ZYXEL
Your Networking Ally

WHITEPAPER
nebula **SD-WAN**

How to Increase 8.2M Euros Annual Revenue

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Executive Summary

Under the global digital transformation (DX), the combined demand for cloud and mobility fundamentally reshapes the application usage and data traffic within the business network. This new challenge influences all organizations but in particular imposes a greater impact on distributed businesses that have more branches and remote users. As businesses transform their network and process for higher level of digitalization, it is imperative that their network must evolve.

This whitepaper firstly elaborates how software-defined wide area network (SD-WAN) provides modern businesses with an ideal solution to address new digital challenges from this paradigm shift in WAN landscape and an opportunity to gain better performance and rationalize costs.

Secondly, this whitepaper demonstrates how SD-WAN enhances cost efficiency for traditional multiprotocol label switching (MPLS) WAN connectivity, bringing significant cost reduction in both capital and operational expenditures, simulates how the cost advantage varies across a small one-site deployment to a large 100-site scale, and depicts how the cost reduction effect remains in a five-year time frame with a Nebula SD-WAN case study.

Last but not least, this whitepaper concludes why SD-WAN is an ideal WAN solution for SMBs and MSPs/ISPs as SD-WAN pays off in not only performance but also cost, management, speed and agility.

CH1: New Digital Era Necessitates SD-WAN

1-1 Paradigm Shift in WAN Requires New Solutions

The bigger picture behind the new dichotomy of SD-WAN and MPLS would be digital transformation, as this new trend gives rise to an irreversible paradigm shift in the WAN landscape and hence driving more and more businesses to turn to the newly rising SD-WAN technology in order to survive new network challenges and embrace benefits from the digital transformation, seeking more streamlined operation, quicker responsiveness, optimal cost efficiency, and ultimately better competiveness.

There are three major drivers that are pushing a paradigm shift taking place in worldwide WAN landscape that every modern business cannot prosper without dealing with – proliferating cloud applications, expanding network demands from business branches, and increasing mobility.

1-1-1 Cloud

Foremost of all, applications are moving to the cloud, as also addressed by David Mitchell Smith, vice president of Gartner: "Cloud computing is increasingly becoming a vehicle for next-generation digital business, as well as for agile, scalable and elastic solutions." Gartner foresees the growing cloud and predicts "by 2021, more than half of global enterprises already using cloud today will adopt an all-in cloud strategy." (Panetta 2017)[1] Another 2018 survey shown in below *Figure 1* also tells 45 percent of surveyed businesses already reckon their WAN structure must adapt to the cloud trend. Moreover, leveraging cloud can also bring new advantages by turning conventional upfront investments into a pay-as-you-go style. One benefit of using cloud computing services is that firms can avoid the upfront cost and complexity of owning and maintaining their own IT infrastructure, and instead simply pay for

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[1] Panetta, Kasey. 2017. Smarter With Gartner: Cloud Computing Enters its Second Decade. 1 30. Accessed 7 21, 2019. https://www.gartner.com/smarterwithgartner/cloud-computing-enters-its-second-decade/.

what they use, when they use it. (Ranger 2018)[2] For start-ups and growing businesses, reduced operational cost can also be a big driver of cloud adoption. (Montaigne 2019)[3]

Figure 1: Customer WAN Priorities to Support Cloud and Digital Needs

Customer WAN Priorities to Support Cloud and Digital Needs

Legend: ■ First Choice ■ Second ■ Third **Sum of Top Three**

Priority	First Choice	Second	Third	Sum of Top Three
A more effective WAN architecture that can address the evolving needs of the cloud and digital requirements	15%	15%	15%	45%
Integration and convergence with IoT networking and wireless LAN solutions	10%	21%	10%	40%
Greater application visibility and ability to implement effective quality of service and performance optimization of the WAN	12%	11%	18%	40%
Ability to orchestrate connections and services across hybrid cloud and on-premises locations and applications	17%	16%	6%	39%
Close integration with business analytics tools such as artificial intelligence and machine learning	10%	12%	17%	38%
Mandate the capability to orchestrate network and security policies across the entire WAN from a central site	13%	9%	6%	28%
Go for more investments on virtual network devices in the branch and remote sites	5%	10%	11%	26%
Invest on zero-touch provisioning (a completely automated WAN solution) capabilities	7%	4%	10%	21%
Invest on hardware-based CPEs having converged network capabilities in branches	12%	3%	6%	21%

-1%   25%   50%
Percentage of Respondents

Base: Those who indicated "meeting cloud/digital-specific requirements" as one of the biggest/potentially biggest concerns with the WAN, excluding don't know/not sure; n = 94
Q12B. Which of these actions would you consider immediately for addressing/tackling the challenges of meeting the WAN requirements specific to cloud and digital application (such as connecting to Office 365 and remote IoT sensors)?
ID: 355369   © 2018 Gartner, Inc.

Source: Gartner (November 2018)

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[2] Ranger, Steve. 2018. What is cloud computing? Everything you need to know about the cloud, explained. 12 31. Accessed 7 21, 2019. https://www.zdnet.com/article/what-is-cloud-computing-everything-you-need-to-know-from-public-and-private-cloud-to-software-as-a/.

[3] Montaigne, Paul. 2019. The true costs of CapEx vs OpEx in a cloud environment. Jan 17. Accessed 4 20, 2019. https://www.cogecopeer1.com/true-costs-capex-vs-opex-cloud-environment/.

1-1-2 Branches

Proliferation of cloud adoption means application use in businesses today is quickly evolving from an old structure, where the business or its data center hosts all applications within the premise, towards a more open Software-as-a-Service (SaaS) model. This then inevitably gives rise to the next new WAN challenge – increasing bandwidth demand from the branches, as all remote sites now require an increasing amount of traffic to go directly to the Internet, bypassing the conventional hub. Legacy WAN infrastructures become too inefficient and obsolete to suit the new requirement as their wasteful traffic diversion causes poor performance and traditional WAN such as MPLS are expensive to scale up and slow to respond to new business strategic needs. This mismatch ultimately results in poor performance and higher costs.

1-1-3 Mobility

Under the new digital era with explosive cloud demands, not only are bandwidth requirements from the branches changing, but the nature of network access has also been getting more complex. With more cloud usage and more scattered business collaborations across the headquarters and branches, workers often need to access applications via the cloud when they are working remotely. Meanwhile Voice over IP (VoIP) have increased in use and workers now use voice apps such as Skype on mobile devices or tablets when they're traveling between multiple sites. Since voice traffic is much more bandwidth-sensitive than traditional data, a slight failure in timely packet delivery results in overall poor voice quality, hence there is a need for an ideal WAN solution to fulfil the bigger traffic challenges for modern businesses that must adapt quickly to operate with greater mobility.

# 1-2 Why SD-WAN Is the Answer

1-2-1 Rise of Hybrid WAN Models

Facing digital transformation and squeezed by increasing network demands from ever increasing cloud usage, branch traffic, and mobility requirements, businesses today will soon find traditional WAN architectures unserviceable for the new traffic patterns with sophisticated connectivity requirements. This will steer business towards a new hybrid WAN model that enables shared use of both the newly increasing traffic to myriad public cloud-based applications and conventional private network hosted within the organizations. In the coming future, hybrid WAN model is the new normal. The next milestone for modern organizations is how to deal with this pressing need to establish robust, efficient, secure, and cost-effective connectivity for mission-critical applications at scattered branch offices and from remote workers. The rapid ascent of the SD-WAN in this context is also observed by IDC. They believe "SD-WAN can solve many challenges with regard to WAN connectivity in today's emerging digital transformation environment, allowing remote offices to reap the benefits of digital transformation in a cost-effective, secure, and manageable way" (Mehra and Greene 2017)[4].

1-2-2 Performance. Security. Management. Cost Advantages

As the hybrid WAN model becomes the cradle where SD-WAN can exert its set of functionalities to boost overall performance and unleash some additional efficiencies inherent in the new networking operation it can make possible. The new advantages are not just performance improvement but also in security, management, and cost perspectives. As another 2018 Gartner survey (See below *Figure 2: Biggest WAN Concern*) also shows, these four are the top WAN concerns troubling modern businesses. SD-WAN is just the right technology candidate showing up at the right time to stand out in fulfilling the four criteria for modern business networks.

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[4] Mehra, Rohit, and Nolan Greene. 2017. Benefits of a Fully Featured SD-WAN. IDC, 1.

Figure 2: Biggest WAN Concern
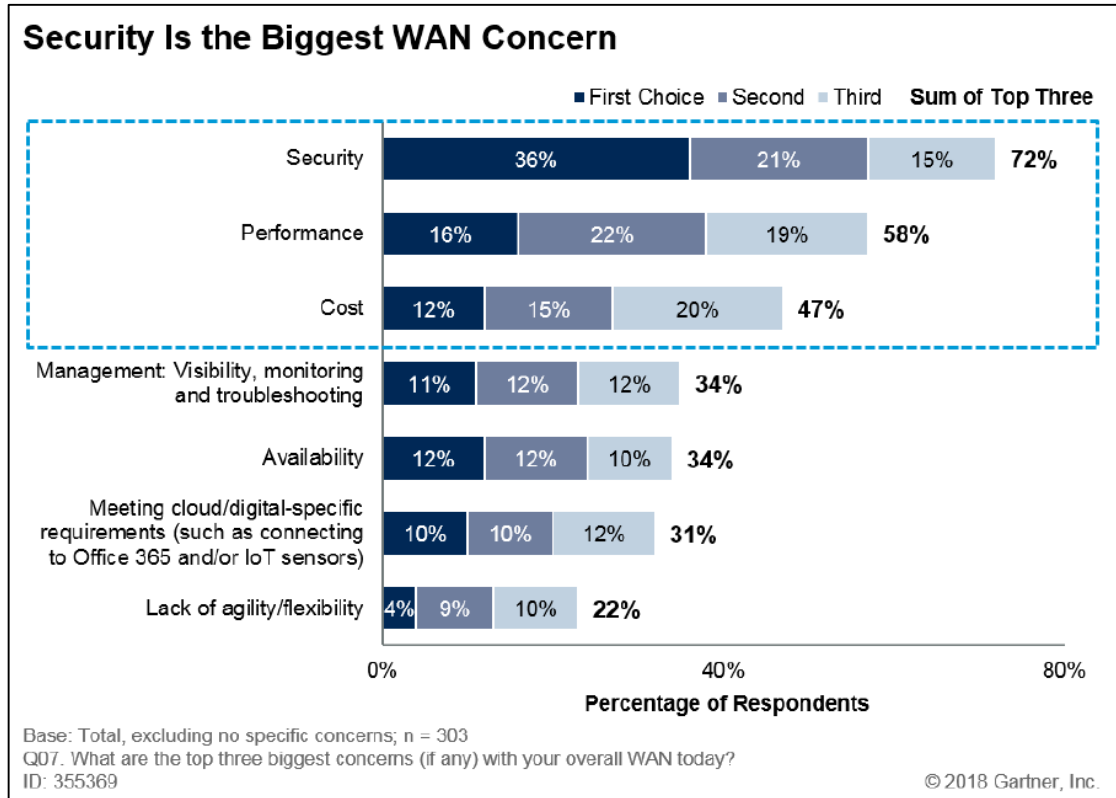
Source: Gartner (November 2018)

Performance

SD-WAN steers traffic intelligently to take the right path at the right time and this easily turns into a guaranteed satisfactory user experience for all kinds of cloud applications accessed from every remote location. Taking Zyxel Nebula SD-WAN for example, its "Dynamic Path Selection" feature performs dynamic adjustment for each packet's path based on smart detection of network latency, jitter, and packet drop status whilst aggregating all available bandwidth to maximize transmission speed. This smart multipath optimization, combined with many other smart routing features, offers faster throughput and achieves a nearly 20-fold increase in speed[5], which transforms site-to-site

5 https://www.zyxel.com/news/Zyxels-Nebula-SD-WAN-achieves-bandwidth-breakthrough-for-SMBs-

20190322-222146.shtml?utm_source=ZyForBusiness&utm_campaign=edm-zyforbiz-

20190509&cmp=1&utm_medium=email

communication for SMBs up to another level. Instead of having to wait hours to transfer vital data from headquarters to branch offices, businesses can now accomplish such mission-critical tasks in a matter of minutes.

Management

Whilst elevating overall network performance and improving perceived service quality, SD-WAN as a cloud-based solution also renders a unique level of network visibility and control of traffic routing with policy management capabilities. For example, Nebula SD-WAN features an online console, Orchestrator, providing clear visibility to network topology, tunnel and health status, giving you better monitoring of your network and troubleshooting control. The processes of maintaining branch hardware are replaced by cloud-based appliances and services, reducing dispatch to the sites in the past. Deployment, configuration, maintenance and troubleshooting are all made easier than ever. It is additionally important in the long term to reduce frictions in IT operations like this, and though the benefits are difficult to quantify yet constitute important results such as of minimized network downtime and interruptions, ultimately making considerable OpEx savings.

Security

Whilst traditional network infrastructure requires IP managers to take additional care of security arrangements, SD-WAN is more of a one box solution that comes with intrinsic security functionalities for a total solution, such as Zyxel Nebula SD-WAN's offering of three default security features – Application Patrol to block external attacks that you can also manage your security policy on applications, Content Filtering to block malicious while restricting inappropriate access, and lastly Geo Enforcer to empower the security protection with IP detection capabilities. IPSec VPN protect your network with encrypted tunnels at all times, delivering uncompromised data safety.

Cost

SD-WAN as a technology provides many levels of resource consolidation across the distributed network, overall reducing IT efforts and multiple appliances in

the branches and the headquarters. If we take the aforementioned performance, security, and management benefits into a monetary perspective, they are exactly the multiple sources of cost reductions on every level in business daily operations, altogether resulting in a strong cost benefit for businesses.

Another cost perspective worth discussing is that capital expenditures (CapEx) is not the only and major source of savings anymore. For business owners, when it comes to rolling out any new technology to embark on the digital transformation journey, one of their key concerns is usually CapEx instead of operational expenditures (OpEx). Certainly CapEx is the conventional top issue as infrastructure costs tend to be a large upfront to pay, but OpEx may now be the new continent in new WAN landscape as the digital transformation has redefined a new cost efficiency on every level. A 2016 study (Conde 2016, 3)[6] also validates this new horizon modern business will discover when they embrace new era networking - the conventional hub-centric CapEx model is becoming outdated, and businesses' major WAN cost saving will shift to OpEx.

In monetary terms, according to Zyxel survey, the total cost reduction is significant for business adopting Nebula SD-WAN to replace existing MPLS networks. Detailed cost reduction will unfold in the next chapter.

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[6] Conde, Dan. 2016. Demonstrating SD-WAN Business Value; Rethinking WAN for a Modern Age. The Enterprise Strategy Group, Inc. (ESG), 3.

CH2: SD-WAN Cost Reduction Case Study

This chapter uses Zyxel Nebula SD-WAN as a real-life example to illustrate how SD-WAN adoption can help MPLS users lower network costs, helping network owners save up to 8.7 million euros per year when their deployment scale is large enough to allow the economies of scale to exert its money saving effects in full swing, meanwhile bringing out the important fact that the more sites or branch offices a business network is composed of, the greater cost benefits the business owner can gain from deploying SD-WAN.

As this case focuses on the cost reduction effect from Nebula SD-WAN replacing MPLS network therefore the case study goes by putting two scenarios in comparison from a cost perspective - one is a rather traditional example of a multiple-site business network using MPLS for connectivity, and the other is an example of using SD-WAN to replace MPLS lines. Zyxel Nebula SD-WAN is the product used in the replacement. This case study then conducts cost modeling to calculate total costs required for different scales in both scenarios. The following section will bring out all parameters that are present in the cost modeling.

2-1 WAN TCO Parameters

Total costs in this example consist of Operational Expenses (OpEx) and Capital Expenses (CapEx) just like usual business network cases. The two parameters sum up to determine the Total Cost of Ownership (TCO) of the business network.

2-1-1 Assumptions

There are inevitably some assumptions in every cost calculation model and this case study is no exception, this section is to declare the research result as shown is based on a certain assumption. This is due to many cost parameters can vary differently case by case as there are seldom enough similarity existing across different network deployment cases to apply a generic cost structure because

each deployment comes with unique local environments and specific business requirements, therefore some assumptions are required in the modeling for it to deliver a referenceable result.

Firstly, maintenance cost of a network deployment, instead of being a clear-cut up front cost, is a continuous operational expense that may vary over time. In this case study it is assumed to be 20 percent of the initial deployment cost based on Zyxel's long-term field experiences. Secondly, this case study applies a five-year time frame as the context therefore this will incur initial setup expense in the first year and maintenance fees for the following four years. This cost structure however can be tuned if users need to estimate SD-WAN cost saving effect for any other shorter or longer period of time. Users can simply shorten or extend the years of maintenance to suit their needs and apply the same structure, parameters, and calculation rationales. Moreover, MPLS costs applied in this case study is based on Zyxel survey around the European regions and therefore may not be able to precisely describe SD-WAN adoption in other areas. This theoretical model is however can be modified to be universally applicable by being fed other regions' MPLS price data. Most importantly, we believe this example as being provided, though based on European data with some assumptions, can already make a clear point and comes as an indication of how great the cost reduction effect SD-WAN can make out of your existing network deployment in practical terms.

2-1-2 OpEx Parameters

OpEx generally refers to all expenses and costs for a company to run its business operations on a daily basis. In this network deployment case OpEx includes all expenses on operational aspects required to build and maintain the network which are not physical hardware investments so we have two parameters in this category for our five-year network deployment example, initial deployment cost and maintenance cost.

Deployment cost

This deployment cost consists of all expenses on human resource to complete the initial network deployment job in the first year and also all other relevant

miscellaneous operational expenditure, including but not limited to expenses on IT employees' salaries and overtime payments for business travels to the deployment sites, their accommodations, food and drinks, all consumable supplies IT men need to complete the installation, and also the company's routine expenses on the sites such as rent, utilities, and general administrative overheads.

Maintenance cost

This maintenance cost covers all expenses with the same operational nature of the aforementioned deployment cost but however takes place only for maintenance purpose after the initial installation is completed, spanning from the second to the fifth year of time in the context of this case study. Apart from the routine human resource expenses, costs on consumable supplies during the four following years, this maintenance cost also extends to cover all other miscellaneous operational overheads to keep the sites and the connectivity running, such as service calls, IT managers' periodic maintenance tours and on-demand troubleshooting trips to the branches.

Maintenance cost may turn capricious at times if there are sudden unpredictable disruptions in the network. It however is set to be 20 percent of initial deployment cost from the second year on in this modeled calculation as a reasonable ground.

2-1-3 CapEx Parameters

CapEx here generally includes all up-front expenses for the initial hardware and infrastructure investments which a business has to make to build up new business networks, including but not limited to the building of new physical network lines and relevant broadband costs, the purchase of new firewall devices along with required licenses and services, and all other wires or gadgets to complete the initial installation.

Besides initial up-front costs, CapEx also remains through the following maintenance period as well, from the second to the fifth year in this case study,

majorly due to firewalls' SD-WAN license renewal, and ongoing network cost on broadband and MPLS.

Device Cost

Device costs are a must in practical terms and cannot be omitted as either the business uses conventional MPLS network or adopts Nebula SD-WAN for connectivity, firewalls are required in both scenarios. However, from a cost perspective, this modeling ignores device costs in the calculation process due to the same reason – it makes no monetary differences when we are comparing MPLS and SD-WAN cases.

License Cost

This cost refers to the license fee of Nebula SD-WAN in the scenario where the business adopts SD-WAN to replace MPLS network. Different SD-WAN vendors have different price policies and in this case study it is the European price of Zyxel Nebula SD-WAN being adopted.

It is worth mentioning that Zyxel offers one-year Nebula SD-WAN service for free trial on ZyWALL VPN Firewalls so the license cost here only comprise of license renewal fees during the maintenance period, which is from the second to the fifth year of the network deployment.

MPLS Cost

The MPLS cost refers to the total fee that incurs to a business owner to not only deploy MPLS network in the first place but also to run maintenance throughout the five-year time frame in the case study. What to note is this case study assumes MPLS users deploy a 10 Mbps MPLS line from the headquarters to each branch in addition to one broadband line deployed from the headquarters and each branch to the Internet. The price information being applied in the calculation comes from Zyxel surveys on MPLS cost across European areas.

Broadband Cost

The broadband cost in this case study is based on the deployment structure where the headquarters and each branch are connected to the Internet by two 50 Mbps broadband lines. The price information being applied in the calculation comes from Zyxel surveys on broadband cost across European areas.

2-2 Cost Reduction Analysis

With all cost parameters clearly defined and explained above, we hereby unfold detailed cost calculation with an overall cost overview first, then followed by a closer look at OpEx and CapEx respectively in more depth.

Figure 3: Case Study - Total Cost Overview

5-year Network Deployment Cost	HQ & 1 Branch		HQ & 2 Branch		HQ & 3 Branch		HQ & 4 Branch		HQ & 5 Branch		HQ & 10 Branch	
	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN
Deployment Cost	€ 357	€ 57	€ 714	€ 67	€ 1,071	€ 77	€ 1,428	€ 87	€ 1,785	€ 97	€ 3,570	€ 147
Maintenance Cost (For 4 years)	€ 286	€ 46	€ 571	€ 54	€ 857	€ 62	€ 1,142	€ 70	€ 1,428	€ 78	€ 2,856	€ 118
OpEx	€ 643	€ 103	€ 1,285	€ 121	€ 1,928	€ 139	€ 2,570	€ 157	€ 3,213	€ 175	€ 6,426	€ 265
Service License (Nebula SD-WAN)	€ -	€ 1,992	€ -	€ 2,588	€ -	€ 3,184	€ -	€ 3,780	€ -	€ 4,376	€ -	€ 7,356
MPLS cost (10Mbps)	€ 87,930	€ -	€ 175,860	€ -	€ 263,790	€ -	€ 351,720	€ -	€ 439,650	€ -	€ 879,300	€ -
Broadband cost (50Mbps)	€ 10,248	€ 20,496	€ 15,372	€ 30,744	€ 20,496	€ 40,992	€ 25,620	€ 51,240	€ 30,744	€ 61,488	€ 56,364	€ 112,728
CapEx	€ 98,178	€ 22,488	€ 191,232	€ 33,332	€ 284,286	€ 44,176	€ 377,340	€ 55,020	€ 470,394	€ 65,864	€ 935,664	€ 120,084
Total Cost	€ 98,821	€ 22,591	€ 192,517	€ 33,453	€ 286,214	€ 44,315	€ 379,910	€ 55,177	€ 473,607	€ 66,039	€ 942,090	€ 120,349
Cost Reduction (%)	77%		83%		85%		85%		86%		87%	

5-year Network Deployment Cost	HQ & 20 Branch		HQ & 30 Branch		HQ & 40 Branch		HQ & 50 Branch		HQ & 100 Branch	
	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN
Deployment Cost	€ 7,140	€ 247	€ 10,710	€ 347	€ 14,280	€ 447	€ 17,850	€ 547	€ 35,700	€ 1,047
Maintenance Cost (For 4 years)	€ 5,712	€ 198	€ 8,568	€ 278	€ 11,424	€ 358	€ 14,280	€ 438	€ 28,560	€ 838
OpEx	€ 12,852	€ 445	€ 19,278	€ 625	€ 25,704	€ 805	€ 32,130	€ 985	€ 64,260	€ 1,885
Service License (Nebula SD-WAN)	€ -	€ 13,316	€ -	€ 19,276	€ -	€ 25,236	€ -	€ 31,196	€ -	€ 60,996
MPLS cost (10Mbps)	€ 1,758,600	€ -	€ 2,637,900	€ -	€ 3,517,200	€ -	€ 4,396,500	€ -	€ 8,793,000	€ -
Broadband cost (50Mbps)	€ 107,604	€ 215,208	€ 158,844	€ 317,688	€ 210,084	€ 420,168	€ 261,324	€ 522,648	€ 517,524	€ 1,035,048
CapEx	€ 1,866,204	€ 228,524	€ 2,796,744	€ 336,964	€ 3,727,284	€ 445,404	€ 4,657,824	€ 553,844	€ 9,310,524	€ 1,096,044
Total Cost	€ 1,879,056	€ 228,969	€ 2,816,022	€ 337,589	€ 3,752,988	€ 446,209	€ 4,689,954	€ 554,829	€ 9,374,784	€ 1,097,929
Cost Reduction (%)	88%		88%		88%		88%		88%	

2-2-1 Immense Total Cost Down from SD-WAN

Above *Figure 3: Case Study - Total Cost Overview* represents the overall costs of a five-year network deployment example with MPLS and Nebula SD-WAN based on Zyxel surveys and field experiences. One point of this case study is to give MPLS and Nebula SD-WAN cost comparison for multiple network sizes spanning from one to 100 branches so it could be widely worth referencing in most small to medium sized business deployment cases.

From the *Figure 3* we can quickly notice an almost exponential growth is exhibited in the total cost reduction when the number of branches increases, which looks to be caused by the elimination of both OpEx and CapEx expenditure increase that cannot be exempted at all when a MPLS network scales up, whilst Nebula SD-WAN is clearly more able to slow down the overall cost increase when the network scales up from few to more branches, hence giving a more flat growth of overall cost increase amounts.

Therefore, it is easily summarized that total cost reduction is significant for business users who adopts Nebula SD-WAN to replace existing MPLS networks as their total cost can reduce up to 77 percent even with only one branch. Then the cost saving benefit goes on to grow pleasantly larger in proportion with every increase of the number of branches, reaching 82 percent when the business expands to two branches, and finally tipping on the top at a nicely 88 percent once the business grows to have over 20 branches.

Due to the different nature of cost increase rate in proportion with network scale-up between MPLS and Nebula SD-WAN deployments, the total cost reduction effect can make a surprisingly enormous difference for big-sized businesses – up to more than 8.2 million euros per year can be saved for those companies who replace MPLS with SD-WAN to deploy 100 branches or more.

2-2-2 Both OpEx and CapEx Witness Significant Cost Reduction

Figure 4: Case Study - OpEx & CapEx Reduction Overview

5-year Network Deployment Cost	HQ & 1 Branch		HQ & 2 Branch		HQ & 3 Branch		HQ & 4 Branch		HQ & 5 Branch		HQ & 10 Branch	
	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN
OpEx	€ 643	€ 103	€ 1,285	€ 121	€ 1,928	€ 139	€ 2,570	€ 157	€ 3,213	€ 175	€ 6,426	€ 265
OpEx Reduction	84%		91%		93%		94%		95%		96%	
CapEx	€ 98,178	€ 22,488	€ 191,232	€ 33,332	€ 284,286	€ 44,176	€ 377,340	€ 55,020	€ 470,394	€ 65,864	€ 935,664	€ 120,084
CapEx Reduction	77%		83%		84%		85%		86%		87%	

5-year Network Deployment Cost	HQ & 20 Branch		HQ & 30 Branch		HQ & 40 Branch		HQ & 50 Branch		HQ & 100 Branch	
	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN
OpEx	€ 12,852	€ 445	€ 19,278	€ 625	€ 25,704	€ 805	€ 32,130	€ 985	€ 64,260	€ 1,885
OpEx Reduction	97%		97%		97%		97%		97%	
CapEx	€ 1,866,204	€ 228,524	€ 2,796,744	€ 336,964	€ 3,727,284	€ 445,404	€ 4,657,824	€ 553,844	€ 9,310,524	€ 1,096,044
CapEx Reduction	88%		88%		88%		88%		88%	

Bearing in mind that total cost undergoes a significant reduction empowered by Nebula SD-WAN replacing MPLS, let's further examine what is going on beneath the total cost in both OpEx and CapEx categories. *Figure 4* above illustrates OpEx and CapEx reduction rates by breaking down the total saving effects into the two categories respectively for more clarity.

First and foremost, it is obviously discernible that both expenditure categories enjoy tremendous cost saving effect from the cost-down capability of SD-WAN, ranging from 77 percent with small one-site deployment to astonishing 97 percent for large scale networks, reasonably echoing with the significant total cost drop as aforementioned in section *2-2-1 Immense Total Cost Down from SD-WAN*. It can be concluded from this cost study that SD-WAN can bring about cost reduction benefits not only in capital expenses as widely known but also in operational aspects as well that may not be as recognized as it should have been.

2-3 Key Findings

2-3-1 Size Matters: More Sites, Greater Cost Saving Effects

The below *Figure 5: Case Study - Total* Cost Reduction Trend visualizes the aforementioned total cost savings with a trend line and this upward line explicitly discloses the growing nature of the SD-WAN saving effect when the network size expands.

Figure 5: Case Study - Total Cost Reduction Trend
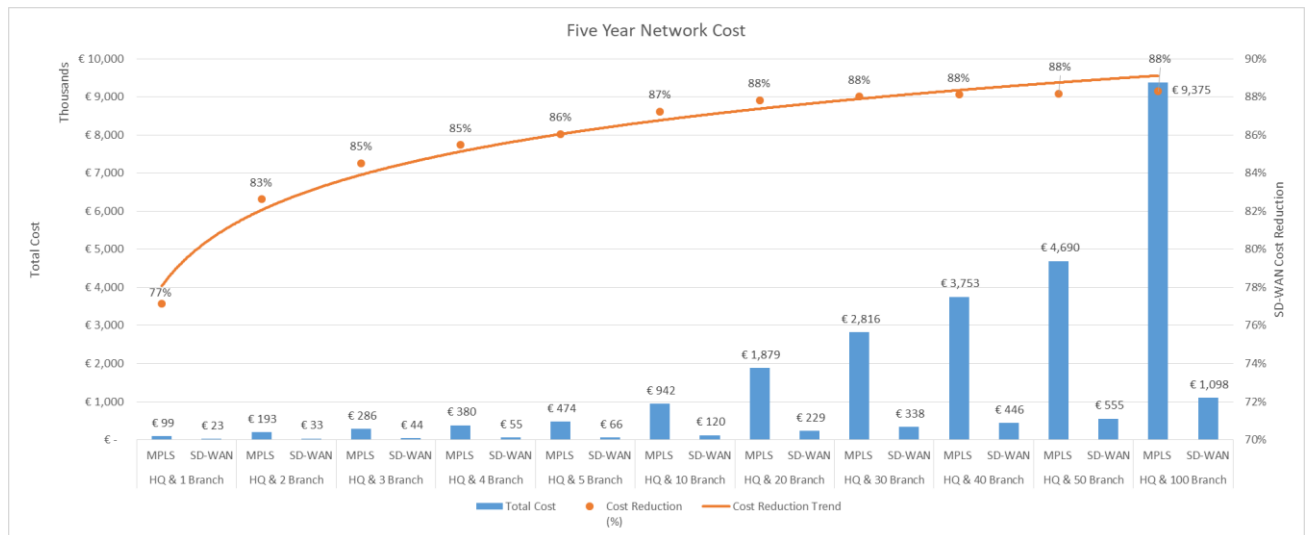
The first good news here for small businesses or start-ups is that even a small scale deployment with only one branch has been empowered by Nebula SD-WAN can harvest up to 77 percent cost-down benefits as shown in this trend, also as expatiated in the *2-2-1 Immense Total Cost Down from SD-WAN* section. What's even better is the saving effect can further level up to 88 percent for expanding businesses or SMBs when they keep growing to over 20 branches. At the first glance 88 percent may not seem a tremendous notch up from the 77 percent base line but if we take the huge incremental total cost-up sticking with every incremental network scale-up into consideration, the 11 percent in difference in practical terms can become a massive total cost-down amounts. For example, as *Figure 3* showcases, two-branch deployment saves 83 percent total cost which is only four percent more than one-branch deployment but

the small gap in percentage in monetary terms means two-branch deployment saves 159,065 euros, more than doubling the amount of one-site, 76,230 euros. This quick increase goes on and on like this exponentially therefore the saving amounts easily grow to more than a million euros for any deployment scales bigger than 20.

Summing it up in a practical sense for network owners, we can conclude it is clearly proved from this case study that size does matter to an indisputable extent if we want to reap the maximum cost-saving benefits from deploying SD-WAN, whilst small scale deployments also enjoy a nice percentage cost down. Therefore, however big or small your business is, Nebula SD-WAN stands as an undeniable cost saving promise for MPLS network users.

2-3-2 OpEx Savings Larger & Longer Than CapEx

As discussed in previous section *2-2-2 Both OpEx and CapEx Witness Significant Cost Reduction* by looking at the cost numbers, we already learnt MPLS network users can greatly reduce both OpEx and CapEx by applying SD-WAN. This section will dig deeper into how the saving effect aligns or varies between the two different operational and capital cost categories.

Figure 6: Case Study - OpEx & CapEx Reduction Trend
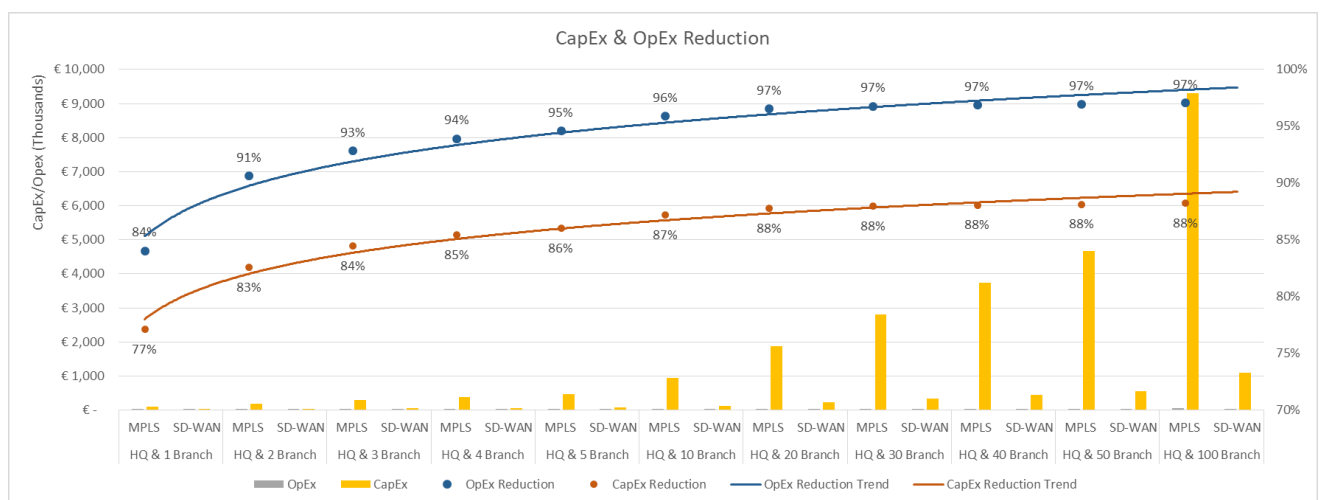
Above *Figure* 6 puts the numbers into a graphical display and it distinctly shows both CapEx and OpEx savings form a similar upward trend in line with total cost. The blue line brings out OpEx saving trend and the orange line CapEx.

Taking a closer look can further reveal that OpEx cost reduction is noticeably more than CapEx savings when the scale grows by a few percent and this difference persists from one-site small deployment at seven percent all the way through to larger scales at nine percent. Just as what we went through in *2-2-1 Immense Total Cost Down from SD-WAN*, this percentage may seem little on the chart but when the deployment scale and hence the total cost is large, this little difference in fact may save up to millions of euros back in business owners' pocket. Just like what *Figure* 6 suggests, OpEx cost-down amount is more susceptible to economies of scale than CapEx as 100-site deployment enjoys a very nice 97 percent OpEx reduction with a 17 percent difference from one-site scenario, whereas CapEx features an 11 percent gap between 100-site big deployment and minimal one-site case.

More importantly, now with this case study as an evidence proving OpEx in fact undergoes a greater saving effect than CapEx, this shall be taken further with a commercial sense meaning the better cost efficiency attained from deploying SD-WAN, apart from merely as an effective short-term approach to avoid heavy capital upfront in initial deployment, can meanwhile carry a steady long-term benefit for the business owners because operational expenses in essence are more of a longstanding factor, and OpEx usually makes up the bulk of a company's regular costs from a long-term perspective and it is always one of the top priority tasks for business owners to constantly look for ways to reduce operating expenses without causing a critical drop in network quality and production output. Therefore, business owners should take note that this persisting long-run influence of OpEx inevitably makes deploying SD-WAN highly beneficiary to maximize the company's long term profitability.

2-3-3 Enormous Network Deployment Time Reduction

Apart from the compelling fact that SD-WAN brings prodigious cost-saving effect, this case study also finds out it's not just the monetary costs that can be reduced but also the network deployment time as well, as listed in below *Figure*

7: Case Study - Network Deployment Time, which displays the total number of days required to deploy MPLS and SD-WAN for each network size.

Figure 7: Case Study - Network Deployment Time

	HQ & 1 Branch		HQ & 2 Branch		HQ & 3 Branch		HQ & 4 Branch		HQ & 5 Branch		HQ & 10 Branch	
	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN
Deployment Time (Days)	18	5.5	24	5.5	32	5.5	40	5.5	48	5.5	88	8
Time Reduction (%)	69%		77%		83%		86%		89%		91%	

	HQ & 20 Branch		HQ & 30 Branch		HQ & 40 Branch		HQ & 50 Branch		HQ & 100 Branch	
	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN	MPLS	SD-WAN
Deployment Time (Days)	88	8	88	8	88	8	4488	28	8008	48
Time Reduction (%)	91%		91%		91%		99%		99%	

Time Saving Effect with Economies of Scale

Time saving effect from deploying SD-WAN carries a similar economies of scale nature as cost saving benefits as explained in section *2-3-1 Size Matters: More Sites, Greater Cost Saving Effect*, meaning the more sites the deployment will build, the greater the time saving benefits will be. As from the above *Figure 7*, for a one-site network, deploying SD-WAN can be 12.5 days faster than MPLS, and for a three-site deployment SD-WAN speeds it up by 26.5 days and already doubles the time-saving effect from one-site scale. Time-saving effect is growing bigger when the number of sites increase and more importantly this growth expands very fast, resulted in the amazing fact that SD-WAN can speed up the deployment up to 21 years at the scale of 100 sites.

Below *Figure 8: Case study - Deployment Time Reduction Chart* further visualizes this benefit with an upward trend of the deployment time reduction from SD-WAN. It is clear that the trend of the time reduction percentages climbs all the way up along with the number of sites increases before lingering around 91 percent for a network with 10 to 40 branches, then skyrockets at 99 percent reduction rate when the business deploys more than 50 sites, validating deployment time can be dramatically reduced from deploying SD-WAN for large sized networks, signifying a robust economies of scale effect.

Figure 8: Case study - Deployment Time Reduction Chart
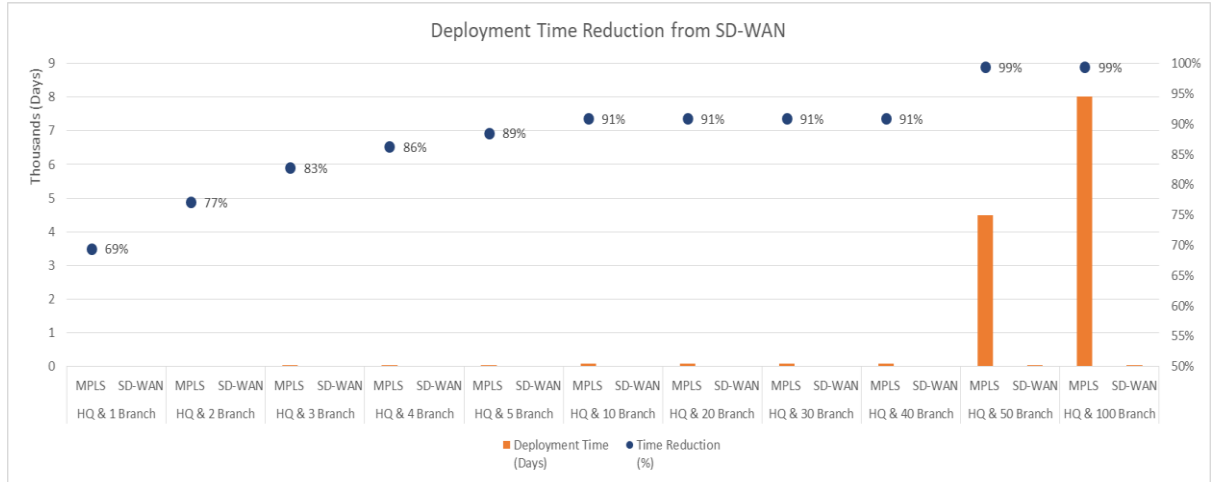
Long-term Commercial & Managerial Benefits

This chapter is majorly discussing cost reduction from SD-WAN yet the important deployment time reduction effect is still to be addressed as cost efficiency should not be limited to only monetary aspects especially it should be a long-term perspective when it comes to business efficiency and growth. The proven ability of SD-WAN to reduce deployment time should also be brought into play because quicker deployments can give potentially more great commercial gains. They may not seem explicitly monetary at the first glance but ultimately can lead to greater cost efficiency and better probability in the long haul, such as a swifter time to market for the company's delivery of products and services, and more streamlined business operations empowered by managerial benefits such as flexibility and agility from SD-WAN.

CH3: Conclusion

3-1 A Better Solution Facing Digital Transformation

Adoption of SD-WAN Can Be Incremental and Flexible

AS a result of the paradigm shift in the WAN landscape, a rise of hybrid WAN models is expectable, where enterprises need to leverage public cloud whilst still running conventional premise network. There is no "one size fits all" elixir as businesses of different sizes in different industries encounter diversified use cases, users, and applications. SD-WAN can fit all genres because SD-WAN is an approach allowing network owners to commit resources incrementally and flexibly. As elaborated in section *1-2-1 Rise of Hybrid WAN Models*, businesses are more and more shifting from traditional WAN to a hybrid mode and SD-WAN is in particular useful when working in conjunction with hybrid WAN environment as SD-WAN's intelligent routing can better distribute traffic with many added extra managerial features and benefits as aforementioned. Businesses can obtain SD-WAN appliances as an add-on to their traditional telco service such as MPLS. How and when organizations adopt SD-WAN can utterly depend on the existing infrastructure and it offers a path for businesses to go forward on incremental transition paths without having to worry about the long lead time like MPLS expansion usually takes. As SD-WAN deployments, with zero-touch and cloud manageability, is swift, easy, flexible, and agile, as elaborated in *2-3-3 Enormous Network Deployment Time Reduction* section and also supported by the "Management" advantages in section *1-2-2 Performance. Security. Management. Cost Advantages*. So businesses of all types and sizes can introduce SD-WAN into their existing infrastructure completely tailored by their specific needs.

Capable to Enhance Existing Traditional WAN Connectivity

Given the manifold of new advantages and benefits as aforementioned that SD-WAN has to offer, IDC believes that traditional WAN will likely continue to be

the primary connectivity option for a while. (Ghai 2017) [7] Luckily SD-WAN technology doesn't land in the WAN landscape in an excluding approach. The dichotomy between SD-WAN and conventional network such as MPLS is not an either-or situation but rather, SD-WAN works with what the businesses already have today and enables different forms of adoption based on individual needs. SD-WAN deployment does not have to wipe out all existing appliances or make a complete conversion of the network. Existing MPLS or other types of networks can all continue to function and SD-WAN simply glues everything available together and deliver a better overall performance out of them all. It can enable an optimal use of a combination of multiple connectivity types at a site by integrating MPLS with other available connections such as broadband Internet and Long-Term Evolution (LTE) to deliver greater uptime and more available bandwidth than legacy network services for less costs because all connectivity types can be optimized and automated. Being a powerful add-on instead of a complete replacement could be a fair reason for SD-WAN's explosive growth in the time full of new digital challenges.

Universally Applicable Cost Advantages

Since SD-WAN adoption can be incremental and flexible and it enhances what business already have today instead of replacing the existing appliances, it hence becomes a universally applicable solution for every modern business facing new digital challenges and requiring a transformation as they can deploy it in their own way to their own suitable extent. This versatility can further extend to the cost perspective, meaning SD-WAN's cost reduction effects are easily applicable for modern organizations regardless of size, type, or industry. Albeit the cast study expatiated in *CH2: SD-WAN Cost Reduction Case Study* manifests the significant cost reduction from replacing the traditional MPLS network with Zyxel SD-WAN, now it can also be concluded that full replacement is not the only way to gain the cost down effect from SD-WAN. A more discernible direct cost down effect is when SD-WAN leverages all available connection types as one and smartly optimizes overall traffic delivering better performance, businesses would not need to upgrade

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[7] Ghai, Rajesh, and Nolan Green. 2017. SD-WAN: Enhancing the traditional WAN for the future. IDC, 1.

expensive MPLS network as often or as much as they used to when their demand for bandwidth keeps increasing.

Also as concluded in *CH2,* SD-WAN can practically impose its cost reduction effects marginally according to different deployment scale and still deliver desirable cost deduction benefits even when the deployment scale is small. So the cost saving benefit from SD-WAN, though may vary by scale, does certainly and consistently persist for both small businesses and large enterprises.

3-2 SMBs: Why SD-WAN Is Right for You

From all the aforementioned benefits and advantages being applicable on SMBs, we can conclude three high level key points why SD-WAN should be every SMB's ideal network choice.

Freeing Up Your IT Resource Stretch

There's a prevailing misperception that SD-WAN is only for large enterprises. SD-WAN, however, nicely addresses many of SMB's most pressing needs and one major pain point is strict limitation in IT staffing. As SD-WAN application abstracts many operation, management, and troubleshooting hassles from physical devices to a centralized cloud console, it simplifies IT administration flow and reduces the time and effort spent on routine maintenance. Therefore, SMB's IT resource demand shrinks and productivity skyrockets, freeing up the workers' time to focus on customers or more important strategic initiatives.

Quicker Responsiveness to Changing Markets and Business Strategies

When competing with large enterprises in the market, SMBs very often need to move faster to acquire enough advantages and ideally can always remain flexible to change directions rapidly and almost effortlessly as they need to quickly respond to volatile market conditions and new customer preferences. The problems are remote sites or branch offices sometimes could come and go quickly and all relevant resources have to move swiftly. SD-WAN being an incremental, flexible, and agile solution as expatiated in *section* 1-2-2

Performance. Security. Management. Cost Advantages and *3-1 A Better Solution Facing Digital Transformation*, combined with easy rollout, quick setup, centralized management, sophisticated policy control, guarantees maximum elasticity, flexibility and agility for modern SMBs to get well prepared to run the race in the new challenging times.

Enhanced Overall Business Competitiveness

As SMBs tend to have insufficient funding for network investments, SD-WAN, in summary of all goodness being explained in previous sections of this whitepaper, SD-WAN certainly offers more for less. SMBs can harvest myriad gains from high performance, easy management, quick rollout, embedded security, superior flexibility, and greater agility and all those gains come with reduced costs. Those beneficiary factors ultimately converge to forge a supportive force within the organizations for SMBs to level up in its long-term competitiveness and to win stronger chances of survival and success in the new digital transformation era. SD-WAN simply is a better network solution offering with lowered costs for SMBs looking to transform their networks without breaking a bank.

3-3 MSPs/ISPs: Why SD-WAN Is Right for You

Apart from all the aforementioned performance, cost, security, management, flexibility benefits and advantages from SD-WAN and how it reduces total costs and deployment time that are all evenly applicable on MSPs and ISPs, what's worth further discussion is strategically what commercial values those factors combine to embody for MSPs and ISPs' businesses if they opt to move customers from pure conventional WAN to SD-WAN empowered approaches.

Time to Market

In this challenging era of digital transformation, time to market sometimes means more of a key to success than anything, and the same phenomenon is also in MSP and ISP arena. Time to market is now often the key to grab

advantages when SPs are launching new products and services. SD-WAN's easy rollout, fast setup, versatile application flexibility, and great agility means ISPs and MSPs can be more swift to expand their networks when they gain opportunities to deliver more services to more customers, whereas traditional WAN such as MPLS takes much longer time and money to develop and build as compared in section *2-3-3 Enormous Network Deployment Time Reduction*. Secondly, since SD-WAN's multiple smart routing features and application policy capabilities can deliver better throughput performance without infrastructure upgrade, MSPs and ISPs, to a reasonable extent, can deliver more service with better perceived quality to more customers without extra bandwidth investments.

Autonomy with Less Dependency on External Partners

The SD-WAN solution revolution can ease MSPs and ISPs' many pains of distributed networks and one of them is SPs often depend on external outsources or third party partners to manage some remote customers or sites for them. When customers encounter network issues, external partners at times may not necessarily solve the problem timely and the communication and collaboration in between can be time and human resource consuming. ISPs and MSPs thus find themselves taking responsibilities of and consequences from external partners' faults instead of their own that cause end customers' network issues to persist. Since SD-WAN's cloud management nature also empowers remote deployment, remote monitoring, and remote troubleshooting, these grants MSPs and ISPs more autonomy on managing customers' network issues on their own as the same troubleshooting tasks that used to require a physical service visit to the client's site now can be conducted on SD-WAN's centralized cloud management platform. Network status and information are also easily and quickly attainable. Hence, MPSs and ISPs can be held by SD-WAN in a better place where they directly and efficiently deliver better maintenance services to customers without having to rely on external partners' responses or endure unnecessary delays and any extra costs incurred.

Time & Cost Efficiency

As we learned by now from previous introductions, quick rollout, remote

management, easy maintenance, and centralized monitor makes it easier and quicker than ever for SPs to deploy, manage, maintain, and monitor a new site. For example, with Nebula SD-WAN, SPs can quickly distribute network settings via email or USB drives to all sites without any service visits required to the site location. The same remote manageability also services all the following network tasks such as service policy adjustment, troubleshooting, and routine maintenance etc., resulting in better time efficiency and cost efficiency for ISPs and MSPs business. Time and cost efficiency eventually translates into better business operations and better profitability.

Appendix

Reference

Conde, Dan. 2016. *Demonstrating SD-WAN Business Value; Rethinking WAN for a Modern Age.* The Enterprise Strategy Group, Inc. (ESG).

Mehra, Rohit, and Nolan Greene. 2017. *Benefits of a Fully Featured SD-WAN.* IDC, 1.

Montaigne, Paul. 2019. *The true costs of CapEx vs OpEx in a cloud environment.* Jan 17. Accessed 4 20, 2019. https://www.cogecopeer1.com/true-costs-capex-vs-opex-cloud-environment/.

Panetta, Kasey. 2017. *Smarter With Gartner: Cloud Computing Enters its Second Decade.* 1 30. Accessed 7 21, 2019. https://www.gartner.com/smarterwithgartner/cloud-computing-enters-its-second-decade/.

Ranger, Steve. 2018. *What is cloud computing? Everything you need to know about the cloud, explained.* 12 31. Accessed 7 21, 2019. https://www.zdnet.com/article/what-is-cloud-computing-everything-you-need-to-know-from-public-and-private-cloud-to-software-as-a/.

Ghai, Rajesh, and Nolan Green. 2017. *SD-WAN: Enhancing the traditional WAN for the future*. IDC, 1.

Singh, Naresh. 12 Nov 2018. Gartner Survey Analysis: Address Security and Digital Concerns to Maintain Rapid SD-WAN Growth. Gartner.

Free Demo

https://nebula.zyxel.com

About Zyxel Networks

Focused on innovation and customer-centric technology and service, Zyxel has been connecting people to the Internet for nearly 30 years. Our ability to adapt and innovate with networking technology places us at the forefront of the drive to create connectivity for telcos and service providers as well as businesses and home users.

Zyxel is a global force in the communications market with an unrivalled international presence that includes:

- 150 markets served
- 1,500 passionate associates
- 700,000 businesses working smarter with Zyxel solutions
- 100 million devices creating global connections

Today, Zyxel is building the networks of tomorrow, unlocking potential, and meeting the needs of the modern workplace—powering people at work, life, and play.

Zyxel, Your Networking Ally.

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