An SDN Reality Check

Authored by

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Introduction

The traditional IT operational model is highly manual and very hardware centric. As a result, IT infrastructure services have historically been both expensive to provide and slow to respond to new requirements. Over the last few years, the pressure that virtually all IT organizations have felt to reduce cost and to be more responsive to new business requirements has driven both the adoption of new technologies, such as server virtualization, and the adoption of new ways of delivering IT services, such as cloud computing.

This white paper is part of a five-part series of white papers and webinars that describe the journey that IT organizations must take to go from the traditional highly manual, hardware centric IT operational model to an operational model that is highly automated, software centric and which reduces both the cost of IT infrastructure services as well as the time it takes to implement those services. This white paper will focus on a key component of that journey: Software Defined Networking (SDN).

The previous white papers in this series, *The Mandate for a Highly Automated IT Function*[1] and *The Promise and the Reality of a Software Defined Data Center*[2], described some of the components of the journey to a new IT operational model. The primary goal of this white paper is to provide a reality check on SDN relative to its current ability to provide greater agility and data center elasticity. To achieve that goal, this white paper will describe the status of SDN development and adoption. The white paper will also identify the role of automation in a software defined network and will describe how SDN is related to DevOps and how that relationship changes the way network organizations need to think about network service delivery.

Status of SDN Development and Adoption

Below are some of the key milestones in terms of the development of SDN.

- The Open Networking Foundation (ONF) was founded in 2011 and its vision is to make OpenFlow-based SDN the new norm for networks. To help achieve that vision, the ONF has taken on the responsibility of driving the standardization of the OpenFlow protocol. Unlike most IT standards groups or industry consortiums, the ONF was not by founded by suppliers of the underlying technologies, but by Deutsche Telekom, Facebook, Google, Microsoft, Verizon, and Yahoo!

- In January 2010 Google began a project to implement SDN in the WAN that interconnects their data centers. As part of this project Google built their own SDN switches and they also developed a centralized traffic engineering service. The network

[1] http://www.qualisystems.com/white_papers/the-mandate-for-a-highly-automated-it-function-2/

[2] http://ashtonmetzler.com/QS%20Paper%202%20V3%200%20(1).pdf

went into production in early 2012. Google claims that they are able to run this network at close to 100% utilization[3].

- In July 2012, VMware acquired Nicira for US $1.26 billion. The Nicira functionality provided the basis of NSX, which is VMware's overlay-based network virtualization platform that was announced in August 2013. See below for a brief discussion of overlay-based network virtualization solutions.

- Some organizations and some vendors believe that the OpenFlow protocol is central to the development of SDN. Version 1.0 of OpenFlow was developed at Stanford University. Subsequent to the publication of OpenFlow V1.0, the development of OpenFlow became the responsibility of the ONF. This OpenFlow specification has been enhanced three times. Version 1.1 was published in February 2011; V1.2 was published in December of 2011; V1.3 was published in June of 2012 and v1.4 was published in October 2013.

- In August 2013 VMware and HP announced their intention to federate HP's SDN controller with VMware's NSX controller. HP also announced a new SDN application which will allow HP's Intelligent Management Center (IMC) to share information about the network with both controllers. The result is an overlay/underlay model in which the NSX controller provisions the virtual network overlay, and HP's SDN controller provisions physical network flows on its switches via OpenFlow.

- In September 2013 HP announced the HP SDN Developer Kit (SDK) and the HP SDN App Store. The HP SDN Developer Kit provides developers tools to create, test and validate SDN applications. The HP SDN App Store lets customers browse, search, purchase and directly download SDN applications onto HP's SDN controller. The ecosystem partners registered for the HP SDN Developer Kit include Blue Coat Systems, Citrix Systems, F5, Infoblox, Intel, Microsoft, Radware, Riverbed, SAP and VMware.

- In November 2013 Cisco announced that it would spend $863 million to acquire Insieme Networks, which it funded as a "spin-in" startup. At that same time, Cisco announced its Application Centric Infrastructure (ACI) initiative, with many of the key components of ACI being delivered during the 2014 calendar year. One of the key components of ACI is the Application Policy Infrastructure Controller (APIC) that translates application policies for security and prioritization into network programming. Similar to Vmware's NSC solution, Cisco's ACI solution supports network virtualization. However, unlike NSX, ACI can provision and monitor the underlying physical network. Also, unlike pure network overlay-based solutions such as NSX, hardware plays a major role in an ACI solution.

- The Open Daylight Consortium, a Linux Foundation collaborative project, was announced April 8, 2013. According to that announcement "OpenDaylight's mission is to facilitate a community-led, industry-supported open source framework, including code

[3] http://www.networkworld.com/news/2012/060712-google-openflow-vahdat-259965.html

and architecture, to accelerate and advance a common, robust Software-Defined Networking platform." In February 2014 the consortium released the first version of its SDN and Network Function Virtualization (NVF) software – code named hydrogen.

The bottom line is that there is a fundamental disagreement in the industry relative to the role of specialized hardware in an SDN solution. In addition, while there are SDN products that are shipping, most SDN products are very early in their life cycle and many vendors are working both through internal development and partnerships to round out their marketectures.

Below are some of the key indicators of SDN adoption.

The 2013 Guide to Network Virtualization[4] (The Guide) described an approach to network virtualization that was based on encapsulation and tunneling and which may or may not involve a controller. When this approach is implemented using a controller it is referred to as an overlay-based network virtualization solution. VMware's NSX solution is an example of overlay-based network virtualization solution. Since these solutions don't control the underlying network hardware, throughout 2013 there was some controversy in the industry as to whether or not these solutions were indeed SDN. That controversy has subsided and now virtually everyone regards these solutions as being SDN solutions.

The Guide presented the results of a survey of enterprise IT organizations. One of the questions asked the survey respondents to indicate the approach that their company is taking relative to adopting overlay-based network virtualization (NV) and SDN. The Survey Respondents were allowed to indicate multiple approaches and a summary of their responses is shown in Table 1.

Approach	NV	SDN
We have not made any analysis of it	26%	19%
We will likely analyze it sometime in the next year	26%	26%
We looked at it and decided to not do anything with it over the next year	6%	5%
We are currently actively analyzing the potential value that it offers	25%	36%
We are currently actively analyzing vendors' strategies and offerings for it	12%	20%
We expect that within a year that we will be running it either in a lab or in a limited trial	14%	19%

[4] http://www.webtorials.com/content/2013/10/2013-guide-to-software-defined-networking-network-virtualization.html

We currently are running it either in a lab or in a limited trial	10%	13%
We expect that within a year that we will be running it somewhere in our production network	6%	10%
We currently are running it somewhere in our production network	7%	6%
Don't know	5%	4%
Other	1%	4%

Table 1: Approach to Implementing NV and SDN

The way to read the data in Table 1 is that 26% of The Survey Respondents work for companies that haven't made any analysis of NV and 19% of The Survey Respondents work for companies that haven't made any analysis of SDN.

While there are some differences between the overall approach that IT organizations are taking to NV and the overall approach that IT organizations are taking to SDN, there are more similarities than there are differences. The high level story told by the data in Table 1 is that today there is a lot of interest in both NV and SDN, but very little deployment of either in production networks. If The Survey Respondents are correct, there will be a modest increase in the production use of both NV and SDN in 2014.

DevOps and its Relevance to SDN

DevOps

The phrase *DevOps* is a result of bringing to together two words: *Development* and *Operations*. That's appropriate because the point of adopting DevOps is to establish tight collaboration between a number of the phases of the application development lifecycle, including application development, testing, implementation and ongoing operations. According to a recent Information Week Report[5], sixty-eight percent of IT professionals are aware of DevOps and of those who are aware of it, twenty-one percent have currently embraced it. That report also stated that eighty two percent of the IT organizations that implemented DevOps saw at least some improvement in infrastructure stability and eighty three percent saw at least some improvement in the speed of application development.

One of the companies that has been very visible in discussing the benefits of DevOps is Netflix[6]. Netflix often discusses how DevOps reduces the amount of time it takes to get a new application

[5] http://www.informationweek.com/strategic-cio/executive-insights-and-innovation/state-of-devops-big-gains-elusive/d/d-id/1113307
[6] http://perfcap.blogspot.com/2012/03/ops-devops-and-noops-at-netflix.html

or a new version of an application into production. With that goal in mind, some of the key characteristics that are usually associated with DevOps are that the applications development team writes primarily small incremental pieces of code that are tested on an architecture that reflects the production architecture. Ideally, the network on which the software is tested will reflect not just the architecture but also the same characteristics (i.e., delay, packet loss) as the production network.

DevOps is relevant to SDN because current network change cycles are typically managed in a slow, manual process following a waterfall development process. Often-times, months pass between points when network changes are certified. However, waterfall methodology and related timelines will likely be insufficient for the pace of incremental changes that will occur in a SDN.

The Role of Automation

As mentioned in the introduction, IT organizations are on a journey to adopt a new IT operational model that is highly automated. Some of the automation that SDN requires, and the specific impact that DevOps has on SDN is illustrated in Figure 1.

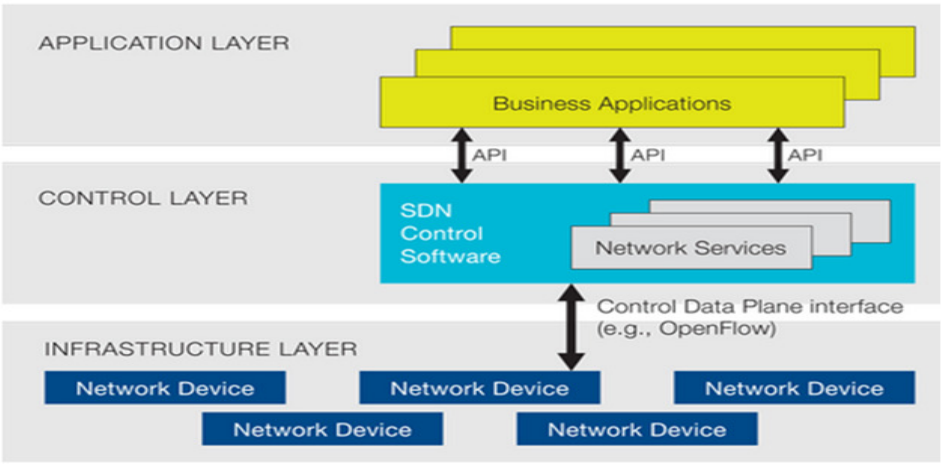

Figure 1: SDN System Architecture

Referring back to the discussion of the HP App Store, SAP and Microsoft applications such as SharePoint are examples of the business applications that are shown in Figure 1. Application Delivery Controllers from Citrix and Radware along with WAN optimization controllers from Riverbed are examples of Network services.

As part of the agile application development process that is associated with DevOps, new applications or modifications to existing applications, whether those applications are acquired from a third party such as SAP or Microsoft or developed internally, are continually being deployed. Testing those applications is extremely complex because they have to be tested in conjunction with the

- SDN controller or controllers on which they run;
- L4 – L7 services that they use;
- Network elements that provide the physical connectivity.

Unfortunately, it isn't sufficient to test the application just within the SDN environment because for the foreseeable future, virtually all date centers will be comprised of new technologies and new network architectures (e.g., SDN) that must interact with traditional technologies and architectures. Hence, the application must be tested in an environment that is comprised of both new and traditional network technologies as well as new and traditional network architectures. In addition, it isn't sufficient to test the application just within the networking domain. The application must be tested both within and across all of the relevant domains; i.e., networking, compute, storage, security.