The Economic Benefits of Virtual Edge Services

Dr. Peter Fetterolf

Sponsored by

EXECUTIVE SUMMARY

Enterprises have been relying on managed service providers for many years to manage their private MPLS networks and more recently SD-WAN networks, which are essential to most enterprise IT systems and digitization strategies. Currently, many managed service providers use physical network appliances to deploy managed services. For example, an MPLS router provides MPLS service, an SD-WAN router provides SD-WAN service, a firewall provides security services, and a WAN optimization appliance optimizes enterprise application services. Each time a new service is deployed the service provider must install a new physical appliance on a site, which requires a truck roll, configuration, and testing. Service providers must also keep a large inventory of many physical devices and track of different hardware versions and features. A new service might require a new type of device and a new vendor.

The virtual edge results in a three-year cumulative TCO savings of 39% and a 412% increase in cumulative cash flow over the same period.

Network function virtualization (NFV) allows many virtual network functions (VNFs) to run on a single x86 physical device. This allows managed service providers to offer many edge services on a single physical platform. This helps reduce both CapEx and OpEx by decreasing hardware expenses, power, operations, and management expenses. In this paper we present the results of a business model that shows a virtual edge can reduce the total cost of ownership (TCO) by 39%. This is driven by a CapEx savings of 37% and an OpEx savings of 65%. Additionally, the virtual edge allows service providers to deploy services more quickly, which provides a 6% increase in revenue. The combined benefit of the TCO savings and revenue acceleration has dramatic impact of the bottom line profitability for a managed service provider. We show a 412% increase in cumulative cash flow over three years.

Managed Network Services

Network operators have been providing enterprises with edge communication services for many years. In the 1990s operators offered managed Frame Relay services. In the late 1990s MPLS technology and services became dominant, and in the last five years SD-WAN services have gained popularity. Enterprise services have traditionally had higher margins than consumer services and have helped contribute to network operators' bottom line.

The managed network services market is large and growing. The global market for managed services in 2020 is estimated at $52 billion, and it is expected to grow to $71 billion in 2025. Clearly, the managed services market is important for many network operators, but there are challenges:

- Competition: SD-WAN and other overlay technologies allow managed service providers to offer services outside of their network footprint, which increases competition
- DIY: Enterprises can build SD-WAN, firewall, and WAN optimization networks themselves as an overlay on top of Internet and MPLS underlay services
- Margin pressure: Enterprises have easy access to the underlying cost of SD-WAN, firewall, and WAN optimization equipment, which puts them in a better bargaining position to reduce service prices

The key requirements for managed enterprise services are:

- Interconnection of branch offices, large buildings and campuses, corporate data centers, and public clouds
- High levels of security
- High levels of service availability
- Optimized application performance
- Visibility and monitoring
- Turn-key solution

Present Mode of Operations

Many managed service providers and enterprises implement a variety of network functions using separate physical appliances that are optimized for specific functions. Examples of physical appliances are:

- MPLS Routers
- SD-WAN Routers
- Firewalls
- WAN Optimization Appliances

Each appliance provided and supported by separate vendors and sometimes multiple vendors is used for the same appliance. Some of the problems with this model are:

- Systems are closed and proprietary
- Difficult to mix and match appliances
- Hard to deliver consistent services
- Difficult to create and roll out new services
- Truck rolls are required for each separate appliance
- Inventory and sparing is expensive and complex

Future Mode of Operations

Over the last decade NFV has emerged as one of the most important trends in networking. NFV virtualizes network functions such as routing, SD-WAN, and firewalls such that they run as VNFs on standard x86 hardware. Virtualization provides a big benefit to managed service providers. Instead of managing multiple physical hardware appliances supplied by multiple vendors, service providers can use standard x86 appliances and host a variety of VNFs to deliver network functions and provide choice of software vendors in areas such as routing, firewalls, and WAN optimization.

An example of a standard x86 edge hardware platform is the Dell EMC Virtual Edge platform (VEP) powered by Intel. The Dell EMC VEP comes in two models:

- Dell EMC VEP 1400
- Dell EMC VEP 4600

Each platform has multiple configuration alternatives for cores, memory, and interfaces and can be configured based on the branch office requirements. A comparison of the PMO using separate physical appliances and the FMO using the Dell EMC VEP with virtual network functions is presented in Figure 1.

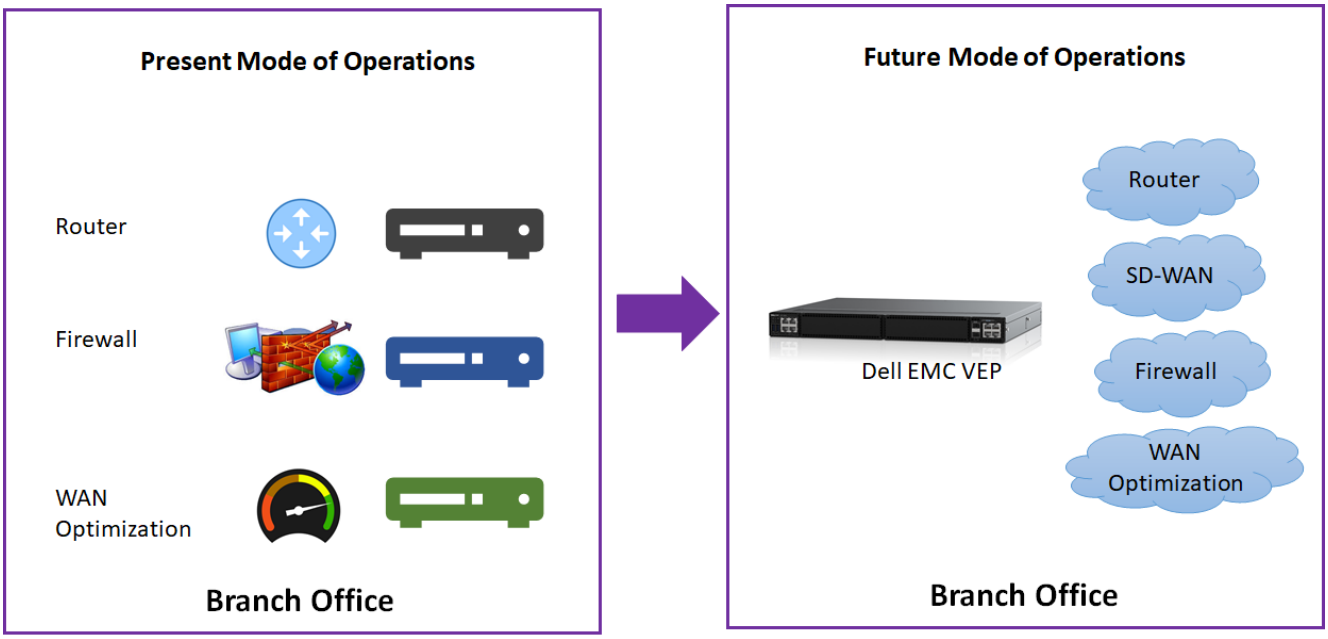

Figure 1. PMO versus FMO

The key benefits of edge service virtualization are:

- All network functions share the same hardware platform, which results in lower CapEx, sparing expenses, and simplified management and operations
- New services can be rolled out without deploying new hardware, which eliminates truck rolls and simplifies service testing and deployment
- Virtual edge services are better suited to orchestration and automated management
- Automation reduces OpEx by reducing labor
- VNF software can be scaled up or down to meet branch office requirements and customers pay for the bandwidth and services required
- A single x86 device consumes less power than multiple physical appliances
- Services can be deployed faster which means faster time to revenue

The virtual edge architecture is well suited to service providers that need flexibility, speed of service deployment, end-to-end orchestration, pay as you grow, and monitoring and analytics. In addition to the general benefits of edge virtualization, some of the specific Dell Technologies features that benefit service providers are:

- Dell Technologies has a global footprint and many supply chain partners
- Dell Technologies can provide rapid response times to solve problems globally, which allows service providers to offer service level agreements without much risk
- Dell Technologies is a single point of contact for hardware provisioning and fault management

The cumulative benefits of the virtual edge architecture can lead to better customer experience and satisfaction, which reduces churn.

Similar to the promise that uCPE provides, Intel solutions also provide the flexibility, performance right-sizing and world-wide ubiquity that maps to Dell Technology key customer VEP value propositions. On-going Dell Technology and Intel collaboration also provide another level of future-proofing that customers have come to expect from Dell Tech and Intel, and that are now extended to the joint, emerging Edge solution portfolio

Business Model and Assumptions

ACG Research developed a business case model comparing the PMO (physical appliances) and FMO (virtual edge). The model was developed using the ACG Business Analytics Engine (BAE)[1] , which is a next-generation economic simulation platform for networks, data centers, cloud, and NFV. The model in this network is representative of a large enterprise network that is operated and managed by a service provider.

An overview of the Adaptive IP TCO model is presented in Figure 2.

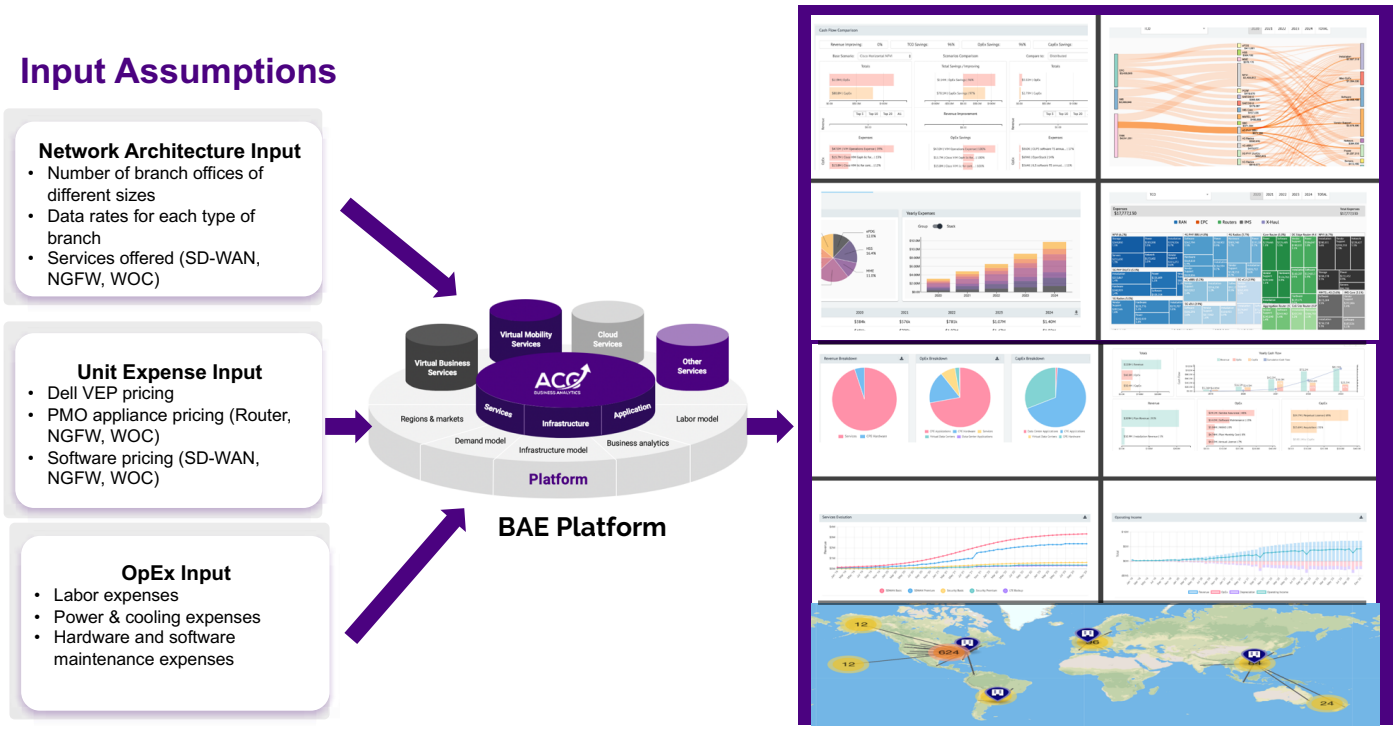

Figure 2. Adaptive IP TCO Model

The model is a three-year business model that forecasts CapEx, OpEx, and revenue for a service provider offering SD-WAN, firewall, and WAN optimization services. It compares the PMO using separate physical appliances with the Dell EMC VEP solution using VNFs on a common x86 hardware platform. There are three primary types of inputs to the model:

- Network architecture inputs
- Unit expense inputs
- OpEx inputs

[1] *https://www.acgcc.com/p/bae-software/*

The types of sites, data rates, and number of devices deployed at the start of the model (2021) and end of the model (2023) are displayed in Table 1:

Enterprise Category	Data Rate (Mbps)	2021	2023
Small site (25 Mbps per site)	25	0	100
Small site (100Mbps)	100	0	1000
Medium site (500Mbps)	500	0	100
Large site (1000Mbps)	1000	0	50
Large site (5000Mbps)	5000	0	4
Large site (10000Mbps)	10000	0	2

Table 1. Deployment 2021 and 2023

Revenues and service profitability are also forecasted using the following service pricing models for North America (based on an ACG research report[2]). Table 2 specifies the average monthly pricing for SD-WAN, firewall, and WAN optimization services in North America. These are the monthly prices that the managed service provider charges an enterprise and vary depending on the data rate required by the branch office. Installation charges are nonrecurring charges.

Mbps	SD-WAN	NGFW	WAN Optimization	Installation
10	171	165	334	400
100	289	189	564	400
500	530	370	818	400
1000	795	685	1601	400
10000	1589	1370	3202	400

Table 2. Average Monthly Pricing

The TCO model assumes that the time to deploy services is faster in the FMO virtual edge scenario than the PMO, specifically we assume services can be deployed two months faster which speeds up time to revenue. Service can be deployed more quickly on the virtual edge because VNFs can be deployed using orchestration and management systems and truck rolls are not required. In the PMO a new service might require a technician to visit a site and deploy, configure, and test a hardware platform which slows down the time to deliver services.

[2] *https://www.acgcc.com/media/reports/files/ACG_Research_Global_Pricing_Strategies_for_SD-WAN_Services.pdf*

Business Case Results

The virtual edge solution results in a revenue improvement of 6% because of faster time to revenue and results in a three-year cumulative TCO savings of 39%. The three-year cumulative CapEx, OpEx, and TCO savings are presented in Table 3. The key drivers of the benefits are:

- Faster time to revenue (2 months) leads to three-year revenue improvement of 6%
- Common platform provides hardware and software expense savings of 37%. This is due to VNF software sharing a common platform rather than deploying physical appliances
- OpEx savings of 65% is due primarily to simplified management and reduced truck rolls.
- Total TCO savings of 39%

Expense Type	Virtual Edge Savings
CapEx	37%
OpEx	65%
TCO	39%

Table 3. Three-Year Cumulative CapEx, OpEx & TCO Savings

The combined benefits of revenue increases and TCO savings results in a significantly better overall business case for managed services using the virtual edge. Table 4 presents a summary of a business case comparison of the PMO with the virtual edge FMO. Note that the cumulative cash flow of the virtual edge is $12.8M versus $2.49M for the PMO with physical appliances. This represents a 412% increase in three-year cumulative cash flow. Similarly, the payback for the FMO virtual edge is 13 months versus a 34 month payback for the PMO. There are similar differences in ROI, IRR, and NPV. The virtual edge solution clearly provides a much stronger business case for managed service providers than the PMO with physical appliances.

	Virtual Edge	Physical Appliances
ROI	99%	12%
NPV	$11.4 Million	$1.84 Million
Payback (Months)	13	34
Revenue	$26.3 Million	$24.9 Million
Cumulative Cash Flow	$12.8 Million	$2.49 Million
CapEx	$13 Million	$20.6 Million
OpEx	$619 Thousand	$1.76 Million
TCO	$13.6 Million	$22.4 Million

Table 4. Summary of Business Comparison

The annual TCO (OpEx and depreciated CapEx) is represented in Figure 4. The key thing to note in this graph is that the cost of the FMO and PMO continue to diverge over time. The cumulative cash flow comparison of the PMO and FMO is depicted in Figure 5. Note that the cumulative cash flow goes positive for the FMO virtual edge much earlier than the PMO cumulative cash flow, which leads to a shorter payback for the virtual edge.

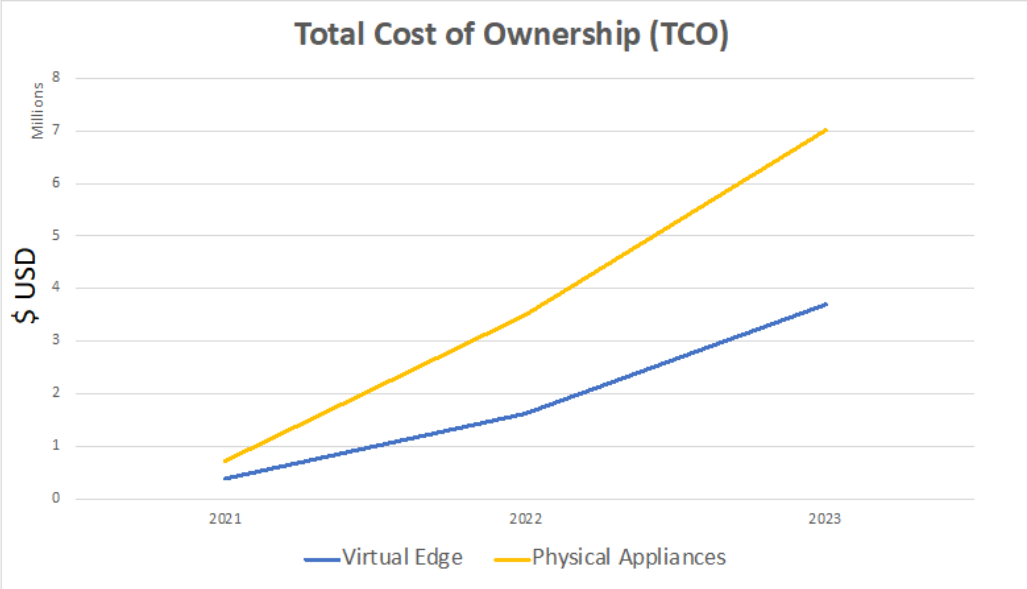

Figure 4. Annual TCO

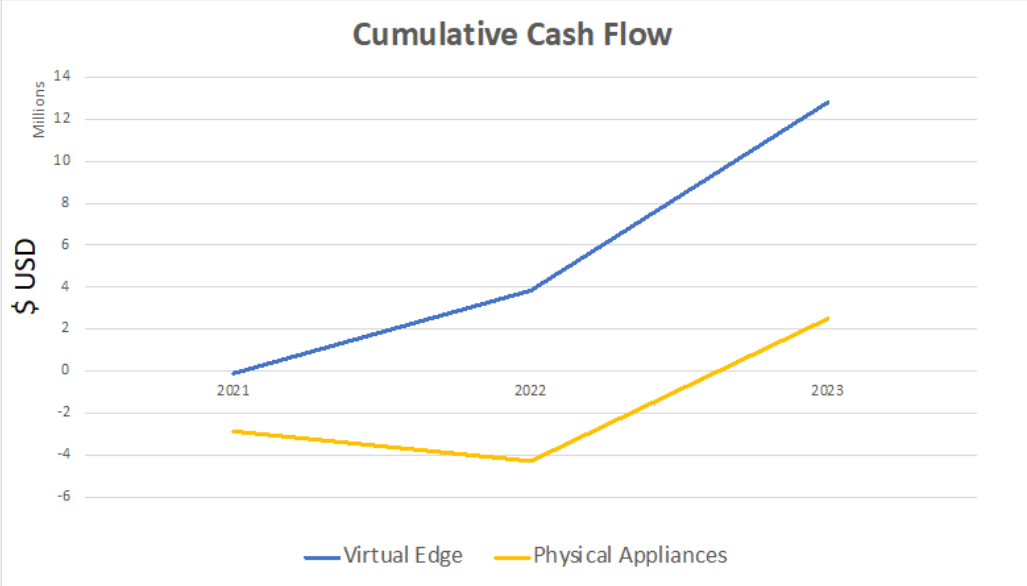

Figure 5. Cumulative Cash Flow

A breakdown of the five-year cumulative CapEx is presented in Figure 6, and the cumulative OpEx breakdown is presented in Figure 7. The left side of the diagram is the PMO expense breakdown, and the right side represents the FMO expense breakdown. Figure 6 shows that the CapEx savings is achieved by replacing the hardware appliances with a common Dell EMC VEP platform and separate software subscriptions. Figure 7 shows that most of the OpEx savings is achieved by reducing the overall cost of WAN operations. This cost is reduced as a result of simplifying hardware deployments, reducing truck rolls, and automating network operations.

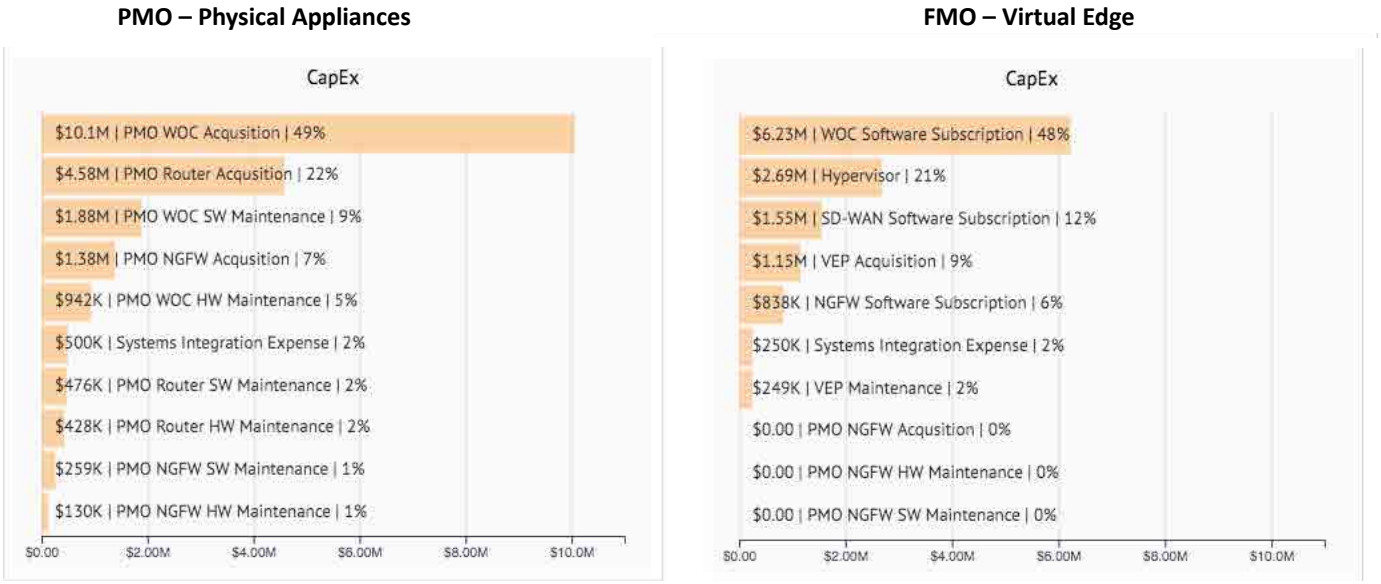

Figure 6. Five-Year Ccumulative CapEx

Figure 7. Cumulative OpEx Breakdown

Conclusion and Summary

The key benefits of the virtual edge architecture are summarized in Table 5.

PMO, Physical Edge	FMO, Virtual Edge
Systems are closed and proprietary.	Open x86 based hardware.
Separate physical appliances are required for each network function.	A single Dell EMC VEP can host all virtual network functions.
New service provisioning requires a truck roll and physical configuration and testing of an appliance on site.	New services can be deployed remotely using orchestration and automation. Truck rolls are not required.
Modern network orchestration systems are not well suited to managing physical appliances.	Most orchestration systems can natively manage virtual network functions.
Automation is more difficult to implement and maintain in physical appliances.	Automation is a key component of NFV.
Physical appliances have fixed capacity and changes in capacity require replacing the appliance.	Virtual network functions can be scaled up or down on demand.
Physical appliances consume more power than virtual appliances.	Virtual network functions share a common hardware platform and consume less power as a result.
Inventory and sparing are complex when many physical appliances are required.	A common Dell EMC VEP platform simplifies inventory management and sparing.
Physical appliances result in higher TCO.	A virtual edge provides TCO savings of up to 39%.

Table 5. Benefits of the Virtual Edge Architecture

NFV has shifted the paradigm of networking from fixed hardware-based appliances to virtual network functions hosted on standard x86 servers. The Dell EMC VEP is an example of an open, x86 based virtual edge platform that provides managed service providers with a flexible environment for offering services. The virtual edge has significant TCO benefits that result in dramatic improvements to the bottom line.