

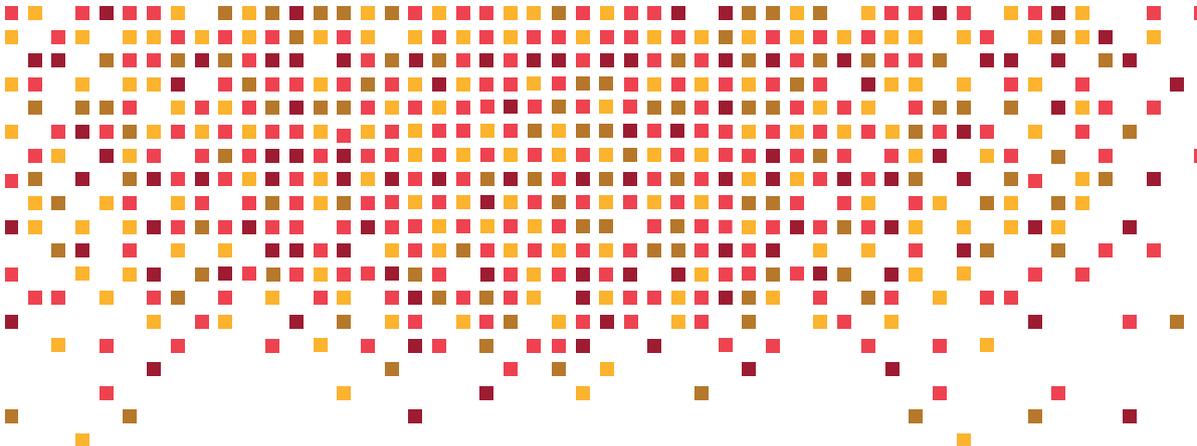
COMPLEMENT YOUR BUSINESS SERVICES PORTFOLIO WITH VIRTUALIZED NETWORK SERVICES

Solution Primer

ABSTRACT

Software Defined Networking (SDN) has delivered significant benefits to datacenter networks, making it possible to unleash the true power of the cloud.

Nuage Networks brings the same benefits to private virtual network services with Nuage Networks Virtualized Network Services (VNS). Our solution is a new approach that complements your premium VPN services and increases your addressable market while reducing the cost to serve.



CONTENTS

- 1 Enterprise IT consumption shifts to the cloud
- 1 Introducing Nuage Networks Virtualized Network Services
- 3 How Nuage Networks VNS works
- 5 Nuage Networks VNS delivers bankable business benefits
- 6 Nuage Networks VNS deployment models
- 8 Increased service footprint and provisioning efficiencies
- 9 Customer empowerment
- 10 Flexibility to choose x86-based service endpoints
- 11 Summary

ENTERPRISE IT CONSUMPTION SHIFTS TO THE CLOUD

The new cloud-based IT consumption model is putting significant strain on the underlying network services used by enterprises. Today's network services were not designed for the dynamic cloud environment and rely on cumbersome manual change control processes. As a result, the network is hindering the speed of change for your customers' businesses.

A high percentage of enterprises have been forced to augment their network services with third-party integration to meet their business needs. Table 1 outlines key concerns enterprises have with network services.

TABLE 1. Limitations of current VPN deployment choices

Key concerns for enterprises	Enterprise needs	How these needs are met with current service offerings
Network services	Full range of network functionality across the complete IP stack	Basic connectivity services plus customized network intelligence from third-party appliances
Moves, adds and changes	Automation with the removal of manual configuration	Manual processing, resulting in unacceptable time delays
Management	Visibility, single point security management	Limited manageability, with little to no actual control
Control	Ability to self-administrate, with information security compliance to their industries' regulations/standards	Request and wait for change control actions. Perform independent auditing and compliance
Configuration	Agility, just-in-time consumption	Request and wait for change control actions

INTRODUCING NUAGE NETWORKS VIRTUALIZED NETWORK SERVICES

Nuage Networks Virtualized Network Services (VNS) is a complementary service to your existing IP and Carrier Ethernet (CE) VPN services. Unlike the other VPN services, Nuage Networks VNS was specifically developed to serve enterprises that are adopting a cloud-based IT consumption model.

Nuage Networks VNS aligns the network service to the needs of the enterprise and provides the flexibility to deliver an unconstrained network experience that matches the dynamic IT environment.

TABLE 2. How Nuage Networks VNS successfully addresses enterprises' cloud networking requirements

Key concerns for enterprises	Enterprise needs	How Nuage Networks VNS addresses the requirement
Network services	Full range of network functionality across the complete IP stack	Integrated network services that incorporate key network functions
Moves, adds and changes	Automation with the removal of manual configuration	Self-service moves, adds and changes via an integrated service portal
Management	Visibility, single point security management	Service-wide and site-specific visibility with auditing and compliance
Control	Ability to self-administrate, with information security compliance to their industries' regulations and/or standards	Self-service control of all service functions including compliance auditing and site additions and/or removals
Configuration	Agility, just-in-time consumption	Self-service portal to manage all service configuration and changes via an intuitive toolset

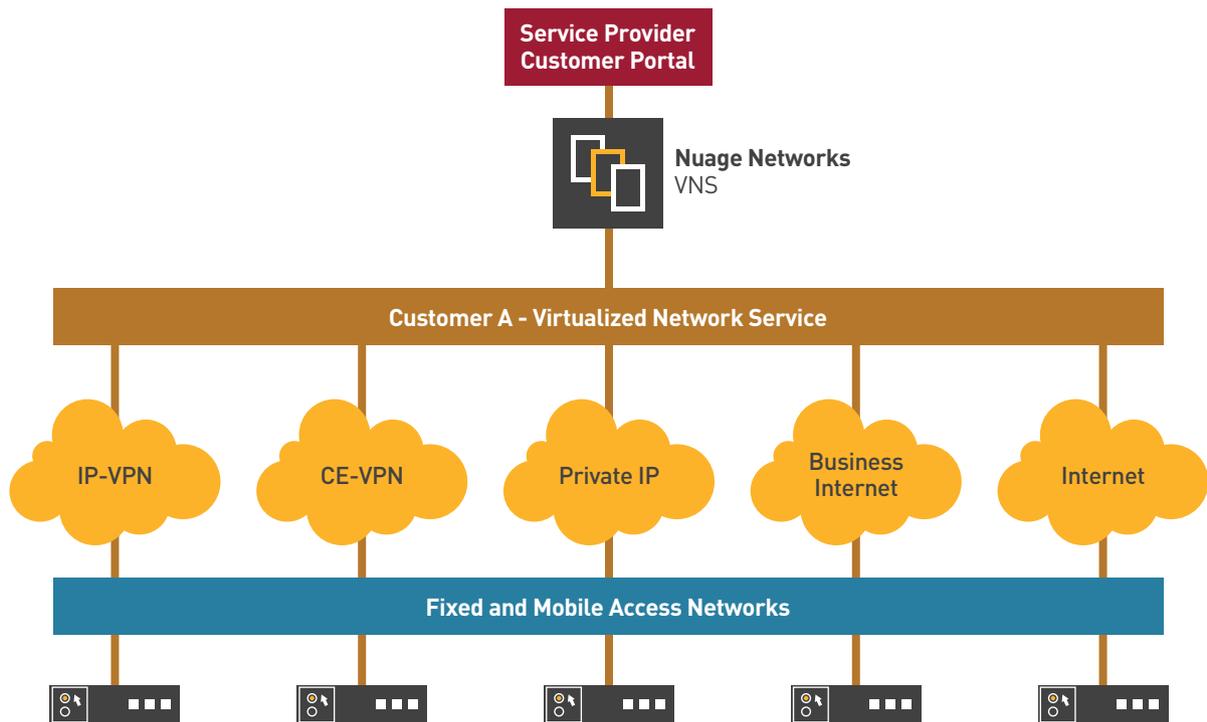
The key differentiator between current VPN services and Nuage Networks VNS is that the service is independent of the network infrastructure and runs as an overlay. This independence provides increased flexibility in reach. With Nuage Networks VNS the key network requirement is simply IP connectivity.

Independence also provides maximum flexibility in the access technology with service support (via demarcation or media conversion) for traditional fixed line, high-speed copper, fiber (Ethernet) or mobile broadband technologies.

The key benefits of Nuage Networks VNS are:

- Overhead associated with provisioning processes is similar to residential broadband activations
- Separation of the network infrastructure from the customer service
- Customer empowerment features to target IP-VPN and CE-VPN customers who choose to manage their own service including a Network Functions Store with advanced features to target third-party network appliances
- Highly customized feature set to provide a consistent, relevant service experience for your customers and reduce the likelihood of competitive churn

FIGURE 1. Nuage Networks VNS over any available network



Later in this paper, we explore the many business benefits Nuage Networks VNS provides over traditional VPN service offerings. First, however, it's important to get an understanding of the core service attributes. The following section provides an overview of the key building blocks of Nuage Networks VNS and how they are implemented.

HOW NUAGE NETWORKS VNS WORKS

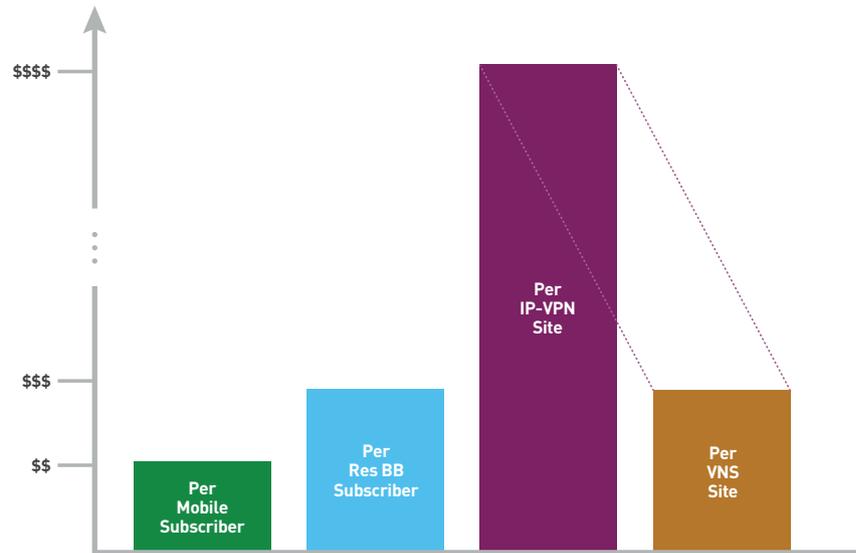
Nuage Networks VNS is a new approach to private wide area networking services based on the Software Defined Networking (SDN) framework. The key concepts used are abstraction of the customer service from the underlying network transport and automation of the major steps in the workflow process.

This approach creates a complementary service to IP-VPN and CE-VPN, with a provisioning and operating model that matches what is available for mobile subscriber or residential broadband activation.

Nuage Networks looked at the technologies that drive the provisioning and assurance aspects of broadband networks:

- Centralized policy-based control
- Separation of the service from the end user's device (for instance the brand or model of broadband router)
- Self-service portals that empower consumers to manage their service and reduce service provider overhead

FIGURE 2. Lowering the cost to provision VPN sites



Nuage Networks VNS will drive a significant reduction in the workflow processes associated with VPN service provisioning

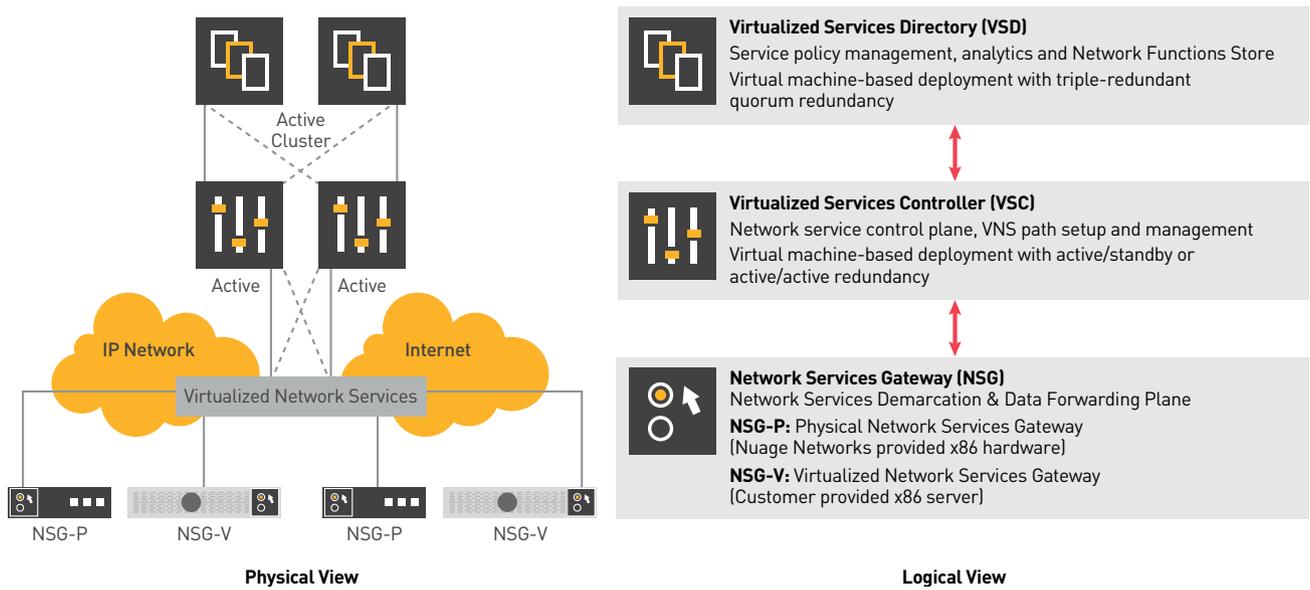
These key service attributes provide a simple operational model for mobile and residential services that has scaled with demand while reducing activation costs.

Nuage Networks VNS provides the same level of benefits for network services, with an estimated reduction in internal activation costs (time and resourcing) of 60% in comparison with current IP-VPN or CE-VPN services.

There are three key components to Nuage Networks VNS:

- **Virtualized Services Directory (VSD)** — This is the centralized policy engine, which defines, deploys and enforces the overall Nuage Networks VNS platform's capability. It includes an upselling avenue in the form of the Network Functions Store, which also facilitates workflow improvements.
- **Virtualized Services Controller (VSC)** — The network controller programs the customer premises equipment with the network overlay paths to form the customer service.
- **Network Services Gateway (NSG)** — The gateway provides service demarcation at the branch location

FIGURE 3. Nuage Networks VNS components



Traditional VPN services are tightly connected to a dedicated network infrastructure. Nuage Networks VNS instances are based on an overlay model that uses any IP network to provide underlay connectivity between sites. This gives you maximum flexibility for service reach and the support of multiple access/last mile technologies including copper, fiber or mobile broadband.

With Nuage Networks VNS, you have the flexibility to mix and match available network and access technologies to serve your customer base across the widest footprint possible. This increases your addressable market with improved responsiveness — a clear market advantage.

For instance, if a Nuage Networks VNS customer requests a new site that does not have immediate access to fiber or copper, you can use a 4G connection until fixed connectivity can be sourced. This provides you with an immediate revenue stream and addresses your customers' needs for faster delivery of connectivity services.

NUAGE NETWORKS VNS DELIVERS BANKABLE BUSINESS BENEFITS

There are many advantages to the Nuage Networks VNS approach:

- Support for multiple deployment models
- Increased service footprint and provisioning efficiencies
- Customer empowerment
- Flexibility to choose x86-based service endpoints

Together, these advantages contribute to the value of the Nuage Networks VNS solution. The overriding benefit to you is that with Nuage Networks VNS you can enhance your service offerings with a cost-effective solution that is optimized for cloud-based services. You can efficiently address your customers' needs and reduce the potential for churn.

Nuage Networks VNS deployment models

Nuage Networks VNS only requires IP connectivity to operate, so there are many network infrastructure options that can be used to provide the service. These options can be segmented into two main types with the flexibility to mix and match to meet customer opportunities:

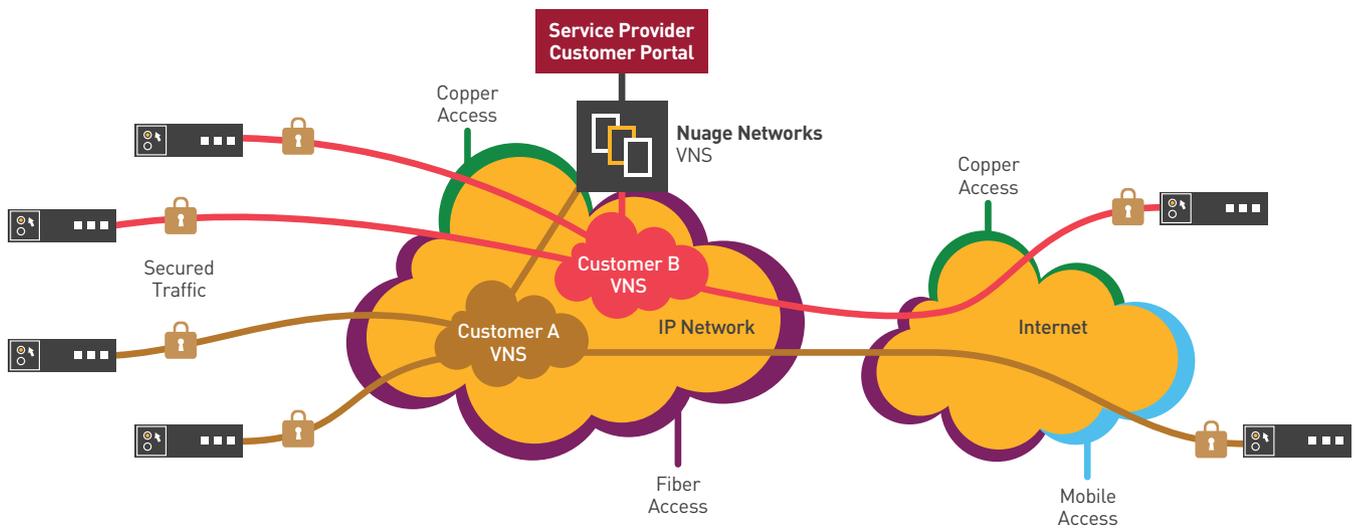
- Shared IP transport (Internet or private IP)
- Dedicated IP transport (IP-VPN, CE-VPN) networks

Depending on the underlay IP service type there are traffic forwarding characteristics that you can promote to provide a scaled pricing model for customers.

Private IP (shared transport) deployment model

For private IP networks (those not directly connected to the Internet) the options include using a dedicated private IP instance as an underlay transport service that is shared by multiple virtual networking customers. You define an appropriate QoS/SLA framework that's greater than Internet / less than premium VPN. See Figure 4.

FIGURE 4. Private IP (shared transport) deployment model



The benefit of this deployment model is that the shared IP network is provisioned via a simple workflow with operational management for maintaining an agreed overbooking factor.

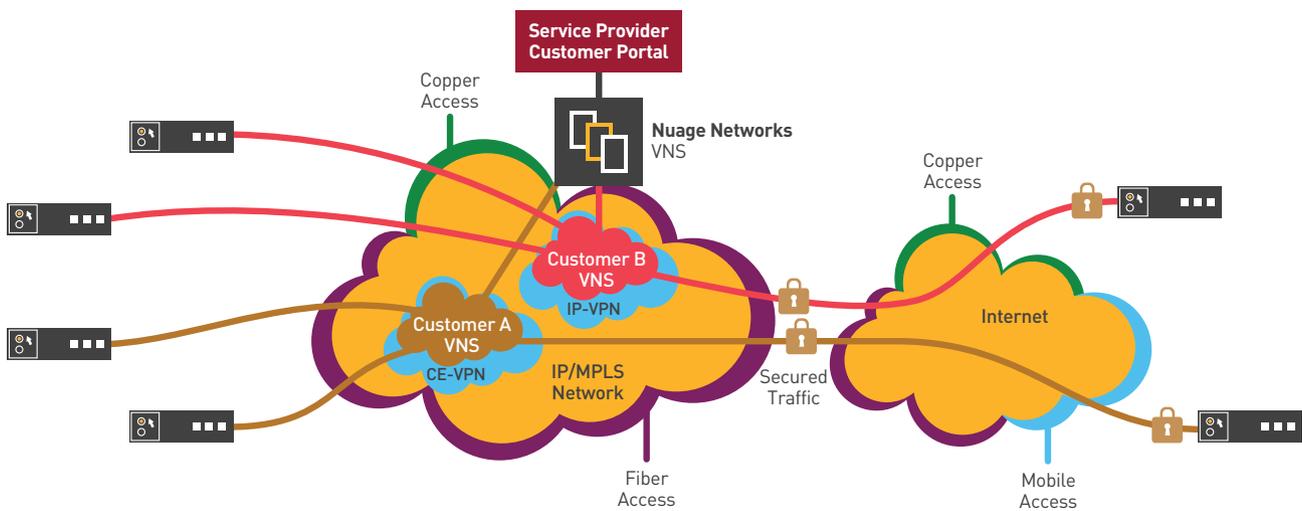
The customer would request the Nuage Networks VNS and provisioning would be limited to providing access tails and base connectivity to the shared IP network instance. Once the underlay is provisioned, customers configure their specific networking configuration through the portal and deploy that functionality as their

own private overlay. This model also provides the ability to position the transport characteristics to match your specific market. For instance, SLA levels on overbooking, traffic engineering and QoS can be placed in between premium VPN offerings and standard and business grade Internet services.

Premium VPN (dedicated transport) deployment model

Another deployment model is to run the customer-specific network service over a dedicated IP-VPN or CE-VPN service. See Figure 5. Your basic provisioning workflow can be followed with no customization (or involvement of your specialist/complex engineering teams). This improves the turnaround time due to the simpler network provisioning steps. Customers then configure their specific network functionality via the portal and run the Nuage Networks VNS over their dedicated IP-VPN or CE-VPN instance.

FIGURE 5. Premium VPN (dedicated transport) deployment model



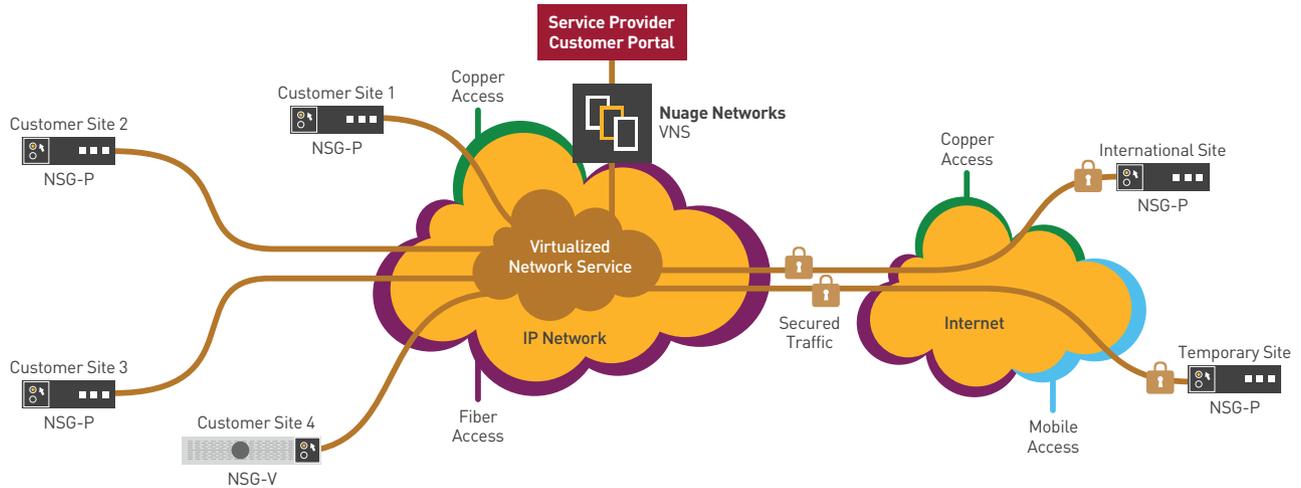
With this model customers receive the premium VPN levels of quality on SLAs, traffic engineering and QoS. You get both the premium tier revenue and a fully customized customer service, without the high overhead of complex service configuration processes. A secondary benefit is customers get exactly the service they require, which increases the value to their business and reduces your competitive pressure.

Supporting mixed (hybrid) deployment models

The choice of underlay IP service type will depend on the customer type and/or locations. It could easily involve a mix of IP networks to provide the connections required.

For instance a large enterprise may use a private IP service from you for the majority of its locations but use either fixed or mobile broadband connections for smaller locations or a home-based workforce. In the latter case, the Nuage Networks VNS traffic can be encrypted and safely transported over the Internet.

FIGURE 6. Nuage Networks VNS customer service using private and public IP networks



Increased service footprint and provisioning efficiencies

Traditional VPN services including IP-VPN and CE-VPN are generally provided as a vertically integrated solution. They rely on the deployment of a network platform of Provider Edge (PE) routers. The associated Operational Support System (OSS) provides the provisioning and assurance capability to deploy and manage each of the customer service instances.

As a service provider, you've made large capital investments to deploy a network footprint that covers your target market. This investment includes IP edge routers and customized support systems for service fulfillment, assurance and billing processes. The result of this tight coupling of support system integration to the functionality of the network service means that there is a high investment required to change features within the service. This has probably forced you into a rigid and lengthy service roadmap with 12-14 month planning cycles. Because of these challenges, a number of your customers are opting for a self-managed service or the use of integrator-based professional services to augment network services with third-party hardware and management systems.

Nuage Networks VNS changes this deployment environment by separating customer service from the network infrastructure. Rather than being vertically integrated to a dedicated set of network hardware (PE routers) and an associated OSS environment, Nuage Networks VNS runs as an overlay service over any available underlay IP network within your footprint. As a result, you can deploy Nuage Networks VNS anywhere IP connectivity can be deployed. You can also extend to your mobile and residential broadband networks, and if you choose, to any adjacent networks available from your partners.

Efficient provisioning options

Service provisioning costs (whole of VPN) and per-VPN site moves, adds and changes are significantly reduced with Nuage Networks VNS through the centrally managed self-service portal and policy management functions.

Our centralized management functionality lets you empower your customers to serve themselves for all aspects of the service. The service portal can be used for everything from initial deployment to VPN site moves, adds and changes and even service-wide policy changes and advanced networking functions such as firewalling policies. The self-serve model significantly reduces the requirement for internal service provider provisioning and assurance resources and lowers the cost to serve.

For instance, if a customer requires an additional site on their service, they log onto the portal to request a new site. The central policy engine (Nuage Networks VSD) logically adds the site to the existing virtualized services instance. The portal can then issue the Network Service Gateway (NSG) either from a central warehouse or retail store location. When that NSG is connected and authenticated, the customer-specific configuration is automatically downloaded. Network paths between the new and existing locations are established in accordance with the customer's service policies.

All this occurs without direct interaction by your staff: the changes are captured at the portal and acted upon across the Nuage Networks VNS instance. Billing or asset system notifications are automatically generated.

You courier the Nuage Network VNS branch equipment to the site and the customer installs it. This significantly reduces the requirement for specialist turn-up engineering and removes the need for truck rolls for the majority of installations

Customer empowerment

Today we use online-based self-service portals and smartphone applications without giving them a second thought. With Nuage Networks VNS the same service transactions can be applied to VPN services. The key contact point for service instantiation and subsequent moves, adds or changes is an online customer portal. Just as the move from branch to online banking reduced overhead, the move to self-service provisioning and assurance will significantly reduce overhead for VPN services.

With Nuage Networks VNS, the customer experience for service ordering and changes is completely handled through an online offering. Key to this is the ability to separate the access/transport connectivity from the higher valued service construct. This allows your customers to select from available access technologies based on their locations. They can order whatever connectivity services they want separately from their network services.

For instance, ordering a new Nuage Networks network service can be reduced to a wizard-based online ordering process where the customer selects the number of sites for the service. The service features are ordered from the Network Functions Store within the portal. You can offer your customers a "whole network" or per-location selection process for whatever basic and advanced network features they would like their Nuage Networks VNS instance to support. These include basic Layer 2 and Layer 3 features and more advanced capabilities including Layer 3 firewalls, QoS profiles, NAT/PAT, DHCP or DNS.

Once selected, these customer-driven service attributes are programmed into the central policy server and deployed on the NSG as the customer connects its sites to the Nuage Networks VNS service.

Nuage Networks VNS is based on an open customer premises equipment model that utilizes industry-standard x86-based compute platforms. These common-off-the-shelf (COTS) systems separate the feature/functionality of the service from the on-premises hardware. This allows you to select a range of form-factors that meet

your customers' requirements and results in a simplified CPE portfolio. This split hardware/software model also allows you to offer the service as a virtual image that Nuage Networks VNS customers can load on their own x86-based server hardware.

Once NSG quantities and types are selected from the customer portal they can be allocated to the customer and dispatched from a centralized warehouse (or retail location) via courier. For your customers, the installation process is as simple as unboxing and plugging in the access circuit. Once connected, the SDN Controller (Nuage Networks VSC) will authenticate the NSG and inform the policy engine, which will deploy the specific customer's virtualized service site configuration and bootstrap the NSG into service.

With Nuage Networks VNS, instantiating a network service at the customer's site does not require truck rolls or dedicated turn-up resources from you. This significantly lowers your per-site turn-up costs and improves the customer's experience.

Flexibility to choose x86-based service endpoints

The compute industry has transitioned from proprietary hardware systems to x86-based systems for the virtualized compute resources that power today's datacenters. It makes sense to adopt the same strategy for network services. There is an emerging trend of x86-based solutions as an alternative to proprietary hardware systems with their closed operating systems and inherent vendor lock-in at the branch.

Nuage Networks VNS has adopted the same open, virtual compute trend. The software images for Nuage Networks VNS are developed to run as a virtual machine on an x86-based hypervisor platform to drive maximum utilization of the available compute and memory resources.

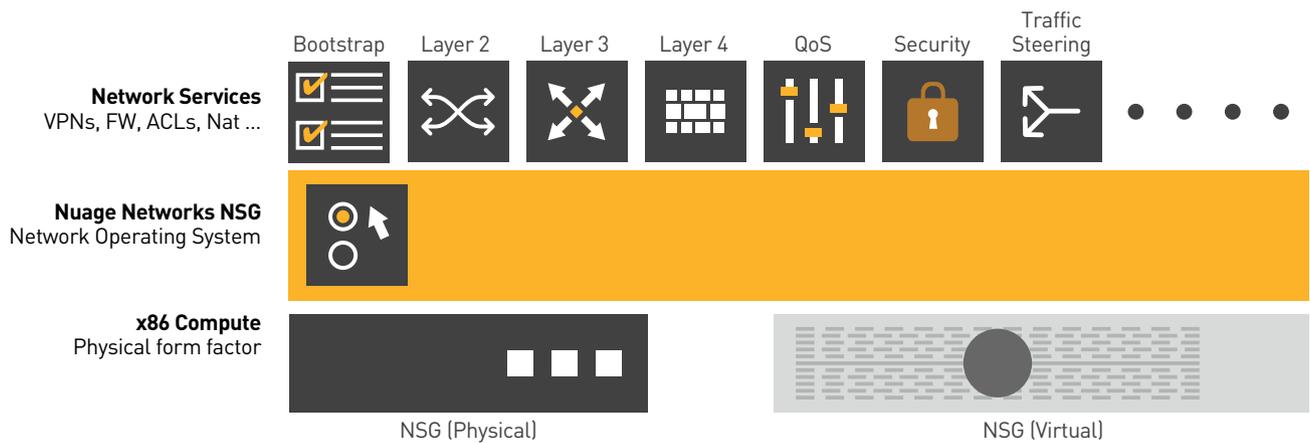
The result is a virtualized service capability that is independent of the brand and model of the deployed customer premises equipment. The choice of x86 form-factor and manufacturer is open to a competitive procurement model that provides flexibility in the supply chain.

Nuage Networks provides a number of options for the NSG including:

- Prequalified Nuage Networks NSG appliances with options for physical form factors to meet the requirements for small, medium and large sites and sustained throughputs (100 Mb/s to 10 Gb/s)
- Minimum specifications table of CPU power/cores and memory requirements so you can select from your chosen IT supplier; we also provide a professional engineering service to validate and certify your selected platforms

The software downloaded to the x86 branch equipment from the Nuage Networks VSD is based on an open framework. The image runs independently of the hardware manufacturer via a hardened hypervisor construct in a similar way to the virtual compute deployments in leading datacenters.

FIGURE 7. Flexible NSG functionality with user-selectable advanced feature set across both physical and virtual branch hardware



Your Nuage Networks VNS customer selects the functionality for its specific service instance via the customer portal. This provides a similar concept to the smartphone application stores we all use today. Customers are presented with a catalog of network functions that they can select from, depending on the site type and capabilities they require.

These functions include the most widely used network forwarding functions and parameters available on proprietary routers. Your customers also have the ability to selectively implement advanced network functions including firewalls, load balancers and the like to create a feature-rich processing chain in the NSG at their sites.

By selecting an x86-based network endpoint, Nuage Networks VNS provides the foundation to innovate the service functions independently to the physical hardware. As new network features are developed, they can simply be added to the customer's selected image. In the future, this will include the option of implementing third-party functions in virtual application containers or allowing for customer-created virtual functions.

SUMMARY

Nuage Networks VNS has the potential to significantly change the costs associated with delivering Virtual Private Network services through the combination of customer self-service portals and industry-leading open compute-based customer premises equipment.

For VPN customers, the increased flexibility and ability to select a service feature set customized to their business needs will provide a more satisfying service experience. As their service provider, you will benefit from a reduced risk of churn.

There is also tremendous value for you in coupling the customized experience of Nuage Networks VNS with the flexibility to deploy virtualized services across any of your existing IP service platforms. For one thing, our approach helps you reduce internal provisioning and assurance costs. It also provides a differentiating service

to complement your existing VPN product offerings. You can target both competitors' VPN customers and upsell to your own customers who are self-managing their existing VPN services.

Industry analyst Nav Chander of IDC uncovered in his 2014 US Enterprise Communication Managers Survey* that of the respondents that use managed WAN services, only 22% of them (for companies of 1000+ employees) purchase this management from their telecoms service provider. Also, 34% of the same respondents picked customizing solutions for their needs as the top factor influencing provider selection for managed services.

Nuage Networks VNS provides the foundation for a market-leading business service offering. You can increase your addressable market by targeting the unmanaged IP-VPN customer base while lowering your costs to serve with our solution's inherent customer empowerment features.

* [Nav Chandler, 2014 U.S. Enterprise Communication Manager Survey: IP VPN Services](#), June 2014, Doc#249151, IDC Presentation.



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