**nuage**networks
From Nokia

# Virtualized Network Services
## SDN solution for enterprises

Nuage Networks™ Virtualized Network Services (VNS) is a fresh approach to business networking that seamlessly links your enterprise's locations regardless of size or geography while reducing the requirement for custom networking.

With Nuage Networks VNS the network that underpins your business locations is unshackled to deliver services where you need them, when you need them. You gain the flexibility and functionality you need to drive your business into the cloud era.

Nuage Networks VNS provides a comprehensive networking service that removes the limitations that exist with traditional Virtual Private Networks (VPNs). Solution benefits include:

- Centralized management and control of the network service tailored to the individual requirements of your business

- Separation of the network service from the network transport, which provides you with flexibility to choose branch connectivity from all available providers

- Quick and simple move, add and change requests to ensure your network services match your dynamic business environment

- Advanced functionality that reduces the requirement for specialist security and network devices at your remote locations

- Increased network-wide visibility to reduce the costs associated with compliance and auditing

**What are Virtualized Network Services?**
Software Defined Networking (SDN) has delivered significant benefits to datacenter networks unleashing the true power of the cloud.

Nuage Networks brings the same benefits to business connectivity services with Virtualized Network Services. Nuage Networks VNS is a new wide area network service construct that provides you with the flexibility to adapt to the ever-changing business environment you work in.

Traditional VPN services are based on set functionality that can be deployed across the widest customer base with little room for per-enterprise customization. This forces you into the complex world of custom branch networking to achieve network capabilities that match your specific business needs.

Nuage Networks VNS gives you the power to centrally manage and deploy your network services. The comprehensive solution puts you in charge of all aspects of service creation and ongoing management without increasing the demands on your IT and Networking teams.

The solution includes three key functions that work in concert to lower your operational overhead while increasing the network's ability to respond to your demanding business needs.

**FIGURE 1. Nuage Networks Virtualized Network Services**
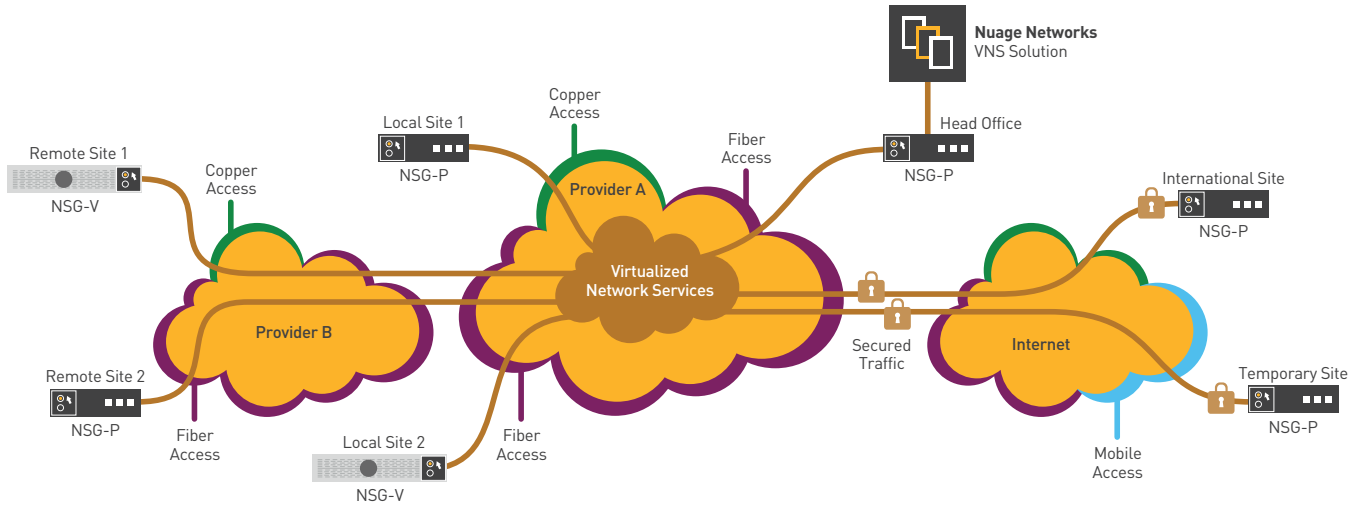


## Solution Components

**Virtualized Services Directory**

The Virtualized Services Directory (VSD) is a programmable policy and analytics engine. It provides a flexible network policy framework that enables network administrators to define and enforce the business policies being applied across the network service in a user-friendly manner.

The VSD contains a network service directory that supports role-based administration of network resources. It is where network configuration including moves, adds and changes are centrally managed via an intuitive graphical user interface.

From within the VSD network administrators can centrally view and change the running policies on the network including deployment of new policies on a single, multiple or network-wide basis. The VSD is also the point for network traffic collection where site-specific and network-wide trending reports are available. The VSD also provides sophisticated rules for collecting information on the status of your network service. This includes functions such as collection frequencies and rolling averages that allow you to build comprehensive Threshold Crossing Alerts (TCA) for both current and historic information on the service performance.

Statistics are aggregated over hours, days and months and stored in a Hadoop® analytics cluster to facilitate data mining and performance reporting.

Information security and compliance functions are also completed through the VSD. This reduces the overhead associated with network availability compliance and auditing for industry regulation such as the Sarbanes-Oxley Act.

Network functions for the service are selected via the VSD's Network Functions Store. This provides a comprehensive set of common network functions, such as firewalling, load balancing, IP address management, and domain name services that can be selected and inserted directly into the network service. This reduces the requirement for dedicated network elements to be deployed at your remote locations and eases your overall investments to deploy and maintain your network.

Through its partner program, Nuage Networks is working with leading network function suppliers to supplement the store's default functions .

The VSD can be deployed as a stand alone or clustered solution depending on scaling needs.

### Virtualized Services Controller

The Virtualized Services Controller (VSC) is the industry's most powerful SDN controller. It functions as the robust network control plane for the network services, maintaining a full view of the network and service topologies.

Through the VSC, virtual routing and switching constructs are established to program the network-forwarding plane using the OpenFlow™ protocol. Multiple VSC instances can be federated within and across the network by leveraging Multi-Protocol Border Gateway Protocol (MP-BGP) — a proven and highly scalable network technology that allows the network service to grow with the requirements of your business whether you are operating  across the country or around the globe.

### Network Services Gateway

The Network Services Gateway (NSG) constitutes the network-forwarding plane for the network service at the central and remote locations of your business. With support for both a hardware and software image deployment, the NSG provides maximum flexibility to meet the demands of your central and remote locations.
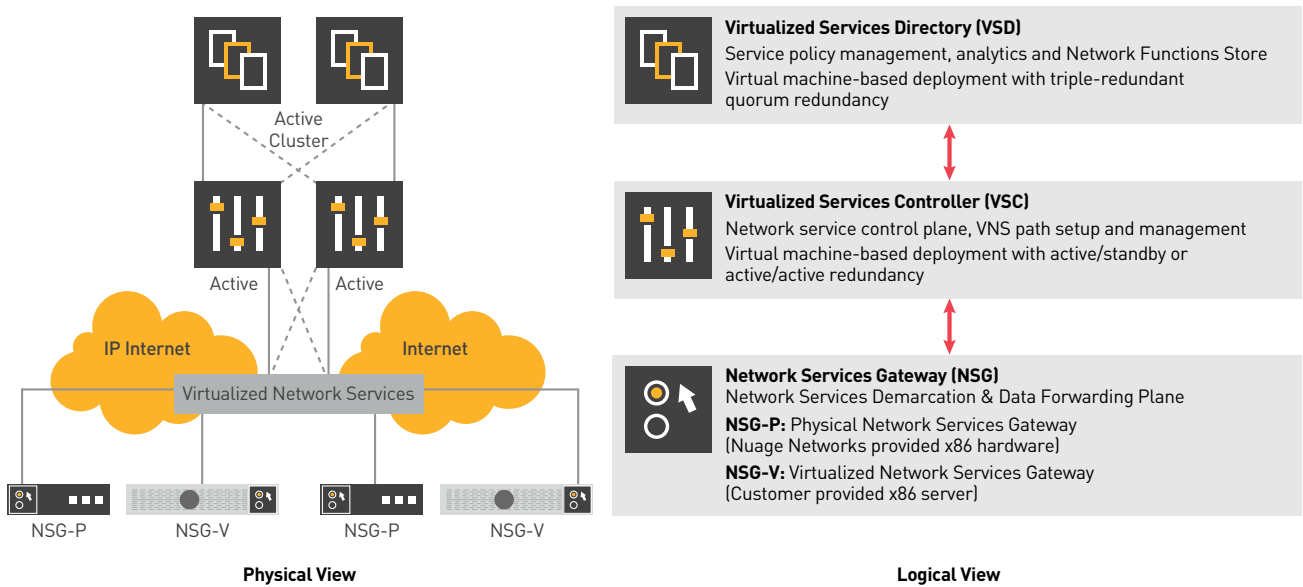
The hardware-based option includes four form-factors to meet the diverse throughput, network interface and network functionality requirements of your locations. The software image can utilize the available x86-based virtualized compute platforms you may have at your sites.

The NSG encapsulates and de-encapsulates user traffic, enforcing Layer 2 to Layer 4 network policies as defined by the VSD. Advanced services including network functions such as load balancing, firewalling, DNS, DCHP and security protocols, such as IPSec, can be enabled via the Network Functions Store within the VSD. These services can be applied to the NSGs centrally on a service-wide or location-specific deployment model. This ensures that your network service is always configured with the standard policies applicable to your business.

Deployment of the NSG is provided by the innovative bootstrapping functionality of the Nuage Networks VNS solution. When a new NSG is connected to the network, it calls home to the VSC and is authorized by the VSD. From there a two-step authentication process is initiated to bring the new site on to the network service.

The automated nature of this bootstrap function reduces the requirement for specialist networking resources at your remote locations. In most cases your branch staff can unbox and plug in the NSG themselves, which lowers the costs of service deployment.

**FIGURE 2. Nuage Networks Virtualized Network Service components**



**Physical View**

**Logical View**

**Virtualized Services Directory (VSD)**
Service policy management, analytics and Network Functions Store
Virtual machine-based deployment with triple-redundant quorum redundancy

**Virtualized Services Controller (VSC)**
Network service control plane, VNS path setup and management
Virtual machine-based deployment with active/standby or active/active redundancy

**Network Services Gateway (NSG)**
Network Services Demarcation & Data Forwarding Plane
**NSG-P:** Physical Network Services Gateway (Nuage Networks provided x86 hardware)
**NSG-V:** Virtualized Network Services Gateway (Customer provided x86 server)

# Technical Specifications

| SPECIFICATIONS | |
|---|---|
| Centralized service definition and endpoint management | ■ Centralized service policy definition and auditing for all endpoints<br>■ Template-based service definition for intelligent endpoints<br>■ Root and organization level permission-based multitenant systems<br>■ Time-based automated endpoint configuration update<br>■ Centralized software lifecycle management<br>■ Auto-discovery of intelligent endpoints<br>■ Secure automated bootstrap of endpoints |
| OSS/BSS integration | Northbound API access through RESTful APIs for all VSD functions |
| Architecture scalability | ■ Federated controller scale-out architecture based on MP-BGP<br>■ Routing engine powered by robust Nokia Service Router Operating System (SR OS) |
| Network services | ■ Inet, L2-managed, L2-unmanaged, L3 and L4 VPN support<br>■ VLAN, VXLAN or MPLSoGRE encapsulation options<br>■ Ingress QoS with configurable rate limiting parameters and DSCP re-write options<br>■ Egress shaping for network and access ports with hierarchical QoS classes<br>■ DHCP services<br>■ Static routes<br>■ 1:1 Network Address Translation<br>■ IPv4 PAT on uplink IP or a configured IP from a PAT address pool<br>■ Automatic VPN creation between different entities belonging to a security domain<br>■ Hub-and-spoke or full mesh security through VXLANoIPSEC with centralized secure key generation and distribution*<br>■ Secure control plane connections<br>■ Service chaining to virtualized network functions<br>■ Application-aware traffic redirect capability<br>■ Full mesh, hub and spoke, and hybrid connectivity models<br>■ Control plane and data plane interoperability with provider edge devices |
| Authentication | ■ LDAP integration for user authentication<br>■ Endpoint authentication through certificates |
| L2 – L4 security | ■ Ingress and egress access control list (ACL)<br>■ Reflexive ACL with dynamic policy creation in both directions for UDP |
| Analytics and reporting | ■ Fully programmable and extensible engine based on Hadoop clusters with real-time analytics support<br>■ TCA-based analysis engine with configurable collection timers<br>■ Drilldown capabilities into individual elements, ideal for troubleshooting and capacity planning based on historical event correlation<br>■ Encrypted channel for stats collection<br>■ Port mirroring to remote location<br>■ Export logs to external logging servers |
| Deployment models | ■ Software image running on reference hardware<br>■ Software image deployed as virtual machine |

* Roadmap