The Business Case for Deploying SDN in Enterprise Networks

Executive Summary

The 2015 Guide to SDN and NFV[1] reported on the results of a survey that was recently taken by 246 IT professionals. One of the things the survey focused on was the factors that are inhibiting SDN deployment. The survey data showed that one of the strongest inhibitors to the broad adoption of SDN by enterprises is the lack of a compelling business case.

Creating a business case for SDN is challenging for a couple of reasons. One reason is that there are a wide range of SDN use cases, each with its own business case. The other reason is that each enterprise network organization is somewhat unique in terms of how they operate their networks and how they interact with the rest of the IT organization and the enterprise's business unit managers. Because of the variability in SDN use cases and enterprise IT environments, it isn't possible to create a single SDN business case that's a perfect fit for all situations. It is, however, possible to create a template that can serve as the basis of a business case that is applicable to the vast majority of enterprise IT organizations.

In order to create that template this white paper describes:

- The primary components of a business case for the enterprise adoption of SDN;
- The experiences of multiple organizations relative to creating a business case to justify implementing a SDN-based LAN.

Table 1 contains the primary advantages that are associated with adopting SDN along with an assessment of the likely impact of those advantages based on the experiences referenced in the preceding bullet list. The third column is to be used by the reader to identify the specific impact that each SDN advantage would have in their network.

SDN Advantage	Likely Impact
Operational Efficiencies	• 80% reduction in operational expense • 72% reduction in the labor to do configuration changes • Make moves, adds in changes in minutes, not minutes
Consolidation of IT Resources	• Reduce the number of switches by 80% • Reduce the number of server racks by 65% • Reduce power consumption by 80% • Consolidate and Virtualize firewall and other network devices up by 90%
Business Agility	• Deploy new business services more rapidly • React to cyberattacks
Increased Network Availability and Performance	• Reduce recovery time from minutes to seconds

[1] http://www.webtorials.com/content/2015/01/the-2015-guide-to-sdn-nfv-4.html

Enhanced Management and Visibility	• Visualization of the entire network • Equipment and virtual networks can be added via a GUI

The Elements of a Business Case

It's relatively easy for an enterprise IT organization to build a business case for implementing SDN in the WAN based largely on the hard dollar savings that are associated with reducing the organization's spend with one or more service providers. A business case based on hard savings usually features a few key financial metrics such as payback period and internal rate of return (IRR)[2]

There are hard dollar savings associated with SDN adoption in the LAN. One example of such savings was pointed out in a recent article entitled *Making the Business Case for SDN*[3]. As that article stated, adopting SDN and flattening the LAN architecture can result in up to a 95% savings in real estate, power, cooling and cabling. The hard savings that result from implementing SDN in the LAN can often be enough to create a business case for adopting SDN. Even in those cases in which the hard savings are not enough, the combination of hard and soft savings will likely be sufficient.

A primary component of a business case to justify SDN adoption is the reduction in the operational support costs. In part because of how diverse enterprise IT organizations are, analyst firms have stopped publishing studies that quantify the Total Cost of Ownership (TCO) for LANs. However, in one of the last studies that was performed, Gartner[4] stated that 73% of the total LAN costs are for personnel resources – connectivity administration, general network and application support and hidden costs. Gartner[5] also stated "When calculating TCO, companies have to be sure to factor in soft costs. For every tech support person on your staff, there are three or four [end users] in the business units who are helping with support. Those costs, plus peer support, casual learning and self-support, should also be calculated into the TCO model." These data points highlight the fact that while the capital costs associated with implementing any LAN are certainly important, those one-time costs are dwarfed by the ongoing operating costs.

In addition to reducing operational support costs, there is a range of benefits that are associated with adopting SDN in the LAN. IT organizations need to determine which benefits are most relevant to their organizations and include those benefits in the business case.

[2] http://blog.silver-peak.com/how-do-i-build-a-framework-to-justify-upgrading-the-wan

[3] http://www.enterprisenetworkingplanet.com/netsysm/making-the-business-case-for-sdn-1.html

[4]

https://books.google.com/books?id=NQUAAAAAMBAJ&pg=PA86&lpg=PA86&dq=total+cost+of+lan+ownership&source=bl&ots=UxCrX_mEf4&sig=8-s6vktWC_Ycwj6XcPs8kvUydkc&hl=en&sa=X&ei=zKE3VYWEGvX8sASt4IHgBQ&ved=0CE0Q6AEwCA#v=onepage&q=total%20cost%20of%20lan%20ownership&f=false

[5] http://www.computerworld.com/article/2570090/it-management/gartner--debunking-five-myths-of-tco.html

Possible benefits to include in a business case to justify adopting a SDN-based LAN are discussed below.

Operational Efficiencies

One of the primary advantages of a SDN is that it reduces the cost and time associated with tasks such as configuration and provisioning by centralizing control and allowing network organizations to configure and provision hundreds of devices as if they were one device. While these savings on their own are very significant, as pointed out by Gartner for every tech support person on a company's network staff, there are three or four [end users] in the business units who are helping with support. As a result, if the quantification of the cost savings that are associated with implementing a SDN-based LAN focuses only on the impact to the network organization, then those cost savings are understated.

Consolidation of Resources

By virtualizing and pooling compute, storage and network resources, IT organizations can significantly reduce the number and the cost of the required physical resources. However, as described below, a SDN is required both to implement efficient network virtualization and to experience all of the potential benefits that result from compute and storage virtualization.

IT Agility

The same factors that drive operational efficiencies in a SDN-based LAN often drive an increase in IT agility. For example, one of the primary benefits of server virtualization is being able to move virtual machines (VMs) between physical servers. This isn't possible in a traditional network environment without costly, time-consuming manual labor. One of the key characteristics of a SDN is that is supports virtual networks which are decoupled from the physical networks. These virtual networks enable VMs to be dynamically moved between physical servers with no manual intervention. Being able to dynamically move VMs results in considerable operational savings and it makes the IT organization more agile.

Another way that SDN increases the agility of the IT organizations comes from the decoupling of the virtual networks from the physical networks and also being able to guarantee complete isolation of each user of the SDN. Because of this isolation, an IT organization can allow application developers to run their applications in a production environment without impacting production traffic. This is particularly important for an IT organization that either already has, or soon will embrace DevOps.

Business Agility

In a SDN, network functions such as optimization and security can be coordinated at a policy level with the SDN controller handling all of the details needed to implement those policies across multi-device, multi-platform infrastructure. This enables the IT organization to support new business services notably faster than in a traditional environment in which each device has to be procured and manually configured.

Improved Application Performance

One of the primary characteristics of a SDN is that there are programmatic interfaces into the SDN controller. These interfaces make the control information that has been centralized in

the controller available to a potentially unbounded set of SDN applications. These applications are capable of dynamically changing the underlying network to perform tasks such as forwarding packets over the least expensive path or improving application performance by changing the QoS settings based on the available bandwidth or other factors.

Increased Network Availability and Performance

There are a number of ways that a SDN can result in increased availability. For example, one of the many advantages of decoupling the virtual networks from the physical networks is that it enables IT organizations to make changes to the physical network, such as scaling out capacity, without impacting the existing flows or having to take the network out of service.

Another way that a SDN can result in increased availability is relative to how traffic is routed. In a traditional network there is a single data path from origin to destination. If that path becomes unavailable, there is an outage until a new path is determined. A key feature of an SDN controller is its ability to discover multiple paths from the origin of the flow to its destination and to split the traffic for a given flow across multiple links. In normal operating conditions, this capability of SDN increases both the performance and scalability of the solution. In the case of an outage, this capability increases availability because there will still be at least one active path from origin to destination. This capability also eliminates the need to add to the complexity of networks by adding protocols such as TRILL (Transparent Interconnection of Lots of Links) or SPB (Shortest Path Bridging).

Improved Security

There are a number of ways that a SDN can result in improved security. For example, in order to respond to myriad industry and government regulations about data security, IT organizations often need to keep the data generated by one set of users isolated from other users. This can be accomplished by adopting a SDN that provides virtual networks that are fully isolated from one another.

In addition, by virtue of Layer 2-4 flow matching capability, OpenFlow access switches can filter packets as they enter the network and act as simple firewalls at the edge. With OpenFlow switches that support modification of packet headers, an OpenFlow-enabled controller will also be able to have the switch redirect certain suspicious traffic flows to higher-layer security controls, such as IDS/IPS systems, application firewalls, and Data Loss Prevention (DLP) devices. Other security applications built on OpenFlow controller can match suspicious flows to databases of malware signatures or divert DDoS attacks.

Enhanced Management and Visibility

As was previously discussed, a SDN dramatically simplifies tasks such as configuration management. A SDN can also help with application performance management. For example, in the majority of instances in which the performance of an application is degrading, the degradation is noticed first by the end user and not by the IT organization. One of the principal reasons why IT organizations are often unaware of degraded application performance is that in the traditional IT environment, IT organizations lack visibility into the end-to-end network flows. One of the key advantages of a SDN is that it enables IT organizations to have end-to-end network flow visibility.

Building the Business Case

This section discusses the experiences of five companies that have implemented a SDN-based LAN. The discussion will highlight the key benefits that each company either incorporated into the business case they used to justify adopting a SDN-based LAN or which they experienced after adopting SDN.

Due to the sensitive nature of the information, none of the five companies can be specifically identified. Two of the companies are university hospitals, one is a manufacturing company, another is a logistics company and the fifth is a railway company. They will be referred to in the discussion as:

- The First Hospital
- The Second Hospital
- The Manufacturer
- The Logistics Company
- The Railway

Operational Efficiencies

The situation that faced both hospitals was very similar. For example, each hospital needs to have an IT environment in which new medical technologies and products can be quickly incorporated into the IT environment so that they can enable new medical services. The barrier to achieving this was the state of each hospital's LANs which had evolved on a department by department basis.

According to The First Hospital's Director of Corporate Planning this departmental approach let to a situation in which "Even daily operations were challenging. Technologies evolve rapidly in the medical field, and doctors often try new equipment. Connecting this equipment to the network involved changing settings and verifying connections, and sometimes even rewiring, putting a considerable strain on the hospital's budget. A network that requires setting changes and rewiring every time a new piece of equipment is connected cannot be called stable. The other issue was slow reconfiguration of the network due to the processes in place. Adding a new piece of equipment could take three months including time to initiate the contract for the add/move/change."

The First Hospital decided that in order to overcome these challenges that it had to implement a centralized LAN whose primary goal was to integrate the departmental LANs. According to the Director of Corporate Planning, while the acquisition cost of the SDN hardware was roughly the same as that of a legacy network, the operational expenses and maintenance cost was reduced markedly. He estimated a savings of 80 percent on his operational expenses, including reduction in staff hours required to manage the network. Given that as previously mentioned, the operational costs associated with a LAN dwarf the capital costs, these savings are truly significant.

One of the network issues that The Manufacturer faced was that their factory network and their office networks weren't separated and this lack of separation

created serious concerns about the security of their manufacturing network. In addition, in order to add edge switches they had to install optical cables to connect the new edge switches with their core switches.

The Manufacturer decided to refresh their entire LAN. They choose to implement a SDN-based LAN in part because the capital costs of the SDN-based LAN were lower than the capital costs of a traditional LAN and in part because the operational costs were significantly less. One example of the reduced operational costs is that The Manufacturer makes somewhat frequent changes to the configuration of its twenty switch network. In the case of a traditional network, each configuration change requires:

- 4 days for design;
- 3 days to create the configuration files;
- 2 days to perform the configuration work.

With the SDN they installed, each configuration change requires:

- 1 days for design;
- 0.5 days to create the configuration files;
- 1 days to perform the configuration work.

Going from a total of 9 days of work to make the configuration changes down to 2.5 days represents a labor reduction of 72%, which is in line with the operational savings that were reported by the Director of Corporate Planning for The Hospital.

The Railway runs one of the largest railway stations in the world and within the station are several dozen LANs. For example, there is a LAN that supports the cameras that are used to manage the operating status of escalators and another that provides information about train service. "We originally built each of the networks separately as the need arose," explains the General Manager of the Electrical & Signal Network System Department at The Railway. "This resulted in extensively jumbled wiring on the backend, creating an extremely complicated situation for us." Adding to this complexity was the level of workloads and bloated timeframes involved when adding to and/or modifying a network. This created some significant challenges in part because a railway station undergoes frequent improvement work and each time it does, configuration changes have to be made to the network devices. Adding to this challenge is that fact that in order to not inconvenience their customers, construction work is limited to a small number of late night hours. The General Manager stated that because of their deployment of a SDN-based LAN "The time and trouble spent when adding a network in the past, and/or relocating equipment and changing configurations due to construction projects inside the station have been eliminated."

As previously noted, the same factors that drive operational efficiencies in a SDN-based LAN often drive an increase in IT agility. An example of that came from the Director of Corporate Planning for The First Hospital who said that because of the reduced maintenance associated with the SDN-based LAN they deployed, that he is able to make much better use of his human resources at the hospital. He added that, "More importantly, I now have the ability to perform moves, adds and changes to my network much faster than before. I

can now provision the network after new equipment installations or equipment moves in minutes instead of the three months it used to take." This reduction in time is achieved by leveraging the OpenFlow protocol, which will automatically connect the equipment to the right network instantly.

Consolidation of IT Resources

The SDN-based LAN that The First Hospital implemented eliminated the stranded capacity with under-utilized switches and servers in some of The First Hospital's departments as well as the need for additional resources in others. As a result, The First Hospital has been able to reduce the number of switches it needs from 40 down to 8, which is an 80% reduction. They were also able to reduce the number of server racks from 17 to 6, which is a 65% reduction. The reduction in the number of switches and server racks results in a range of savings including a significant cutback in the cost paid by The First Hospital for electricity. In addition, the reduction in the number of servers also considerable reduces the cost of the maintenance associated with the servers.

The situation facing The Logistics Company was that in order to improve efficiency and reduce operating costs, the company decided to implement a private cloud. According to the Network Planning Group Leader for their IT organization "Network storage could be easily setup using virtualization. The problem occurred when a virtual machine is added or modified, then the physical layout of network equipment and LAN cables has to be moved, and the configuration settings of network equipment must be adjusted manually." Under the current structure, making adjustments to the network required onsite support from the network supplier.

After implementing a SDN-based LAN the rack space required by their core switches went from 32u to 10u – a 70% reduction. Correspondingly, their power consumption went from 14 KW to 2.5 KW – an 80% reduction. Having deployed the SDN they were able to make adjustments to the network without needing support from the supplier which eliminated an additional $75,000 of annual expense.

Business Agility

As a result of having implemented a SDN-based LAN, The First Hospital now intends to merge their IP address space and mobile network. According to the Director of Corporate Planning, "Once realized, medical equipment or other computers and devices can move not only within the hospital but also within the home or anywhere in the active area of your mobile phone."

The General Manager of the Electrical & Signal Network System Department at The Railway stated that the SDN that they adopted enables the rapid deployment of new services, and is expected to serve as the driving force behind strategic IT activities. One plan they are looking at is aimed at utilizing a wireless LAN and

tablet PCs to expand and improve operational support services for station personnel. If train delays and other such scheduling information was transmitted from the control room directly to tablet PCs being carried by station personnel, this would not only be useful for the station personnel in carrying out their jobs but would also enable the provision of more detailed information and guidance to passengers. The company is also exploring a variety of other new service possibilities, such as detecting and displaying passenger congestion in the concourse and train platforms by using IP cameras, and to display train service information at the required location.

The Second Hospital is launching a new medical service that utilizes smartphone camera functionality. "Until now, if we wanted to register photographs of a patient's injury or photographs for surgery notes, we had to connect the digital camera to the electronic medical record system and register the photos manually," explains a medical information engineer at the hospital. "However, this method can easily lead to medical accidents such as incorrectly identifying patients. Now we've built a system that requires the correct patient to be identified by smartphone before taking clinical photos. These photos can also be transferred via wireless LAN from anywhere in the hospital, such as a ward or operating room, and immediately recorded in a patient's medical records, providing us with a method that is both safe and efficient."

Increased Network Availability and Performance

The Director of Corporate Planning for The First Hospital said that "Now we are enjoying rapid recovery time and flexibility in a network with reduced maintenance and operational costs. The time for recovery was reduced to seconds rather than minutes with STP and RSTP."

The General Manager of the Electrical & Signal Network System Department at The Railway said that "In addition to providing equipment redundancy, that the new SDN network ensures alternative routes in two directions at a minimum, and achieves high availability. In addition, even in the unlikely event that trouble should occur, the cause of the problem can immediately be discerned using an easy-to-understand graphical user interface."

Enhanced Management and Visibility

The Second Hospital has been able to enhance their network management and monitoring by enabling visualization of the entire network infrastructure, which has greatly improved medical safety. Equipment can be added to the network and virtual networks can be constructed on the GUI, enabling rapid roll-out of advanced medical services that use the latest medical technology.

Summary

There are many ways to build a business case to justify implementing a SDN-based LAN. For example, as shown in this white paper a SDN-based LAN enables a company to deploy new

services in a drastically reduced amount of time. For some companies, that increased business agility is sufficient justification to implement a SDN-based LAN.

Other companies require either sufficient hard savings to justify the investment in SDN on its own merits or enough hard savings to justify the investment when combined with soft savings such as increased business agility. As shown in this white paper, a SDN-based LAN results in hard savings in two key areas:

- Consolidation of IT resources;
- Operational efficiencies.

Consolidation of IT resources

Both The First Hospital and The Logistics Company experienced significant hard savings as a result of the consolidation of IT resources that their SDN-based LANs enabled. The First Hospital was able to reduce the number of switches it needs from 40 down to 8, which is an 80% reduction. They were also able to reduce the number of server racks from 17 to 6, which is a 65% reduction. After implementing their SDN-based LAN The Logistics Company was able to reduce the rack space required by their core switches from 32u to 10u – a 70% reduction. Correspondingly, their power consumption went from 14 KW to 2.5 KW – an 80% reduction. They were also able to eliminate an additional $75,000 of annual expense

Operational efficiencies

As pointed out by Gartner, roughly three quarters of the total cost of a LAN is the cost of personnel resources – connectivity administration, general network and application support and hidden costs. As shown in this white paper, after implementing a SDN-based LAN, The Railway, The First Hospital and The Manufacturer all experienced a significant reduction in the need for manual labor. Those savings included the:

- Eighty percent savings on operational expenses, including reduction in staff hours required to manage the network, that was experienced by The First Hospital;
- Seventy-two percent reduction in the amount of manual labor that was required to do configuration changes that was experienced by The Manufacturer;
- Elimination of the time it takes to relocate medical equipment or change configurations that was experienced by The Railway.