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Executive Summary

Over the last year, the hottest topics in networking have been Network Virtualization (NV) and Software Defined Networking (SDN). There is, however, considerable confusion amongst enterprise IT organizations relative to these topics. There are many sources of that confusion, including the sheer number of vendors who have solutions that solve different problems using different solution architectures and technologies, all of whom claim to be offering SDN and/or NV solutions.

The primary goal of the 2013 Guide to Software Defined Networking & Network Virtualization (The Guide) is to eliminate that confusion and accelerate the adoption of NV and/or SDN. The guide will achieve that goal by walking the readers through the following set of topics:

1. What are the problems and opportunities that NV and SDN help to address?
2. What are the primary characteristics of NV and SDN solutions?
3. How does NV and SDN help IT organizations respond to problems and opportunities?
4. How are IT organizations approaching the evaluation and deployment of NV and/or SDN?
5. What is the role of organizations such as the ONF and the OpenDayLight consortium?
6. What approach are the key vendors taking relative to NV and SDN?
7. What should IT organizations do to get ready for NV and SDN?

The Guide will be published both in its entirety and in a serial fashion. This is the third of the serial publications. The first publication focused on NV and the second publication focused on SDN. This publication will focus on the NV and SDN ecosystem and will provide a general overview of that ecosystem as well as a detailed analysis of one of the key members of the ecosystem - QualiSystems. The fourth and final publication will focus on planning for NV and SDN.

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1 webt torials.com/Metzler
Overview of the NV and SDN Ecosystem

One measure of the extent of the NV and SDN ecosystem is that there are currently more than 100 members of the Open Networking Foundation\(^2\) (ONF). This subsection of The Guide identifies the major categories of organizations that are part of the NV and 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 organizations that are part of the NV and 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. As is explained below, in some instances there can be a very wide range in terms of the functionality provided by the members of a given category.

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.

It is possible that some of these vendors will also influence the development of NV. However, some of the major players in this segment of vendors, such as Facebook and Google, currently make little use of NV.

Representative Members:

- Yahoo
- Google
- Facebook

\(^2\) [https://www.opennetworking.org/blog/tag/open-networking-foundation](https://www.opennetworking.org/blog/tag/open-networking-foundation)
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 and/or NV 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.

The preceding chapter of The Guide 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\(^3\) are currently using SDN and Network Function Virtualization (NFV)\(^4\) to enable them to offer a new generation of WAN services and Verizon\(^5\) has announced a trial based on using SDN to enable a new generation of data center to data center WAN services.

**Representative Members:**

- Pertino
- Deutsche Telekom
- NTT Communications
- Verizon

Switch Vendors

Value Proposition: Relative to SDN, the majority of these vendors takes at least some of the control functionality that has typically resided in their switches and now relies on that functionality being provided by an 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
- Avaya
- Cisco
- Dell
- Extreme Networks
- HP
- NEC
- PICA8
- IBM

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\(^3\) [http://www.pcmag.com/article2/0,2817,2415354,00.asp](http://www.pcmag.com/article2/0,2817,2415354,00.asp)

\(^4\) NFV was explained in the preceding chapter of The Guide.

Network Management and Automation

Value Proposition: Most, if not all of the providers of NV and 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 NV and/or SDN solutions themselves. The vendors listed below either currently provide, or soon will provide management functionality that isn't offered by the providers of the NV or SDN and solutions and/or they integrate the management of these solutions into a broader management structure. The breadth of management functionality provided by the members of this category is illustrated in the next sub-section of The Guide - the sub-section entitled Representative Vendors.

Representative Members:

- Packet Design
- QualiSystems
- EMC
- NetScout
- CA

Providers of Network Services

Value Proposition: The members of this category provide network services such as security and optimization that are part of NV and SDN solutions. Some of these services were described in the preceding section of this report. There is the possibility that over time that a large number of independent software vendors (ISVs) will also provide these services.

Representative Members:

- Embrane
- A10
- Radware
- HP
- Riverbed
- Citrix
- Cisco
- Extreme Networks
- NEC

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6 The preceding section of The Guide discussed service chaining/Insertion
Testing

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

Representative Members:

- QualiSystems
- InCNTRE
- Ixia
- Spirent

Standards Bodies

Value Proposition: The 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.

Representative Members:

- ONF\(^7\)
- IEEE
- IETF
- Network Function Virtualization (NFV) – under the auspices of ETSI\(^8\)

Providers of SDN or Network Virtualization Controllers

Value Proposition: These vendors provide the controllers that are part of any SDN solution and which are part of many NV and SDN solutions.

Representative Members:

- Big Switch Networks
- NEC
- Nuage Networks
- Netsocket
- HP
- Cisco
- Open Daylight Consortium\(^9\)
- VMware/Nicira

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\(^7\) The role of the ONF was discussed in the preceding section of The Guide

\(^8\) The relationship between SDN and NFV was discussed in the preceding section of The Guide

\(^9\) The Open Daylight Consortium was discussed in the preceding section of The Guide.
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
- 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 NV and SDN solutions.

Representative Members:

- Citrix
- Microsoft
- VMware
Representative Vendor: QualiSystems

The Opportunity that QualiSystems is Targeting

Software Defined Networking introduces the notion of network programmability from applications that interact with centralized SDN controllers via northbound APIs. This API-driven network paradigm opens opportunities for agile SDN application development, service creation and more seamless OSS/BSS integration. The SDN paradigm shift also creates challenges—namely the need for networking engineering organizations to adopt to a software-centric business model. Practically speaking, this means that these organizations need the ability to deliver rapid access to end-to-end network environments, in order to enable application delivery stakeholders to follow an agile dev/test process for SDN applications and OSS/BSS integration. Without access to end-to-end, production-like network environments, testing becomes a waterfall process, and quality impacts multiply as application defects are found only after they are deployed into the production network.

QualiSystems’s Value Proposition

QualiSystems’s value proposition in the SDN Ecosystem is to offer self-service automation for the SDN dev/test process to SDN adopters such as enterprise IT and service providers, as well as SDN ecosystem vendors such as switch manufacturers. QualiSystems-empowered self-service automation provides:

- A platform for network engineering teams to build an agile dev/test process that delivers high quality SDN applications and solid network reliability
- A QA, tech support, online training test lab automation solution for SDN product vendors
- A self-service automation platform for offering cloud-based SDN app certification

Functionality Provided by QualiSystems

QualiSystems automation platform offers a number of capabilities that enable SDN dev/test self-service automation:

- **Centralized inventory management:** Engineers gain visibility to any component needed to design and publish network topologies required by developers and testers.

- **Packaged driver libraries plus open device driver creation:** QualiSystems provides driver libraries with its products, but also enable engineers to create device drivers to integrate with multi-generational legacy network devices through record and capture tools or through object-library integration of existing scripts or code. This capability ensures that networking teams maintain agility in the face of rapid changes.

- **Object-oriented automation paired with GUI tools:** QualiSystems implements an object-oriented approach to automation which contrasts with creating long, monolithic automation documents such as scripts. All automation elements including network element resources, device drivers, provisioning actions (such as loading an OS image) and automation tasks (such as running a traffic test) are captured as small-scope objects. QualiSystems’ object-oriented approach offers a number of advantages:
  - The limited scope of automation objects means that they are easy to capture, maintain, and refactor to meet the requirements of a changing network environment.
A shared library of resource, provisioning and testing objects can be maintained in a systematic fashion.

Automation objects can be tagged with arbitrary labels so that they can be easily searched and leveraged by many users from a shared library.

An object library optimizes the skills of programmers, who can maintain the shared library as a high quality service to the rest of the network engineering team.

The object library can be leveraged by non-programmers using GUI-based, drag and drop-style network topology design and automation workflow tools. This maximizes the productivity of the whole network engineering team, especially as topologies and workflows are shared and reused by multiple users.

- Self-Service Portal: QualiSystems enables network engineers to publish heterogeneous network topologies (including SDN and non-SDN elements) to a self-service portal catalog for dev/test users to access.

QualiSystems Proof Points

QualiSystems automation technology is being used to create a cloud-based SDN app certification self-service by one of the industry’s leading networking vendors. When app developers want to certify their SDN apps, they can go to a web-based self-service catalog, reserve and activate a SDN network “sandbox” that provides them with a live environment consisting of a topology of real networking switches and a SDN controller. They can connect live to this network and run API tests and view the resulting behavior in order to ensure that their SDN application will work correctly. This cloud-based dev/test environment illustrates the type of capability that enterprise and service provider adopters of SDN technology can build as a practice within their network engineering teams to support SDN application lifecycles.
Automation for Agile Infrastructure

Corporate Overview

Founded: 2004
North America HQ: Santa Clara, CA
Market-leading supplier of automation solutions for:
- Network test and test lab efficiency, productivity and savings
- IT infrastructure self-service for DevOPS agility and cloud evolution

Mature, proven technology:
- Hundreds of customer deployments
- Millions of infrastructure elements managed
- $Billions in infrastructure managed

Automation Platform

Comprehensive Automation Framework
- Resource management
- Heterogeneous environment design + workflow authoring
- Reporting and business intelligence
- Self service portal

Object library-based architecture
- Supports & enforces best practices
- Optimizes programming staff skills
- Achieves high ROI through ease of maintenance and scalability

Any-Stack Integration
- Key API integration libraries + open driver creation
- Freedom from vendor roadmaps, allows integration with legacy, home-grown components
- Overcomes interface silos

User-friendly GUI-based automation design
- Break open expertise bottlenecks
- Systematize knowledge, increase reusability
- Maximize total team productivity
SDN Self-Service Automation

- SDNs offer northbound API's for applications to drive network behavior
- Yet SDN adopters will need to manage heterogeneous network environments with both legacy and SDN elements
- CloudShell provides the means to automate the delivery of SDN/legacy network environments for DevOPS network application development, testing and deployment

TestShell

TestShell is an object-oriented test and lab automation platform. It delivers powerful lab infrastructure management, and test automation solutions for network, data center, tech support, and demo/PoC lab environments. TestShell is deployed by leading service providers, technology manufacturers, enterprise and government IT departments around the world.

TestShell's object-oriented architecture revolutionizes network, data center and cloud infrastructure testing by:

- Dramatically increasing the efficiency and ROI of test infrastructure through improved resource sharing
- Simplifying the creation, maintenance and re-use of automated device control interfaces, provisioning actions and testing tasks through a shared object library
- Empowering non-programmers to create, save, share, integrate and reuse complex test topologies and automation workflows
- Enabling seamless hand-offs of topologies and automation workflows between developers, architects, QA teams, pre-production, technical support, field operations and customer engineers
CloudShell is a self-service automation platform for heterogeneous, multi-generational IT infrastructures and networks. It helps infrastructure and networking teams to deliver agile, end-to-end infrastructure to application delivery stakeholders including developers, testers, compliance and security engineers, and deployers.

**Self-service automation of heterogeneous, multi-generational IT infrastructure**

- Legacy systems and stack
- Traditional datacenter and network environments
- Industry-specific IT components
- Software-Defined Networking
- Private and public clouds

**Helps IT infrastructure and network teams achieve DevOPS agility**

For more information about QualiSystems, visit our website at www.qualisystems.com