How to Plan for SDN

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Background and Goal

As described in The 2013 Guide to Network Virtualization and SDN, there is considerable interest in Software Defined Networking (SDN). However, as that document also described, the amount of interest dwarfs the amount of implementation. The goal of this document is to help IT organizations move from interest to implementation by giving IT organizations a framework for planning for SDN that they can customize for use in their environment. It is not a goal of this document to provide a background on SDN such as what can be found in The 2013 Guide to Network Virtualization and SDN or the successor document once it is published.

It should be noted that when The 2013 Guide to Network Virtualization and SDN was written, many in the industry considered overlay-based network virtualization to be fundamentally different than SDN. That is no longer the case. As such, throughout this document an overlay-based network virtualization solution will be referred to as an overlay-based SDN solution, which is in contrast to a fabric-based SDN solution.

Crafting a Plan for SDN

This section outlines a process that a hypothetical company, that will be referred to in this document as GottaChange, can use to plan for the implementation of SDN. The intention is that IT organizations will customize this process for use in their environment.

Define SDN

While some of the initial disagreement in the industry about what exactly is meant by SDN has dissipated, there still isn't uniform agreement in the industry as to the precise definition of SDN. As part of developing an implementation plan, *GottaChange* must develop a definition of SDN that is well understood and agreed to within their organization.

Identify the Primary Opportunities

In order to intelligently choose vendors, architectures and enabling technologies, GottaChange needs to first identify the primary opportunities that they are hoping to address by implementing SDN. To assist with this process, The 2013 Guide to Network Virtualization and SDN identified the primary use cases for SDN and also presented market research that showed the interest that IT organizations had in each of the use cases.

To exemplify the relationship between the opportunities and the various solutions being proposed by vendors, if the primary opportunity that is driving an IT organization is the need to support the dynamic movement, replication and allocation of virtual workloads, then an overlay-based SDN solution is a

viable candidate. An overlay-based SDN solution unto itself, however, doesn't make it easier to respond to opportunities such as making it easier to implement QoS, nor does it enable applications to dynamically request services from the network.

Identify the Key Metrics

Having identified the primary opportunities, *GottaChange* needs to identify the key business-related metrics that are associated with each opportunity. The principal use of these metrics is to enable the IT organization to create a successful business case for implementing SDN. However, *GottaChange* will likely use these metrics throughout the evaluation process; i.e., evaluating solution architectures and performing a proof of concept.

In some cases the key business metrics may be obvious. For example, if one of the primary opportunities that *GottaChange* is trying to address is the centralization of configuration management and provisioning, then one of the key business metrics associated with that opportunity is likely to be labor savings. In contrast, if one of the primary opportunities is to enable business agility, *GottaChange* must identify one or more IT-related metrics and tightly link those metrics with business metrics. The idea is that at some stage in the evaluation process *GottaChange* will be in a position to demonstrate whether or not the implementation of SDN will improve the IT metrics. If SDN does improve the IT metrics, then as part of the *Obtain Management Buy-in* (see below), *GottaChange* has to build the case that the expected improvement in the IT metrics will lead to a significant enough improvement in the business metrics to justify the investment.

Define the Scope of Possible Solutions

Based on how *GottaChange* defines what they mean by an SDN solution, it may or may not be possible for them to acquire a complete solution from a single vendor. For example, it is reasonable to consider just an overlay-based solution to be a complete solution unto itself. If this is what *GottaChange* means by an SDN solution, *GottaChange* can certainly buy a complete solution from a single vendor.

However, if *GottaChange* has an expanded definition of solution, it is less likely that they will be able to acquire a complete solution from a single vendor. An expanded definition of what *GottaChange* means by solution could include functionality such as orchestration; the L4 to L7 functions that are inserted into the service that is consumed by users; and the business applications that access the control information in the SDN controller.

Decide: Best of Breed vs. a System Solution

As described above, based on how *GottaChange* defines what they mean by a solution, it may be possible for them to acquire a complete SDN solution from a single vendor; a.k.a., a system solution. However, even if it is possible for *GottaChange* to buy a system solution they may decide to at least explore the option of buying best of breed components from varying vendors. If *GottaChange* determines that they are willing to acquire components from varying vendors, *GottaChange* must evaluate the testing that was done on both the individual components as well as the complete solution; how the solution will be updated and tested over time; and whether or not there is a single throat to choke.

It's reasonable for *GottaChange* to think that if they are acquiring an SDN solution from a single vendor, that the solution won't have interoperability issues. While that is a reasonable thought, IT organizations

still need to request details of the testing that was performed by the vendor themselves, as well as the results of any third party testing that was performed. This testing is important both to demonstrate interoperability of the components of the solution as well as to identify the performance limits of the solution.

Evaluate NV and/or SDN Solutions

The process that *GottaChange* uses to evaluate SDN solutions should be cyclical. As part of the first stage of the evaluation process, IT organizations perform a cursory evaluation of numerous vendors. The primary goal of the first stage of the evaluation process is to enable *GottaChange* to determine which solutions correspond to the opportunities that they are seeking to respond to and it also makes *GottaChange* aware of the varying approaches to SDN that the vendors have, each with their own value add. Upon completion of the first stage of the evaluation process, *GottaChange* is in a position to eliminate vendors from consideration and to begin a more detailed analysis on a small set of vendors. As described below, the result of this detailed analysis may well be the recommendation to go forward with a proof of concept (POC).

When evaluating a vendor's SDN solution, IT organizations need to understand the following aspects of those solutions.

- **The Solution Architecture**

  This includes topics such as which components of the solution are provided by the vendor and which are provided by a partner; what functionality is done in hardware vs. in software; how much control is centralized in the SDN controller; what protocols are used within the solution; how the solution supports high availability and the level of abstraction that is provided by the controller's northbound API.

  In addition, *GottaChange* must evaluate the various SDN solutions based on their ability to respond to the opportunities that the IT organization has identified. For example, assume that one of the opportunities that the *GottaChange* has identified is being able to support the dynamic movement of VMs. Given that, then as part of the evaluation of solution architectures, *GottaChange* has to identify how each solution accomplishes this as well as the pros and cons of each approach.

  Chapter 2 of The 2013 Guide to Network Virtualization and SDN contains a set of 7 key questions that *GottaChange* can ask vendors about the architecture of their SDN solutions.

- **The Controller**

  GottaChange should evaluate the architecture of a number of SDN controllers. For example, does the controller have a modular architecture that will enable the addition of new functionality over time? Is the controller based on the OpenDaylight controller? As part of this evaluation *GottaChange* also needs to understand how the controller's architecture enables scalability, high availability and performance. At the author's web site is a white paper that discusses ten criteria that IT organization should use to evaluate SDN controllers.

- **The Network Elements**

  Most overlay-based SDN solutions are network agnostic. If that is the type of solution that *GottaChange* is evaluating, then it's possible that there isn't a need for them to evaluate the physical network elements on which the potential NV solutions run. As a minimum, however, *GottaChange* will want to determine which vSwitches the overlay-based solution supports. In addition, some providers of overlay-based SDN solutions have established relationships with providers of fabric-based solutions that enable the two vendors to federate their solutions. If this is the type of solution that *GottaChange* is evaluating, then many of the questions referenced below are applicable to the combined solution.

  Chapter 2 of The 2013 Guide to Network Virtualization and SDN contains a set of key questions that *GottaChange* can ask vendors about the network elements that they support.

- **Management**

  There are three aspects of SDN management that *GottaChange* needs to evaluate. One aspect is the ability of the vendor's solution to alleviate the management challenges created by implementing SDN. Based on the type of solution that *GottaChange* is considering, this may include monitoring the performance of the controller; providing end-to-end visualization of the virtual networks; configuring the SDN switches and monitoring the physical and logical networks between switches. The second aspect of management that *GottaChange* needs to evaluate is whether or not there is any additional management capabilities that are associated with the solution, such as the ability to centralize configuration management. The third aspect of management that *GottaChange* needs to evaluate is the integration of the management of SDN into a broader management solution.

  Chapter 2 of The 2013 Guide to Network Virtualization and SDN contains a set of 5 key questions that *GottaChange* can ask vendors about the management of their SDN solutions.

- **Security**

  There are also two aspects of security that *GottaChange* needs to evaluate. One aspect is what functionality the vendor provides in order to secure their SDN solution. One of the reasons this is important is because SDN controllers are new attack surfaces. The other aspect of security that needs to be evaluated is the ability of the solution to enhance the overall security of the IT infrastructure. An example of how SDN can potentially improve security is demonstrated by the OpenDayLight consortium's SDN controller which contains a toolset that can be used for the detection and mitigation of DDoS attacks.

  Chapter 2 of The 2013 Guide to Network Virtualization and SDN contains a set of 5 key questions that *GottaChange* can ask vendors about the security of their SDN solutions.

- **Additional Functionality**

  There are two approaches that an IT organization can take relative to implementing network functions that ride on the SDN controller. One approach is to acquire the network functions from a vendor. Since most IT organizations will acquire network functions from vendors, evaluating vendor supplied network functions is a key component of the overall process of evaluating SDN solutions.

The second approach is for the IT organization to develop some of all of the required network functionality itself. The primary advantage of this approach is that it enables the IT organization to customize the network functions to meet the organization's specific requirements. One of the disadvantages of this approach is that it requires the IT organization to have the set of skills that are necessary both to develop the network functions and to maintain those functions over their life cycle.

GottaChange should use the process of evaluating SDN solutions to determine if it can acquire all of the network functions it needs to respond to the opportunities that it has identified or if it has to develop some or all of those functions itself.

Test and Certify Solutions

Even if all of the components of an SDN solution come from a single vendor, as part of evaluating those solutions *GottaChange* needs to understand the testing that was done to ensure both the smooth operation and the performance of the solution. Particularly in those situations in which the components of the SDN solution come from multiple vendors, *GottaChange* needs to understand if the solution is certified. By that is meant, if *GottaChange* implements the solution, will it have a single point of contact to resolve any problems that develop.

There may be instances in which *GottaChange* has to either do testing itself or to commission a third party to do testing on its behalf. For example, if *GottaChange* were to develop one or more network functions, it would need to test the operation of those functions on the controller(s) that it had selected and it would need to redo that testing prior to implementing new versions of the controller or new versions of the network functions. If *GottaChange* anticipates facing a situation like this then as part of the evaluation process, *GottaChange* needs to evaluate both the tools that are available to enable the organization to do the testing itself as well as the functionality provided by external test labs.

Integrate with the Existing Environment

It is certainly possible for *GottaChange* to evaluate SDN solutions in isolation from the IT organization's current environment. However, given that the SDN solution might at some time be implemented in *GottaChange's* production network, then as part of the evaluation process *GottaChange* should examine how the SDN solution would fit into the existing infrastructure. For example, what mechanisms exist to enable traffic to flow between the SDN solution and the traditional network? Is it possible to extend the SDN solution so that it operates both in a data center and in a branch office? So that the solution operates in multiple data centers?

Educate the Organization

SDN is both embryonic and rapidly evolving. Hence, in order to create and update a plan to potentially implement SDN, *GottaChange* must continually educate itself as to what is happening in the broad SDN ecosystem. This includes analyzing what is being said in the industry about the relevant use cases and the techniques that can be used to justify deployment. It also includes reviewing product announcements; the announcement of enabling technologies that are either new or have evolved; the results of plugfests that are intended to test the interoperability of SDN solutions; and the work of organizations such as the OpenDayLight consortium.

Much of the education discussed in the preceding paragraph can be accomplished by reading articles and white papers and by attending seminars and workshops. *GottaChange* should also consider downloading some of the open source products that are readily available and playing with those solutions to gain deeper insight into their capabilities and weaknesses. In addition, the author has published a mock RFI for SDN solutions that is hosted at the author's web site (www.ashtonmetzler.com). *GottaChange* can use this document to structure a dialogue with selected vendors.

Evaluate Professional services

Given that SDN is a new way of implementing networking, *GottaChange* may choose to use a professional services organization to help with one or more stages in the overall Plan, Design, Implement and Operations (PDIO) lifecycle. The relevant services that *GottaChange* might use could be technology centric (e.g., developing SDN designs, testing SDN solutions), organization centric (e.g., evaluating the skills of the current organization, identifying the skills that are needed and creating a way to develop those skills) or process centric; e.g., evaluating the current processes and developing new ones. These services could be light-weight (i.e., the professional services organization provides limited support) or heavy-weight whereby the professional services organization provides significant support. They may also be consumed just as part of an initial rollout of SDN or they could be consumed over an extended period of time as *GottaChange* extends its deployment of SDN.

If *GottaChange* is considering leveraging professional services from a third party, then as part of the overall evaluation process, *GottaChange* needs to evaluate the professional services that are provided, both by the potential providers of the SDN solution as well as from independent providers of professional services.

Eliminate Organizational Resistance

Organizations tend to resist change and the amount of resistance is typically directly proportional to the extent of the change. Hence, if *GottaChange* is looking at a narrowly defined SDN solution, such as one that implements a network tap application, it can expect minimum organizational resistance. Conversely, if *GottaChange* is looking at a broadly defined SDN solution, then it must anticipate significant organizational resistance.

Organizations are particularly resistant to change if that change is likely to have a significant impact on jobs. The overall movement to implement a wide range of IT functionality in software, of which the movement to implement SDN is just one instance, has the potential to impact the jobs of network professionals. For example, the deployment of SDN is likely to reduce the amount of manual labor that *GottaChange* has to perform and is likely to increase the amount of programming that *GottaChange* chooses to perform. As part of planning for SDN, *GottaChange* needs to anticipate resistance from the network organization and respond accordingly. For example, *GottaChange* may sponsor members of its network organization achieving some of the new certifications that various SDN vendors have recently announced.

Perform a POC

Assuming that the previous steps in their plan have produced positive results, *GottaChange* may elect to perform a POC. The breadth of the POC is directly related to how *GottaChange* has scoped the proposed SDN solution and the length of the POC is directly related both to the criticality of the tasks that the solution is intended to support and the potential cost of the SDN solution.

One goal of a POC is to determine if the proposed solution works and if so, how well it performs. Another goal is to quantify the previously defined key metrics that are associated with each opportunity that *GottaChange* is hoping to address. As noted, quantifying these metrics is necessary in order to obtain the management buy-in that is required to put the solution into production.

Obtain Management Buy-In

GottaChange's network organization needs varying levels of management buy-in at the various stages of their SDN plan. For example, little if any management buy-in is needed just for members of *GottaChange's* network organization to attend a seminar or workshop and in many cases, little buy-in is needed in order for them to download open source solutions and to spend a modest amount of time coming to understand the functionality and the limitations of those solutions. Increasing levels of management buy-in are typically needed to engage vendors in detailed discussions of SDN, to conduct a POC or to implement an SDN solution.

GottaChange is more likely to get management buy-in if they anticipate management's concerns and work to resolve those concerns over the entire planning cycle. For example, like virtually all organizations, *GottaChange* will likely face management resistance to implementing any technology or new way of delivering technology if the associated security and compliance concerns are not thoroughly addressed. In addition, *GottaChange* will likely face management resistance if any of *GottaChange's* key processes are impacted.

Like virtually all IT organizations, *GottaChange* will need to develop some form of business case to justify implementing SDN. There are three primary components to the business case that *GottaChange* has to develop. One component is the quantification of the benefits that will occur if *GottaChange* implements the proposed SDN solution. As noted, one of the primary reasons for performing a POC is to quantify those benefits. Another component of the business case is a multi-year financial analysis that details all of the costs as well as the benefits that are associated with implementing the proposed solution. The third component of the business case is an analysis of what *GottaChange's* IT organization will do to mitigate the risk that is associated with implementing the proposed solution. In addition to mitigating the risk associated with the solution not performing well, this includes mitigating the previously mentioned concerns that management has about issues such as security, compliance and the impact on existing processes.

Summary and Conclusions

There is no doubt that over the next few years that SDN will have a significant impact both on enterprise networks and on the role of network professionals. Because of that, IT organizations and IT professionals need to develop a plan to evaluate and potentially implement SDN.

Given the embryonic and rapidly changing nature SDN, any implementation plan will likely evolve over time. The process that a company such as *GottaChange* should take to evaluate solutions and possibly implement one or more solutions includes the following steps:

1. Define SDN
2. Identify the Primary Opportunities
3. Identify the Key Metrics
4. Define the Scope of Possible Solutions
5. Evaluate SDN Solutions
6. Test and Certify Solutions
7. Integrate with the Existing Environment
8. Educate the Organization
9. Evaluate Professional Services
10. Eliminate Organizational Resistance
11. Perform a POC
12. Obtain Management Buy-In

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