SCTE·ISBE CABLE-TEC EXPO 2018 | ATLANTA, GA OCTOBER 22-25

2018 Fall Technical Forum SCTE·ISBE • NCTA • CABLELABS

How An MSO Can Leverage SD-WAN To Grow Its Enterprise Revenue

Impact of Rapid Penetration of Overlay Connectivity and Pull-Through Services

A Technical Paper prepared for SCTE•ISBE by

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Introduction

Software Defined Wide Area Networking (SD-WAN) services are gaining increasing traction in the enterprise communication market because of the confluence of two developing trends – growing cost and complexity of WAN connectivity services, and emergence of virtualization-enabled network programmability. Enterprise IT managers must contend with increasingly complex branch office communication needs being shaped by significant bandwidth growth, emergence of cloud services, proliferation of end points with diverse connectivity requirements and the need to ensure adequate WAN protection against emerging threats, while holding firmly to the expense budget.

Simultaneously, however, network programmability based on policy-based routing, network function virtualization, and analytics-driven zero-touch automation has greatly simplified traditional WAN management. SD-WAN captures these functionalities through a range of alternatives that tailor the WAN solution to specific enterprise needs cost effectively. Enterprises can move low-priority sites from Multi-Protocol Label Switching (MPLS) to internet-only connectivity, augment MPLS with internet to optimize local traffic distribution at selected sites or deploy internet breakout at some sites for direct cloud connectivity. SD-WAN also enables flexible branch networking with deployments varying from "thin" end points, which focus primarily on connectivity, to "thick" ones that additionally provide value-add services.

While SD-WAN benefits from the complementarity of these two trends, an MSO needs to evaluate the resulting economics for itself considering its target enterprise market and the required networking and platform expenses. To this end, after briefly describing current enterprise WAN challenges and discussing how SD-WAN addresses them, this paper focuses on how a typical MSO can develop SD-WAN's revenue and profit potential projections and enhance them through sensitivity analyses of key demand and cost parameters. A distinctive aspect of the proposed model is its utility-based approach that correlates an enterprise's SD-WAN adoption to its value – measured in terms of desired WAN attributes – relative to its current WAN service. We present an illustrative case study for a generic MSO; the results indicate that SD-WAN can significantly impact the operator's enterprise revenue while delivering an attractive business case with a payback period of 2.25 years. The proposed modeling approach is extendible to other operators, regions and markets worldwide.

Study

1. Challenges faced by MSOs

An MSO faces increasing challenges along multiple dimensions for its enterprise business.

Market threats: MSOs have a growing presence in the enterprise segment that is largely limited to small and medium businesses (SMBs). They face declining revenues per bit, while public and 3rd party cloud providers present new challenges due to their high levels of service ubiquity and agility, in addition to strong pricing economics.

MSOs are also constrained by their limited connectivity to enterprise customers; the high cost of cable rollout severely limits new network build. While Data Over Cable System Interface Specification® (DOCSIS) 3.1 has significantly expanded the range of their services, they remain threatened by the expanding fiber footprint of telecom operators.

WAN complexity: Current static and inflexible MSO networks are unable to cope with growing WAN complexity faced by enterprises because of increasing site bandwidth needs, diverse branch connectivity requirements and seamless networking with public and 3rd party clouds, while ensuring appropriate scalability. An enterprise's ability to rapidly add new branches, terminate temporary locations, and move functionalities across sites requires a level of network programmability and location-independence of routing and other network functions that current MSO networks are unable to offer.

Traditional MSO WAN services also do not provide adequate network visibility to enterprises, nor do they lend them the required network control and monitoring capability. This is a key reason why MSOs are unable to attract many enterprises who prefer to remain unmanaged instead of ceding control to traditional managed services.

WAN economics: As enterprise IT managers seek to reduce their networking costs in the face of growing bandwidth usage, MSOs are ideally positioned to offer solutions to help them. To avail of this market opportunity, MSOs are challenged to come up with innovative approaches to improving branch networking efficiency through leaner, more automated operations, and by realizing the economic benefits provided by new technologies, such as Software-Defined Networking (SDN) and Network Function Virtualization (NFV).

Increasing security risks: Network virtualization and increasing use of cloud services also open new areas of vulnerability. Flexible, service-specific protection is needed against threats from untrusted sources, new and larger attack surfaces, more frequent software and life cycle management updates, and rapid growth in east-west traffic. Greater customer usage of cloud services, and consequent regulatory considerations such as General Data Protection Regulation (GDPR), also implies a greater need for MSOs to securely segment an enterprise's operations while keeping overall WAN complexity and cost in check.

Low service agility: Many traditional MSOs and other network operators carry the legacy of slow sales cycles, high overhead costs and complex product catalogs that constrains their ability to rapidly offer new services. Expensive and time-consuming truck rolls and manual integration steps for deploying new sites, and the strong dependence of major provisioning and assurance processes on manual tasks further diminish MSOs' service agility.

2. How SD-WAN addresses these challenges

SD-WAN helps mitigate many issues described in Section 2.

Market opportunity: SD-WAN opens new revenue opportunities by expanding service portfolios and markets. It enables MSOs to couple value-add services (VAS), such as security and unified communications, to provide "multiple service, single access" connectivity to replace the prevailing "multiple service, multiple access" deployments resulting in significant cost reduction for both enterprises and themselves. It also simplifies MSO connectivity offers to off-net enterprises and, for business sites passed by its cable footprint, it positions the MSO as a secondary carrier for providing underlay services. By placing many WAN routing functionalities in the MSO network, it provides a range of flexible deployment options.

WAN simplification: Relative to traditional WAN services, SD-WAN provides enterprise IT managers with significantly greater network visibility and control to help them translate their application-level policies into effective routing decisions. In addition to enabling MSOs to offer more granular services with performance guarantees tailored to the specific needs of individual sites, it also provides enterprises and MSOs with a better understanding of the drivers behind their traffic growth to help contain

networking cost increases. For many enterprises with unmanaged WAN, this can be the tipping point for adopting MSO-managed services.

Separating the data, control, and management planes allows SD-WAN to distribute complex WAN functionalities between the enterprise site, its data center and the MSO. The complicated WAN path computation and routing functions in traditional on-premise solutions are substituted by relatively simple data forwarding engines that are located on site under the control of policy-driven SDN controllers placed in the MSO network to facilitate easy integration of diverse site connectivity and performance requirements. Greater automation also leads to simplified deployment, flexible service provisioning and assurance, and enhanced solution scalability in terms of enterprise sites and service SLAs.

Improved WAN economics: Distribution of WAN functionality results in thin on-premise equipment that leads to lower MSO capital investment per site. SD-WAN deployment costs are further reduced through automated provisioning that minimizes costly truck rolls and labor-intensive integration steps. Automation also reduces operating expenses incurred for routine care, fulfillment and assurance operations – such as software upgrades, fault management, inventory management, and performance monitoring – as well as longer-term capacity management operations. SD-WAN also enables significant transport cost savings by rationalizing site connectivity in several ways – such as augmenting MPLS connectivity with internet for channeling low-value traffic, providing internet breakout for cloud connectivity, and by moving low-priority sites to internet-only connectivity (and potentially dropping MPLS altogether).

Improved security: SD-WAN draws upon an MSO's virtualized platform functionalities to provide programmable, policy-driven services that can be scaled to meet customer-, site- and application-specific security needs. Segmentation of enterprise DCs, branches and cloud sites into zone-based security policy groups helps reduce attack surfaces and work across heterogeneous resources such as virtual machines (VMs), containers, and physical appliances to protect against untrusted sources. Vulnerability mitigation measures, such as microsegmentation, help address threats arising from east-west traffic. Analytics-driven automation enables SD-WAN to detect many security threats ahead of their actual realization and take effective remediation measures.

Improved agility: Greater automation helps SD-WAN reduce the time to market new services and to upgrade existing services. It also eliminates expensive and time-consuming manual steps in the service assurance process. Use of self-service portals eliminates the complexity of product catalogs and improves customer experience while simultaneously reducing MSOs' new order provisioning time and cost.

3. SD-WAN revenue potential

We adopt a two-step approach to estimating SD-WAN revenues for a typical MSO. First, we develop a 5-year SD-WAN connectivity revenue projection for the MSO's target market. Next, we build the MSO's share of overall market connectivity revenue and combine it with estimated SD-WAN enabled value-add services revenue to determine overall 5-year SD-WAN revenue.

3.1. SD-WAN connectivity market assessment

The 5-year SD-WAN connectivity market is built bottom up by considering the existing number of enterprise sites and their growth, current WAN services at these sites, projected SD-WAN adoption rates and estimated SD-WAN connectivity prices. Figure 1 illustrates the individual steps of this assessment framework that are now described.

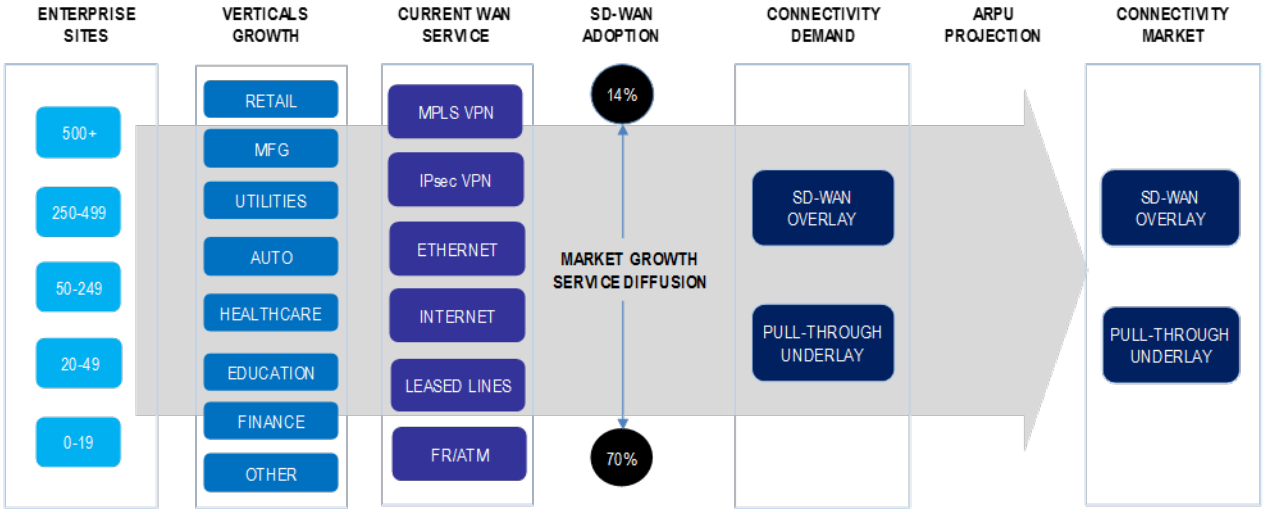

Figure 1 - SD-WAN Connectivity Projection

Number of enterprise sites

First, we estimate the current population of enterprise sites in the MSO's target market, broken down by their sizes – micro (0-19 employees), small (20-49), medium (50-249), large (250-499) and very large (500+) – and their verticals.

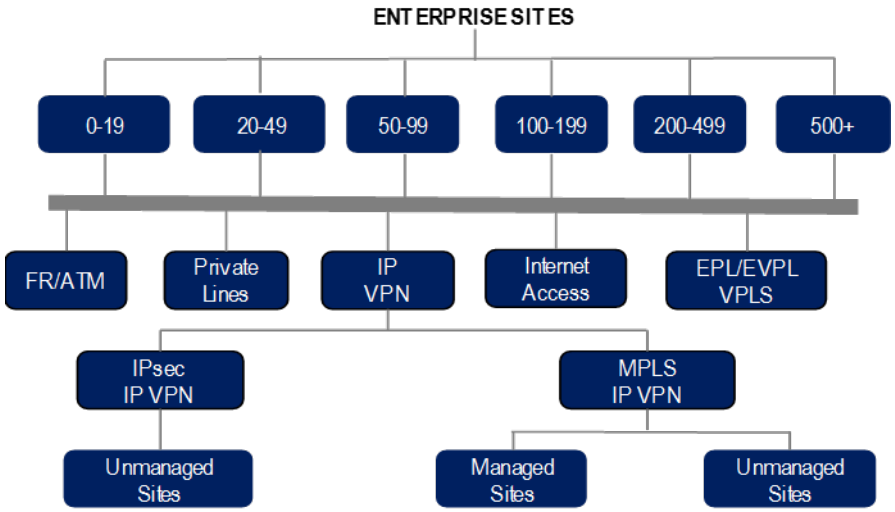

Figure 2 - Enterprise Site Map by Existing WAN Service

Growth of verticals

Next, we forecast future enterprise site count and bandwidth needs by projecting the current site population along the expected growth (or decline) trajectory of these verticals over the next 4 years. This step yields a 5-year map of enterprise sites by their sizes and the verticals they belong to.

Existing WAN services

At this step, we project the deployment of current WAN services across the various enterprise sites. These services include Frame Relay, ATM, private lines, internet access, ethernet service – including VPLS, EPL and EVPL – and IP VPN (an MSO may not offer some of these services). As shown in Figure 2, we break down IP VPN sites into MPLS- and IPsec-based sites, and furthermore, MPLS IP VPN sites into managed and unmanaged sites. We also develop the future deployment of these services at various enterprise sites by incorporating their growth trends shown in Figure 3Figure 3.

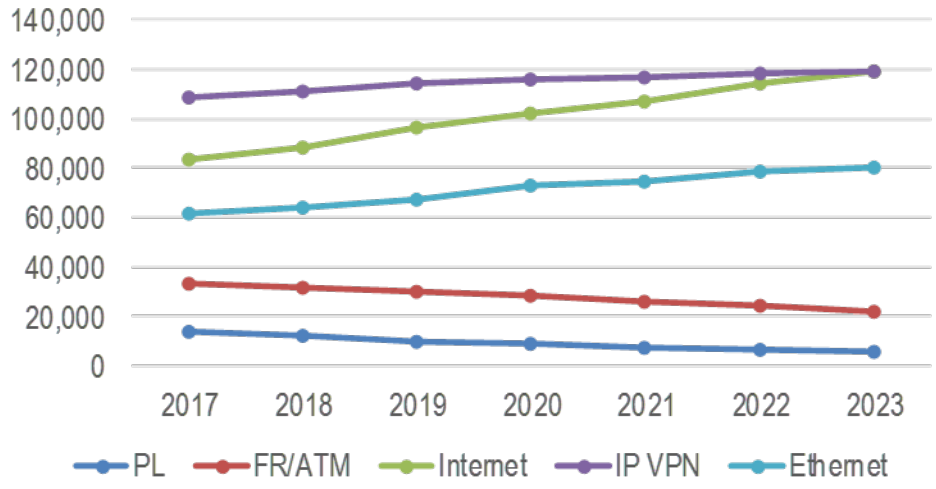

Figure 3 - Growth of Existing WAN Service Connections

SD-WAN adoption and connectivity demand

The key premise of the market assessment model is that an enterprise's SD-WAN adoption is predicated on the incremental utility, or the *value,* that it provides relative to the enterprise's current WAN service. We measure the value of a WAN service along the following 8 dimensions:

1. Service cost: Total cost of WAN operations to the enterprise with a given WAN service. It comprises the cost of the WAN service, such as the monthly managed service fee charged by a service provider, and internal expenses incurred for providing network connectivity.
2. Service performance: Key performance capabilities of the WAN service. It includes the range and quality of supported SLAs, service reliability, and its ability to support service chaining and secure connectivity to public and 3rd party clouds.
3. Implementation complexity: Ease and speed of deploying the WAN service. It is a measure of the enterprise's ability to rapidly set up new site connectivity, terminate temporary connections, and add new services.
4. Control: Ease and speed with which the WAN service can translate enterprise policies into WAN routing decisions. This includes, for example, the ease with which the enterprise can reconfigure service priorities across individual applications, change traffic routing decisions at individual

sites, etc. This dimension reflects a key reason why many enterprises remain unmanaged as traditional managed services do not allow them to exercise the desired level of control.

5. Implementing value-add services: Ease and economics of deploying value-add services. It measures the ability of the WAN service to efficiently support enterprise applications relating to network security, unified communications, and other enterprise-specific needs.
6. Scalability: Ability to scale both size and scope of services supported at each site. This includes the ease with which the WAN service can scale bandwidth allocated to each site, connect a site to public and 3rd party clouds, and move applications across private, public and 3rd party clouds.
7. Network management support: The WAN service's ability to provide required levels of performance monitoring and reporting, and network assurance and fulfillment support.
8. Security: Overall protection provided by the WAN service, determined by its ability to prevent, detect and mitigate threats, especially in the context of increasing interaction with external clouds, more dynamic fulfillment and provisioning, and more frequent life cycle updates.

Each dimension is broken down into *attributes* to enable more granular characterization. Each attribute is assigned a *weight* that reflects its importance for a given site deployment. For example, a site currently supported by managed MPLS service has higher weights for service performance and network management support, and relatively lower weights for service cost. We assign each WAN service a utility *score* for each attribute that captures the extent to which that attribute is reflected in that service. For example, internet over broadband will score high on cost economics but relatively low on performance and security. The assignment of attribute weights and WAN service-specific attribute scores reflects WAN managers' preferences gleaned through various consulting engagements and analyst reports.

With this construct, the model determines the value of each WAN service for a given site as the weighted sum of its attribute scores. The probability with which a given site will migrate to SD-WAN is proportional to its relative value over the current WAN service. SD-WAN's overall adoption rate for the market is the sum of these probabilities over all enterprise sites in the target market. Note that this adoption rate indicates SD-WAN's share of the WAN services market in the eventual, steady state. We model its market share in the interim years through a diffusion process using an approach proposed by Bass (see [1] for example) to determine the number of SD-WAN connections created during each year of the 5-year planning horizon. Figure 4 shows how the diffusion rate can impact the number of connections during the interim years.

In order to determine the net new connectivity market created through SD-WAN adoption, we also compute the loss of connections due to the cannibalization of existing WAN services, and incremental connectivity gains resulting from pull-through underlay services. [Note that SD-WAN adoption does not always result in the displacement of current WAN service; it is deployed in many cases, such as Hybrid SD-WAN, also to augment existing services.] The first stream captures connections lost to service providers as their existing customers churn from their current WAN services to SD-WAN. The second stream addresses the new underlay internet and MPLS connections created to support the adopted overlay SD-WAN services. For example, an enterprise site switching from current Frame Relay service to SD-WAN over MPLS triggers new revenues on account of both overlay SD-WAN and underlay MPLS services; there is also a simultaneous loss of cannibalized Frame Relay revenue.

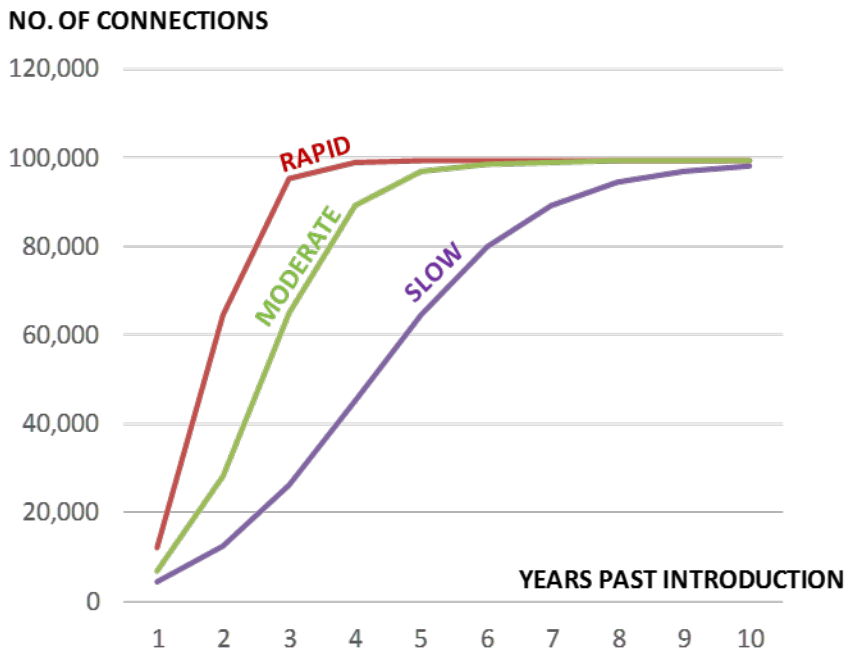

Figure 4 - Sensitivity of Connections Market to Speed of Diffusion

At the end of this step, we have a map of new overlay SD-WAN connections and new underlay internet and MPLS connections, as well as a count of cannibalized existing WAN service connections.

Average Revenue per Service (ARPS) Projection

In order to monetize the projected number of SD-WAN connections, we first estimate the average revenue per service (ARPS) for individual SD-WAN connectivity services, and next determine the revenue generated annually at each enterprise site based upon the type of service provided to that site.

We determine the basic connectivity ARPS for speeds ranging from 30 Mb/s to 1 Gb/s. It is estimated through simultaneous consideration of demand- and supply-side economics, and market prices. From customers' perspective, ARPS must reflect their willingness to pay for the incremental utility received over their current service. From MSOs' perspective, it should provide the targeted operating margins. From the market's perspective, ARPS should reflect the prevailing prices of services currently available.

The pricing model captures these 3 considerations; it reflects the market prices for currently available services (primarily at lower connectivity speeds), while ARPS at higher speeds is computed using a utility-based approach similar to one described earlier for determining SD-WAN adoption rates; this approach ensures that there is an increase in net utility for customers switching to SD-WAN. The model also verifies that MSO operating margin requirements are met; it is further validated through SD-WAN business case evaluation discussed in Section 5.

Overall Connectivity Market Revenue

The final step for arriving at the SD-WAN enabled connectivity revenue requires combining ARPS values with connection projections and netting out cannibalization losses. We include additional revenues generated through options, such as redundant CPE devices and high availability packages, to round up the overlay connectivity market projection.

To determine the overall SD-WAN enabled connectivity market, we also include revenues generated through additional pull-through underlay services – primarily internet and MPLS – required to support SD-WAN for the migrating sites that do not currently have these services.

3.2. MSO revenue projection

An MSO's 5-year SD-WAN revenue comprises its share of the SD-WAN connectivity market for both overlay and underlay services and pull-through revenues generated by value-add services enabled by SD-WAN. We focus on determining the *net new* revenues generated by SD-WAN after considering all revenue streams impacted by SD-WAN adoption.

Connectivity Revenue

We first consider the MSO's current enterprise customers. As described in Section 4.1, we estimate the number of current sites, project their 5-year growth in terms of their count, bandwidth requirements, and WAN services. Combining these connections with estimated services ARPS yields a baseline MSO revenue map prior to SD-WAN adoption.

Using the incremental utility-based evaluation and Bass diffusion approach discussed earlier, we next develop SD-WAN adoption rates to project the number of SD-WAN connections added each year across these sites. We estimate ARPS for various SD-WAN services using the 3-pronged approach discussed in Section 4.1 to develop 5-year SD-WAN connectivity gross revenue projection.

In order to determine SD-WAN's net new revenue impact, we additionally consider the following adjacent reveue streams that are triggered by SD-WAN adoption:

1. Revenue cannibalization: For many customers, SD-WAN will substitute the existing WAN service, resulting in the cannibalization (and loss) of current revenues. [Note that SD-WAN can be viewed as protecting the revenue streams with these customers, as otherwise they would be lost to other providers.]
2. Hybrid SD-WAN: However, in some cases – especially with MPLS services – SD-WAN will be adopted to augment current services leading to hybrid SD-WAN deployments with no cannibalization. For example, Verizon notes that SD-WAN has improved its MPLS sales [2].
3. Customer churn: Some migrating customers may switch to other SD-WAN providers, leading to loss of current underlay service revenue.
4. Pull-through underlay revenue: Some SD-WAN customers will require new internet or MPLS underlay connections, as well as LTE or other backup lines.
5. Cloud connect: Some customers will also opt for dynamic and secure connectivity to 3rd party and public clouds.
6. Options and additional services: Many SD-WAN customers will buy additional options such as dual CPEs, and professional services involving configuration support, etc.

In addition to generating new revenues from existing customers, SD-WAN also helps the MSO expand its current customer base. There are two modes through which new customers can adopt SD-WAN with the MSO: they can either churn into SD-WAN from their existing services with other providers, or they can adopt SD-WAN overlay from the MSO while retaining their current providers for underlay services. Enterprises adopting the latter path provide the opportunity for the MSO to rapidly build its market share by reaching out to off-net customers outside its cable footprint without having to make expensive investments.

To compute the revenue impact of new customers, we classify them into two groups – those covered by the MSO's cable footprint and others who are not. The revenue potential of the first group is computed much the same way as the existing customers with the obvious recognition that the enterprise sites under consideration cover all locations in the MSO's target market that are not its current customers. Other than cannibalization and customer churn, the other adjacent revenue streams apply here as well. For the second group, we primarily consider the revenue impact of overlay SD-WAN connection and a subset of options and additional services as other adjacent flows do not apply.

Figure 5 shows a typical enterprise customer map for an MSO that captures several SD-WAN connectivity variants discussed above.

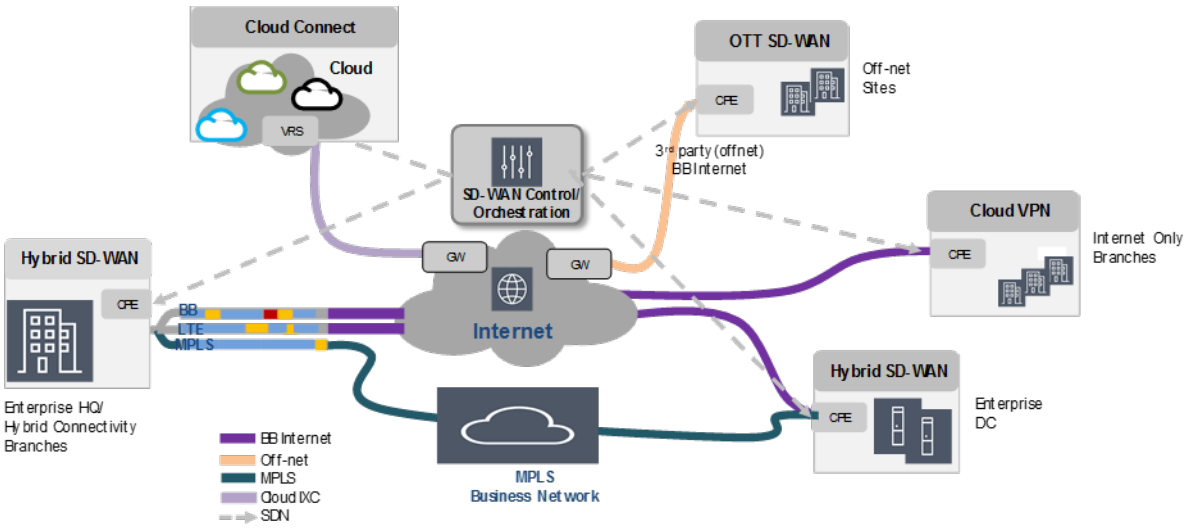

Figure 5 - SD-WAN Connectivity Map

Value-add Service Revenue

In addition to connectivity, SD-WAN also enables new value-add services. We include two groups of these service in the revenue model - security services and unified communications – that are closely related to network connectivity. However, depending upon the MSO's enterprise strategy, the scope of these value-add services can extend far beyond to span other enterprise applications and business processes, and result in revenues exceeding those generated through basic connectivity.

As noted earlier, network security services are a natural adjunct to SD-WAN connectivity. We include basic services – such as anti-virus, IPS, DDoS mitigation, web filtering, antispam, and mobile security – in the model. Similarly, we include voice, email, messaging, collaboration sites, web and video conferencing services as part of the unified communications package. Adoption rates of value-add services are determined through the utility-based approach discussed earlier, and they are evaluated at prevailing market prices.

Figure 6 presents the 5-year MSO revenue broken down into SD-WAN overlay, pull-through underlay and value-add services. Overlay services are clearly dominant, accounting for 68% of the overall $135 million revenue over 5 years. However, value-add services also contribute significantly by providing 20% of the total revenue; as noted earlier, the share of value-add services revenue can be more substantive if the MSO is willing to offer a broader range of these services as part of its enterprise strategy. Also worth

noting is the 12% revenue uplift generated by pull-through underlay services that can play a significant role in determining the viability of the overall business case.

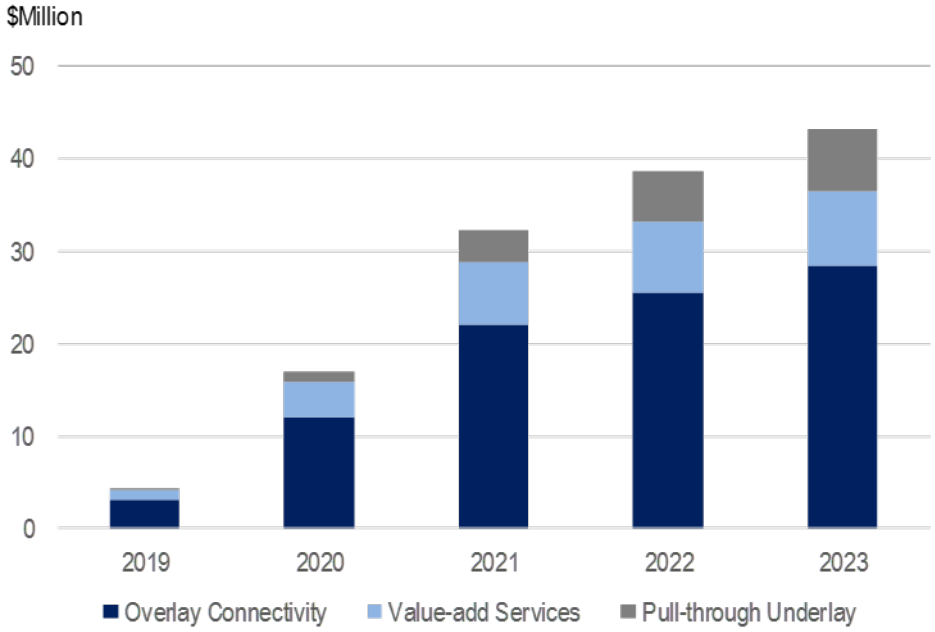

Figure 6 - MSO Revenue Projection

3.3. Revenue sensitivity

It is important to understand the sensitvity of SD-WAN revenue projection to market and business parameters. Figure 7shows the impact of two such parameters – the pace of SD-WAN market growth and the MSO's realized share of this market. Gradual market growth relates to the steady state penetration being reached in 7 years; balanced and aggressive growths reduce this time interval to 5 and 3 years, respectively. Likewise, we bound MSO market shares at Reach (30%) and Pessimistic (20%) levels around the target share of 25%. The nominal 5-year revenue of $135 million, following the growth shown in Figure 6, is projected for a balanced market growth and target MSO market share of 25%.

As shown in the table, MSO revenue can vary considerably across the scenarios. Specifically, if the market grows aggressively, it presents significant upside potential for the MSO. An MSO planning for the target market share must nonetheless be ready to avail of any sales opportunity as even a 5% increase in market share translates into $36 million to $61 million additional revenues over 5 years depending upon the pace of market growth. On the other hand, a gradual market growth does not significantly diminish overall revenues; this is a strong plus for SD-WAN. For example, at target market share, the MSO's 5-year revenues drop only by 11% (from $135 million to $120 million) if the market grows gradually. On the other hand, with aggressive market growth, these revenues increase by 36% (from $135 million to $184 million).

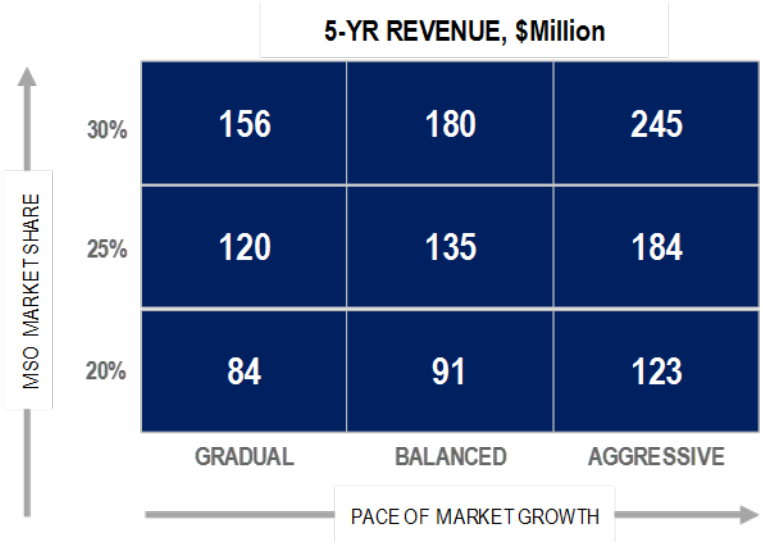

Figure 7 - Sensitivity of MSO Revenue Projection

4. SD-WAN Business Case Evaluation

The 5-year SD-WAN business case for the MSO is built upon the revenue projection described above through a bottom-up computation of incremental capital expenses (capex), and network and non-network operating expenses (opex) required to support this revenue.

Figure 8 gives the key revenue, capex and opex components considered in the business case evaluation. Capex is driven by the investment in SD-WAN solution elements shown in Figure 9 that comprises both hardware, such as CPE devices and self-service portals, and software required for the orchestrator, SDN controller, virtual network functions (VNFs) and other components of the solution stack. Capex also includes incremental capital expenses incurred for common infrastructure, such as the DC network, that SD-WAN shares with other network services. Configuring and sizing equipment hardware, as well as establishing software license requirements, is driven by parameters such as the number of subscribers, required features and options, and processing capacity demand. Market prices are used to estimate the cost of procuring SD-WAN elements and the common infrastructure. We also build in the cost of overall system integration (including interworking with existing OSS/BSS systems) into capex computation.

SD-WAN opex includes network expenses to support hardware and software maintenance, network operations such as fulfillment, assurance and capacity planning, and for meeting the network power and real estate needs. It includes right-to-use fees for 3rd party software; a large share of overall opex also comes from non-network expenses on account of sales & marketing, general & administrative items, and customer care and billing services.

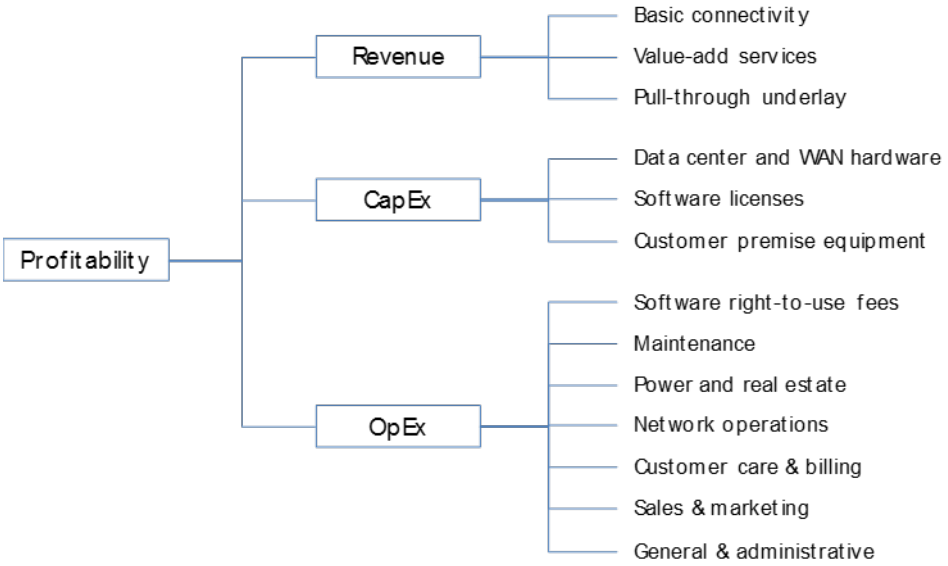

Figure 8 - Business Case Components

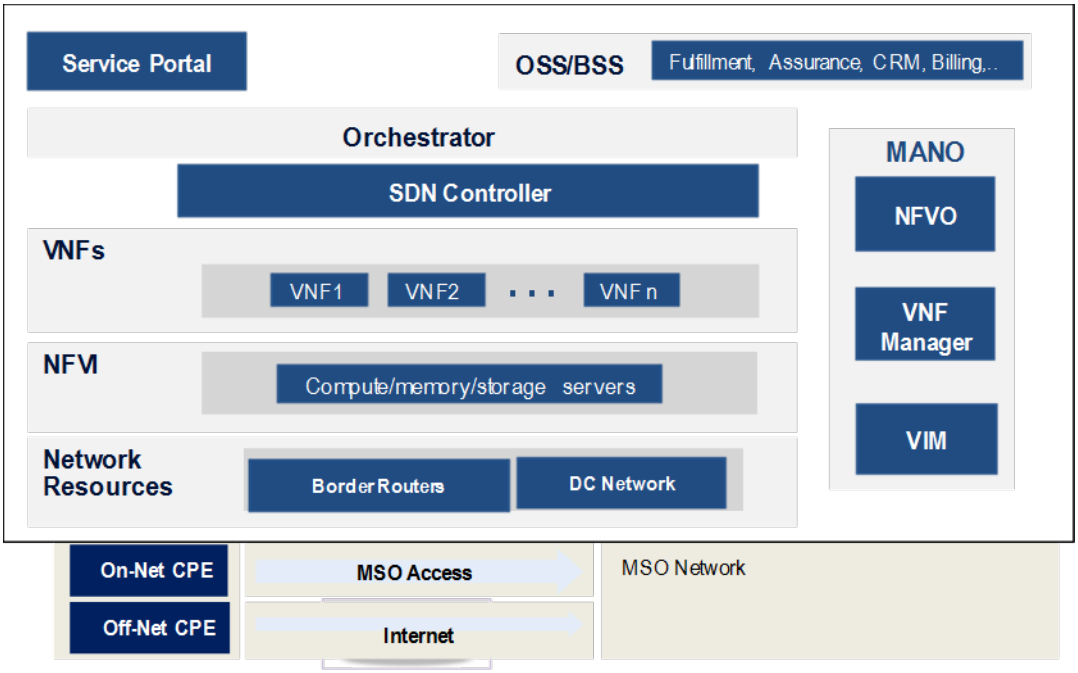

Figure 9 - SD-WAN Solution Components

Figure 10 captures the individual elements of the business case financials, and also shows the resulting profitability in terms of the cumulative discounted cash flow (CDCF) through each of the 5 years. These values indicate a strong SD-WAN business case for the MSO with a 5-year net present value (NPV) of $36 million and a payback period of 2.25 years.

SD-WAN capex is driven primarily by the cost of the CPE device and the self-service portal, both of which scale with actual deployment. A key implication of this cost structure is that it significantly reduces the inherent financial risk of SD-WAN deployment in that major capital investment is backed by immediate customer order and revenue inflow. Other capex elements, such as the virtualization platform, account for about 32% of overall 5-year capex with the bulk of these investments coming in the later years.

Major drivers of SD-WAN opex are right-to-use fees for 3rd party value-add services software, sales & marketing expenses, general & administrative costs, SD-WAN software maintenance fees, and customer care expenses.

In addition to establishing baseline SD-WAN financials, it is also necessary to understand their sensitivity to key market and business parameters. It is difficult to precisely predict how the market will behave in future, what the actual SD-WAN take rate will be, and how competition will respond. It is also important for the MSO to understand the implications of its own actions, such as market entry timing. In order to capture some of these sensitivities, we simulate the results of 3 scenarios and contrast them with the baseline financials discussed above. The scenarios investigated are:

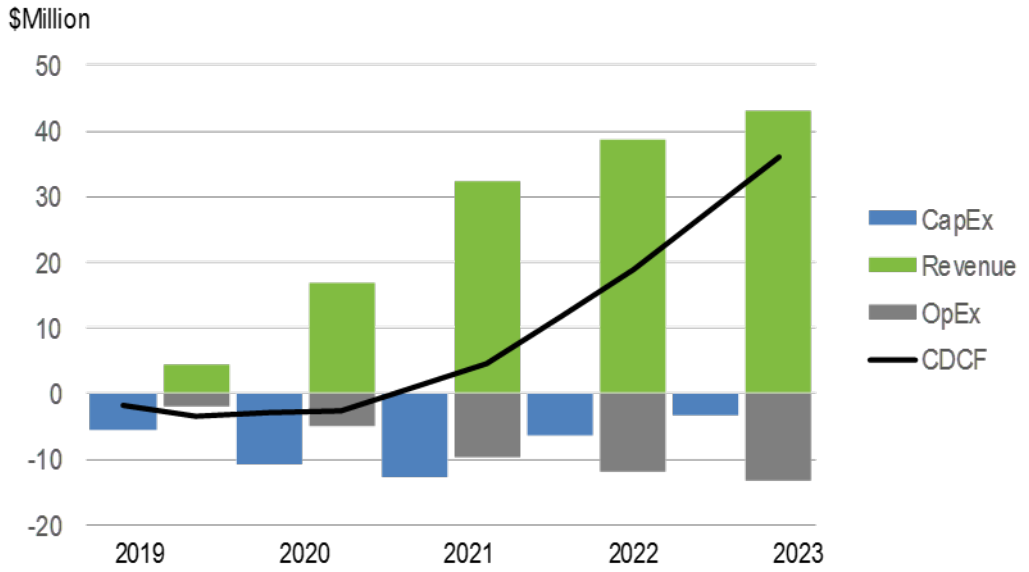

Figure 10 - SD-WAN Business Case Financials

Scenario 1 – MSO late to a rapidly growing market by 1 year. MSO's entry is delayed by 1 year into a market that is growing more rapidly than one considered in the baseline.

Scenario 2 – Slow market adoption of SD-WAN. While SD-WAN eventually achieves the baseline market penetration, there is a 2-year delay due to slower diffusion during the interim years.

Scenario 3 – Phased VAS introduction. MSO strategy to deploy only connectivity services at a site initially, and delay VAS deployment at that site by 1 year.

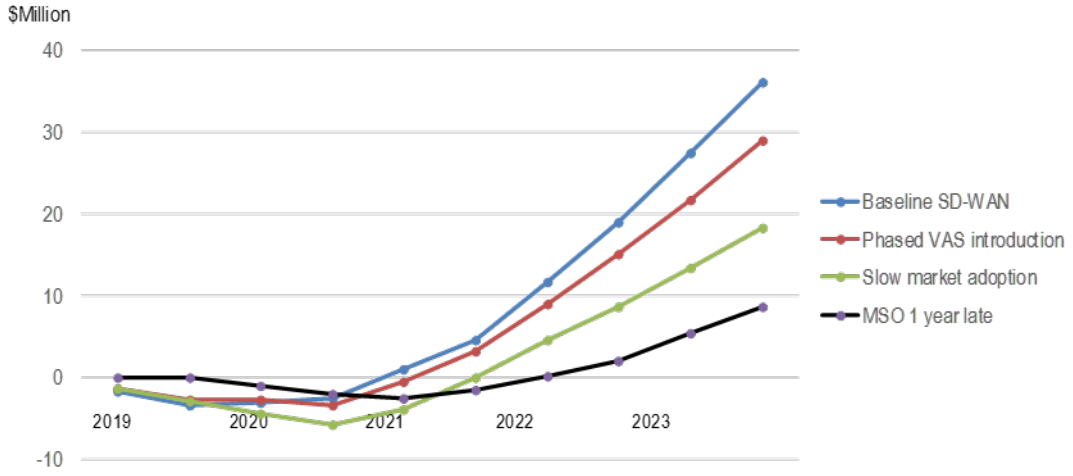

Figure 11 - SD-WAN Business Case NPV Sensitivity

Figure 11 captures the NPV implications of these 3 scenarios. Late entry in a growth market under Scenario 1 has the most severe impact on the MSO's business case. Not only is its NPV reduced significantly throughout the 5-year planning horizon, the NPV growth trajectory in the later years (and beyond) is seriously compromised as well because the MSO's late market entry reduces its market share and ARPS, and increases customer churn, in the face of early competitive presence in a growth market.

While a slowly developing SD-WAN market under Scenario 2 reduces 5-yar NPV by 50% and increases the payback period, the MSO may still find the business case to be viable, especially as SD-WAN deployment risk, and the risk of stranded investments, is inherently low for the reasons discussed earlier.

A phased VAS deployment approach under Scenario 1 has minimal impact during early years, and the baseline payback period is generally preserved. It also staggers initial investment costs with a relatively small impact on SD-WAN connectivity market share. However, the delayed realization of higher-margin VAS services results in lower NPV over the 5-year horizon. A viable catch-up strategy for the MSO under this scenario would be to pursue VAS deployment more aggressively in the later years.

Conclusion

In this paper, we present a utility-based approach to developing SD-WAN revenue and profit projections for a generic MSO. Market and revenue projections are based on SD-WAN adoption rates driven by its incremental value measured in terms of WAN service attributes desired by individual enterprise sites. We show that the SD-WAN market is significant and growing, and its adoption provides the MSO a viable business case with a payback period of 2.25 years. We also note that SD-WAN has inherently low financial risk as the bulk of the required capital investment is based on actual deployment, and therefore, it scales naturally with revenue.

While SD-WAN financials based on expected market growth remain attractive in of themselves, the MSO needs to also be ready for demands exceeding these projections in order to maximize its revenue opportunity. Increasing virtualization, growing enterprise adoption of cloud services, and need to simplify WAN operations and reduce costs in the face of expanding branch office connectivity and application needs are trends that portend significant potential for faster SD-WAN growth.

A word on SD-WAN technology maturity. Backed by a strong ecosystem, SD-WAN has reached a level of performance stability and maturity that makes it ready for mass deployment. It provides a range of solution alternatives that makes it easily deployable in a phased manner. As it expands its capabilities through increasing automation and analytics support, SD-WAN will enable an MSO to further distance its WAN solutions from traditional alternatives.

Abbreviations

ARPS	average revenue per service
CDCF	cumulative discounted cash flow
CPE	customer premise equipment
DC	data center
DDoS	distributed denial of service
EPL	ethernet private line
EVPL	ethernet virtual private line
MPLS	multi-protocol label switching
MSO	multiple system operator
NFV	network function virtualization
NPV	net present value
OSS/BSS	operational support system/business support system
SMBs	small and medium businesses
SDN	software defined networking
SD-WAN	software defined-wide area networking
SLA	service level agreement
VAS	value-add service
VM	virtual machine
VNF	virtual network function
VPLS	virtual private line service
VPN	virtual private network
WAN	wide area networking

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