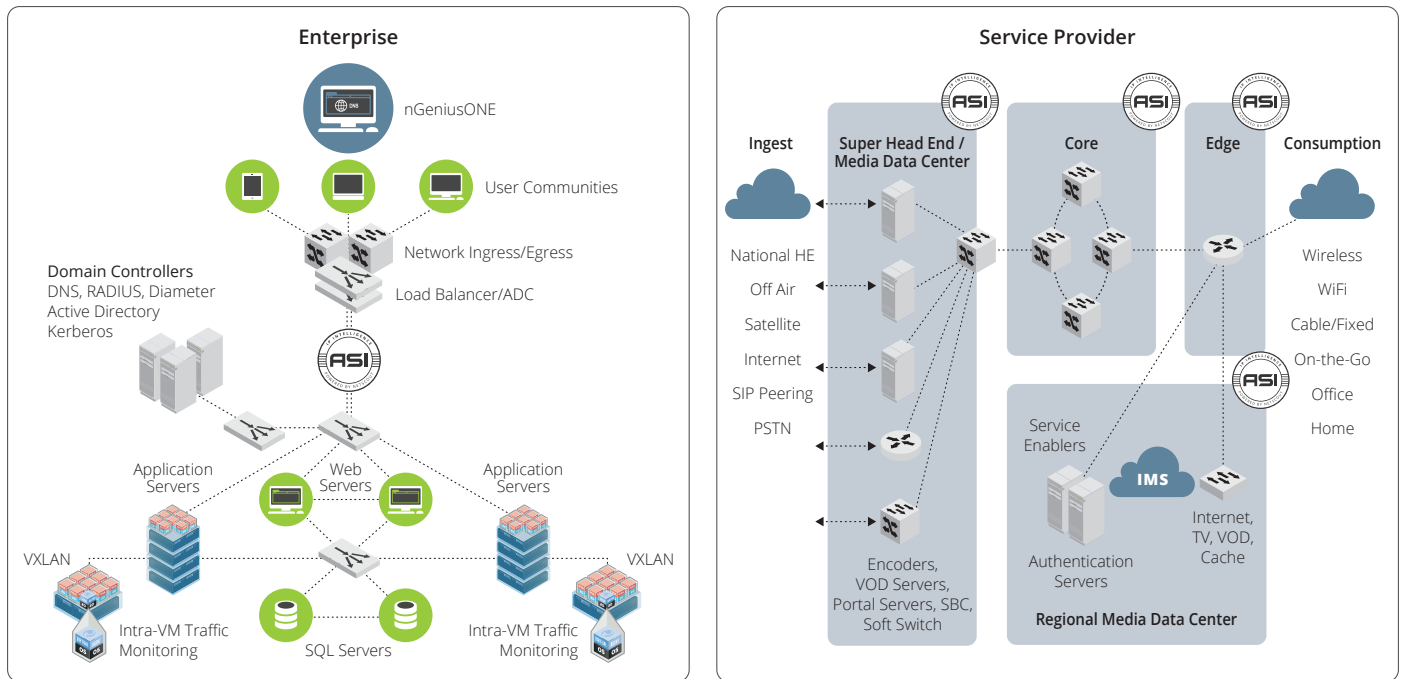


Figure 1: Service Instrumentation in Enterprise and Service Provider Environments.

## Core Technologies

NETSCOUT's unique ability to gain a pervasive end-to-end visibility into the service delivery environment, and enable rapid service triage is centered on NETSCOUT's ASI technology, utilizing packet flow data, and providing scalable packet flow access.

### Adaptive Service Intelligence (ASI)

Adaptive Service Intelligence is patented technology which uses rich packet-flow data to generate highly scalable metadata that enables a comprehensive real-time and historic view of service, network, application, and server performance. This powerful packet inspection and data mining engine runs on NETSCOUT's Intelligent Data Sources generating metadata based upon actual session traffic in real time as the packets cross physical or virtual links. NETSCOUT's ASI technology is the foundation of a highly scalable service delivery monitoring architecture which seamlessly collects, normalizes, correlates, and contextually analyzes data for all services: voice, data, and video.

### Leverage Packet Flow Data

NETSCOUT uses packet flow data as the foundation for generating highly scalable metadata that enables a comprehensive real-time and historic view of all service components including physical and virtual networks, n-tier applications, workloads, protocols, servers, databases, users, and devices.

### Provide Scalable Packet Flow Access

NETSCOUT Packet Flow Switches and TAPs provide the foundation for a scalable monitoring architecture needed for service assurance. NETSCOUT's nGenius Packet Flow Switches (PFS) filter, aggregate, and distribute the targeted data to NETSCOUT's Intelligent Data Sources in a transparent, selective, and efficient manner. NETSCOUT physical and virtual TAP network monitoring devices provide comprehensive and reliable access to packet flow data and establish strategic service visibility points across the entire service delivery infrastructure.

## Service Delivery Monitoring in SDN Environments

NETSCOUT has partnered with VMware, the global leader in virtualization and cloud infrastructure, to provide service delivery monitoring solutions in VMware NSX environments. These solutions enable NETSCOUT to gain full visibility into applications traversing NSX environments in the following use cases:

- **Traffic between the VMs on the same hypervisor** is monitored by integrating NETSCOUT's ASI technology into a virtual machine (VM), functioning as a virtual Intelligent Data Source. NETSCOUT's VM either analyzes the intra-VM traffic in a self-contained virtualized mode or redirects the traffic to an external NETSCOUT Intelligent Data Source for analysis.
- **Traffic between VMs that reside in different hypervisors** is monitored by NETSCOUT Intelligent Data Sources that decode the VXLAN encapsulation and access the original packet flow data between the VMs.
- **Multi-tier East-West and North-South Data Center traffic** is monitored by collecting data from a combination of multi-tier physical and virtual service delivery environments, correlating, and contextually analyzing all the interrelationships and dependencies across all monitored service delivery components. These include n-tier applications, workloads, protocols, servers, databases, users, and devices.

## Solution Comparison

NETSCOUT's ability to provide end-to-end visibility into multi-tier physical, virtual, and hybrid service delivery environments combined with proactive service triage, helps address the key problems associated with silo-specific, component-based, bottom-up performance management approaches.

Attribute	Bottom-Up Triage Problems	NETSCOUT's Solution	IT Benefits
End-to-End Visibility	Point visibility into individual service delivery components from a variety of multi-vendor silo-specific tools. Lacks the necessary insight into interrelationships of service delivery components.	Holistic end-to-end visibility into service delivery infrastructure using one cohesive, consistent set of data, for service provider and enterprise services delivered in physical and virtual environments.	<ul style="list-style-type: none"> <li>• Optimize experience of user communities and customers.</li> <li>• Comprehensive solution from a single vendor.</li> <li>• Full visibility into services running in physical, virtual, and hybrid environments.</li> </ul>
Rapid Service Triage	Reactive and time-consuming triage result in poor user experience, and extended service downtime impacting multiple users.	Rapid service triage helps resolve service degradation in real time before large numbers of users are impacted.	<ul style="list-style-type: none"> <li>• Increase service uptime and end-user productivity.</li> <li>• Support more services with existing IT resources.</li> <li>• Reduce time wasted in war rooms.</li> </ul>
Scalability	Lacks scalability to assure delivery of modern business services for service providers and enterprises.	Scales to assure service delivery across any size of service provider and enterprise infrastructure.	<ul style="list-style-type: none"> <li>• Optimize your return on investment in performance management by gradually expanding the solution over time.</li> </ul>

## About NETSCOUT Systems, Inc.

NETSCOUT Systems, Inc. (NASDAQ:NTCT) is a market leader in real-time service assurance and cybersecurity solutions for today's most demanding service provider, enterprise and government networks. NETSCOUT's Adaptive Service Intelligence (ASI) technology continuously monitors the service delivery environment to identify performance issues and provides insight into network-based security threats, helping teams to quickly resolve issues that can cause business disruptions or impact user experience. NETSCOUT delivers unmatched service visibility and protects the digital infrastructure that supports our connected world. To learn more, visit [www.netscout.com](http://www.netscout.com).

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## Radware's Software Defined Networking Solutions: Enable Network Wide Services via SDN and NFV Applications

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Radware SDN-enabled ADC and security services transform applications from device-based solutions to become network wide services that intelligently divert traffic to service engines. Radware enhances SDN functions by leveraging our Virtual Application Delivery Infrastructure ([VADI](#)). This enables an EveryWare network service paradigm where applications are available anywhere and everywhere.

Key benefits of the Radware SDN network service infrastructure include:

- **Intelligent application delivery and security** – Optimal application service delivery
- **Easy implementation** - Improved operational efficiency of network management
- **Lower overall network service solution costs** – Deploy network services as needed
- **Greater scalability** – Scale network services throughout the network
- **Easier operational control** – Streamline network operations

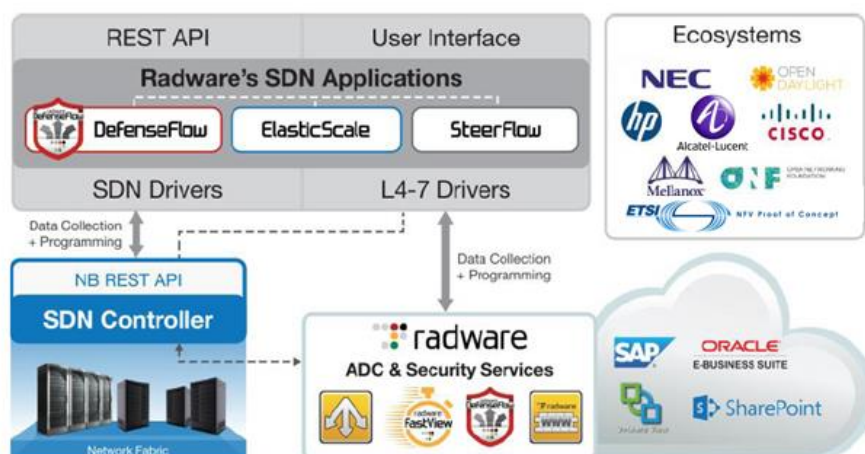
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### Partnering for Success: Our SDN and NFV Ecosystem

The SDN and NFV eco-systems are a critical focus for Radware. Through partnerships with the industry's leading SDN and NFV consortiums and vendors, Radware ensures customers that our application delivery and security solutions integrate successfully into target architectures.

### Learn More

To learn more about how Radware's SDN solutions can enable you to get the most of your business and IT investments, email us at [info@radware.com](mailto:info@radware.com) or go to [www.radware.com](http://www.radware.com).

# Securing End-User Quality of Experience from the Cloud

There are many applications an enterprise will consider as mission-critical to their business. While it varies by enterprise, some example applications include customized CRM, web-based retail, accounting, and billing. Sonus has a long and successful history of securing and optimizing the end-user experience for real-time communications. As applications continue to migrate to the Cloud, Sonus is applying that knowledge to optimize mission-critical applications that are sensitive to IP transport.

As both service providers and enterprises look to embrace cloud-based environments, there remain some significant challenges that need to be addressed with respect to security, interoperability, portability, quality of service, quality of experience, and performance guarantees.

In a cloud-based environment, service providers must offer connectivity to an enterprise customer that is extremely resilient in order for mission-critical applications to be trusted and operated. The traditional way of provisioning, managing, and selling their network assets is no longer dynamic enough to keep up with the new demands of data center connectivity for the enterprise. Service providers have some challenges. They have to deal with competitive pressures that drive down pricing, yet also be responsive with the delivery of network resources and bandwidth connectivity that mission-critical applications require.



As enterprises will choose between various competing service providers, an additional important differentiator that needs to be addressed is perceived service quality. A service provider should be able to transparently monitor and react quickly to any service quality problems before an enterprise is aware. An optimal Quality of Experience (QoE), when end-users judge the usability of an application based on their own experience, must be achieved, while constraining the application to behave as efficiently as possible to minimize operational costs.

For today's enterprises/CIOs, they need connectivity solutions that allow them to manage their networks more intelligently and dynamically, defining end-to-end policies that align transport with mission-critical applications to deliver a high QoE within their tight operational budgets. The ability to understand and manage QoE for end-users provides a great opportunity to set themselves apart.

What is necessary to meet these needs for both service providers and enterprises requires new approaches that guarantee adherence to concerns on security, as well as to industry requirements for lifecycle management of the services and network resources.

## Combining the Intelligence of the Session and Network Control Layers

Sonus provides a solution that combines session layer intelligence with software-defined networking intelligence at the network layer.

Sonus' Session Border Controller (SBC) SWe, integrated with VelloS, Sonus' virtualized network control platform, enables the sharing of security, and policy management information between the session layer and the network control layer. The application-specific intelligence from the Sonus SBC SWe, combined with VelloS' knowledge of traffic flows at the network control layer, gives service providers the ability to offer much higher levels of quality of service than ever before, guaranteeing bandwidth for specific mission-critical applications.



The Sonus solution provides a holistic, systems approach to security—providing a security perimeter in real-time at the network edge. As a result, enterprises can make informed choices and dynamically compose and personalize services in a secure way through transparent interaction with the IP session and transport layer.

The Sonus solution enables delivery of mission-critical applications with an assurance of service level agreements (SLAs) without over-burdening the network. With this holistic view of how one network can intelligently optimize packet flows based on application prioritization, a service provider or enterprise will have a solution that monitors service parameters (like throughput) and automatically proactively react if network conditions may result in QoE degradation.

The combination of the Sonus SBC SWe and VelIOS enables a guarantee of SLAs for specified bandwidth in real time for mission-critical applications. By integrating session layer intelligence with network control intelligence, data center network connectivity and cloud-based service delivery are optimized.

## About Sonus Networks

Sonus enables and secures real-time communications so the world's leading service providers and enterprises can embrace the next generation of SIP and 4G/LTE solutions, including VoIP, video, instant messaging, and online collaboration. With customers in more than 50 countries and nearly two decades of experience, Sonus offers a complete portfolio of hardware-based and virtualized Session Border Controllers (SBCs), Diameter Signaling Controllers (DSCs), Cloud Exchange Networking Platform, policy/routing servers, and media and signaling gateways. For more information, visit [www.sonus.net](http://www.sonus.net) or call 1-855-GO-SONUS. Sonus is a registered trademark of Sonus Networks, Inc. All other company and product names may be trademarks of the respective companies with which they are associated.

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