

# VIRTUALIZED SERVICES PLATFORM

## Software Defined Networking for enterprises and service providers

### Why it's unique

The Nuage Networks VSP is the only enterprise and service provider-grade SDN platform that:

- Enables applications to be developed and operated without having to specify network resources
- Scales to meet the demands of global public cloud providers
- Unites private and public clouds into a manageable whole
- Supports any mix of server virtualization hypervisors, Docker containers and network hardware
- Ensures manageability at scale via full automation, monitoring with high granularity, and intelligent policy
- Delivers complete network programmability for multiple partner products and in-house customizations
- Provides a consistent security approach across the entire environment

The Nuage Networks Virtualized Services Platform (VSP) provides Software Defined Networking (SDN) for clouds of all sizes — from a department-level private cloud to the largest public clouds in the world. A completely software-based approach, the Nuage Networks VSP makes the network as readily consumable as the compute resources.

Nuage Networks VSP has been architected to be a non-disruptive overlay for all existing virtualized and non-virtualized server and network resources. No proprietary or purpose-built hardware is required since all components install in Docker<sup>®</sup> containers, hypervisors, or virtual machines.

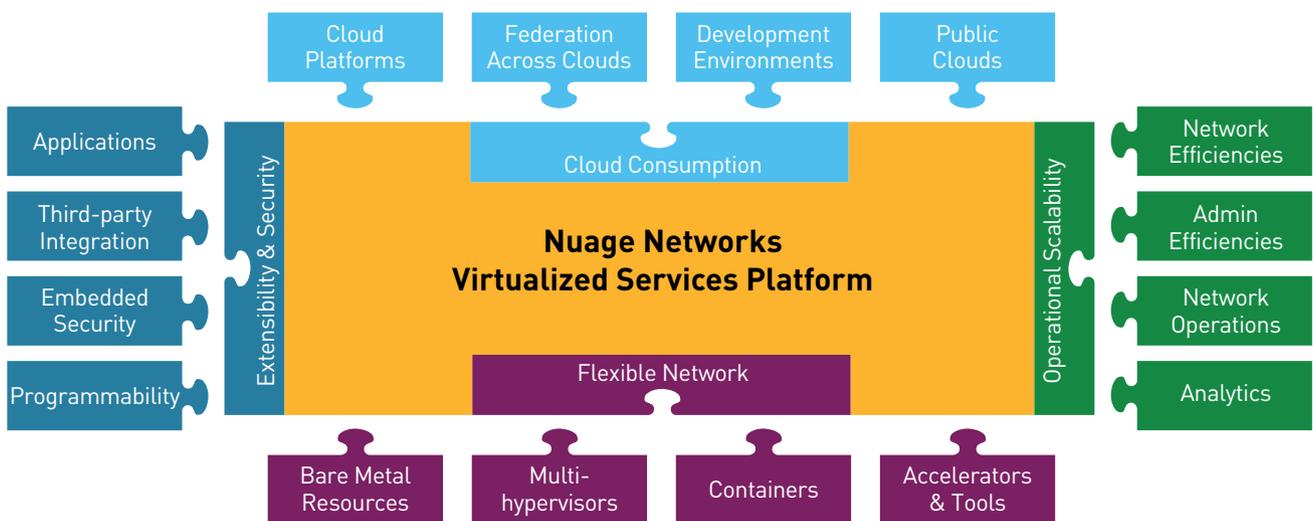
### Open platform capabilities

Using robust interfaces, existing legacy infrastructure can be managed along with leading-edge software and hardware (such as Docker containers and network accelerators). The platform integrates with a broad range of tools and environments — from cloud platforms such as CloudStack™ and OpenStack® through custom self-service interfaces. Both leading and leading-edge network equipment such as firewalls, load balancers, and security appliances can be integrated easily. The platform includes functionality for efficient management at cloud scale.

Looking at the interfaces in Figure 1, rich and granular interfaces interoperate with both established and emerging cloud platforms, development environments, virtualization and container environments, applications, operating systems, and hardware.

- **Cloud consumption:** Provides unified cloud consumption controls over public, private or hybrid clouds. When consistently implemented, Nuage Networks VSP not only manages multiple public and private clouds discretely but can also unify (or “federate”) any combination of these public and private clouds into a single, coherent cloud. This unified cloud can be orchestrated by cloud platforms (such as CloudStack and OpenStack), provisioned by customers and administrators via open interfaces (such as OpenStack Horizon), and customized via a wide range of development environments (such as Kubernetes by Google® and Apache™ Mesos™).
- **Extensibility and security:** Enables extensibility to applications (such as Oracle®), third-party integration for Anything-as-a-Service (XaaS) approaches such as Load Balancer as a Service (LBaaS), security appliances from both established and emerging vendors, and operating systems (OSs) such as Red Hat® and Ubuntu® Linux™. Application developers can control network resources by leveraging policies and templates either preset by the network team or defined via an intuitive UI. Programmability options provide robust customization capabilities.
- **Flexible network:** Overlays virtualized and bare metal resources (such as network equipment from Alcatel-Lucent®, Arista®, HP®, and others) without requiring upgrades. Multiple server virtualization environments — such as KVM, Docker containers, VMware®, and Xen® are supported side-by-side.
- **Operational scalability:** Delivers efficient, multitenant operations at cloud scale. Key functionality includes improved network efficiencies via a range of features including multicast and increased operations efficiencies via network template capabilities. These templates facilitate copying network configurations from development to production environments. Robust overlay / underlay visibility is provided by products such as [Nuage Networks Virtualized Services Assurance Platform](#).

**FIGURE 1. Software Defined Networking platform integrates with best-of-breed applications, platforms, tools and hardware**

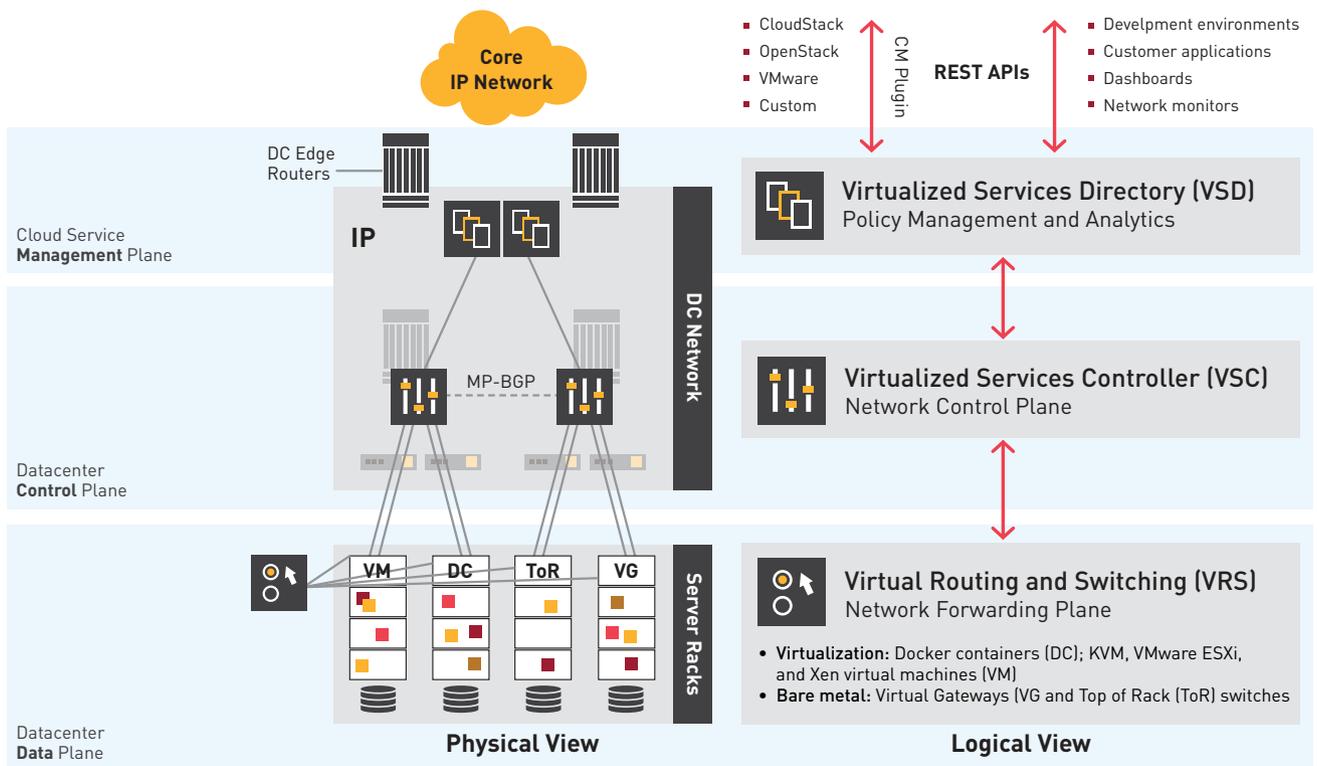


## Platform architecture

Consistent with the tenets of SDN, the Nuage Networks VSP architecture separates control from the data transfer of the network. As shown in Figure 2, there are three major platform components — Cloud Service Management Plane, Datacenter / WAN Control Plane, and Datacenter / WAN Data Plane.

The Nuage Networks VSP federates across controllers to create a coherent, unified network. Optional hardware or software gateways enable the same controls over bare metal resources as exist for virtualized resources.

**FIGURE 2. Nuage Networks Virtualized Services Platform architecture Platform components**



## Why it's secure

The Nuage Networks VSP minimizes exposure surface to maximize security

- Protects all resources — including bare metal servers — at the very first connection to the network
- Isolates and protects VM-to-VM and container-to-container interactions
- Interprets a single network or security policy intelligently, consistently and appropriately across the entire network — across datacenters, across public clouds, and across devices.
- Provides protection against manual errors and omissions via a Zero Trust default security policy
- Handles even the most complex application topology with service chaining automation
- Enables networking controls in software for protection against back doors and other exposures
- Delivers an integration framework for both established and emerging third-party security products
- Provides a granular security model that enables security admins to specify organizational-level policies while allowing application owners to specify application-specific policies

## Platform components

Each component is completely software-based. Components can be implemented in clustered or standalone modes.



### Cloud Service Management Plane – Virtualized Services Directory

The Virtualized Services Directory (VSD) is a programmable policy and analytics engine. It provides a flexible and hierarchical network policy framework that enables IT administrators to define and enforce resource policies in a user-friendly manner.

The VSD contains a multi-tenanted service directory that supports role-based administration of users, compute, and network resources. It also manages network resource assignments such as IP and MAC addresses.

For the purpose of service assurance, the VSD allows the definition of sophisticated statistics rules such as collection frequencies, rolling averages and samples, as well as alerts. Statistics are aggregated over hours, days and months and stored in a Hadoop® analytics cluster to facilitate data mining and performance reporting.



### Datacenter / WAN Control Plane – Virtualized Services Controller

The Virtualized Services Controller (VSC) is the industry's most powerful SDN controller based on open standards. It functions as the robust network control plane for DCs, maintaining a full view of per-tenant 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 DCs by leveraging MP-BGP — a proven and highly scalable network technology.



### Datacenter / WAN Data Plane – Virtual Routing and Switching

The Virtual Routing and Switching (VRS) component is an enhanced Open vSwitch (OVS) implementation that constitutes the network forwarding plane. It encapsulates and de-encapsulates user traffic, enforcing L2-L4 traffic policies as defined by the VSD. The VRS tracks virtual machine (VM) creation, migration and deletion events in order to dynamically adjust network connectivity. The VRS supports multiple hypervisors in virtualized server environments. It can operate as a gateway for bare metal servers or service appliances.

## Key benefits

Nuage Networks VSP eliminates the constraints that have held back the responsiveness and efficiency of cloud and datacenter networks by:

- Making the network as dynamic and consumable as compute infrastructure through automated instantiation of network services
- Scaling to meet the demands of thousands of tenants with unique application requirements, distinct security policies, and committed service levels
- Enabling operators to design, build and put clouds and services into production quickly enough to take advantage of trends and targeted business opportunities
- Unifying even complex configurations such as public and private clouds with multiple datacenters and bare metal servers into a single manageable cloud network
- Supporting open source and emerging tools such as Docker to gain competitive advantage
- Providing granular security policies that are applied intelligently, consistently and provably across the entire cloud

## Technical specifications

REQUIREMENT	SUPPORT
Cloud Platform	<ul style="list-style-type: none"> <li>■ Apache CloudStack™ 4.3 and later</li> <li>■ OpenStack™ – Support Icehouse, Juno, and Kilo Releases               <ul style="list-style-type: none"> <li>• Neutron project: Plug-in supported for open source OpenStack and vendor distributions (Canonical®, Mirantis®, Oracle, and Red Hat)</li> </ul> </li> <li>■ VMware vCenter™ 5.5 and later</li> </ul>
Hypervisors and Containers	Docker containers, KVM, VMware ESXi™, Xen
Routing / Switching Hardware and Software	Any IP-capable device for datacenter networking (for example, Alcatel-Lucent, Arista, HP and others)
Firewalls, Load Balancers, and DNS/DHCP Servers	Open ecosystem support through native interfaces and cloud platform programmable frameworks (for example, OpenStack / CloudStack FWaaS, LBaaS). Vendors supported include A10 Networks®, Avi Networks™, F5®, Palo Alto Networks®, and vArmour.
Linux	Compatible and tested with distributions from Canonical, Oracle, and Red Hat. Nuage Networks VRS also supports CentOS™.
Interfaces	<ul style="list-style-type: none"> <li>■ Comprehensive REST API that includes               <ul style="list-style-type: none"> <li>• Cloud consumption interface</li> <li>• Extensibility and security interface for partner product interaction</li> </ul> </li> <li>■ Python™ Software Development Kit (SDK)</li> <li>■ HTML5-based web portal for user self service</li> </ul>
Support for Non-Virtualized (Bare Metal) Components	<p>Bare metal support enables non-virtualized components to be managed along with virtualized components:</p> <ul style="list-style-type: none"> <li>■ Top-of-rack / top-of-row VTEPs and gateways from Arista and HP</li> <li>■ Nuage Networks 7850 Virtualized Services Gateway (VSG): the industry's first Layer 3 gateway for virtualized services</li> </ul>
Security and Compliance	<p>Robust functionality includes:</p> <ul style="list-style-type: none"> <li>■ Logical L3 / L2 networks provides isolation and secure multi-tenancy</li> <li>■ Granular network segmentation based on distributed policy-based L2-L4 firewall</li> <li>■ Unified security policy framework for physical resources, virtualization environments, and Docker</li> <li>■ Compliance automation based on policy templates with the ability to customize policy per L3 / L2 domain</li> <li>■ Logging of ACL permit/deny events for auditing, compliance and visibility</li> <li>■ Role based access control, auditing of user access and policy changes, LDAP for user authentication</li> <li>■ Traffic steering to security partner devices (for example L4-7 next-gen firewalls)</li> </ul>
Virtual Private Networks (VPN)	Seamless IP-VPN integration based on MP-BGP with use of standard BGP functionality.
Network virtualization	NVO3 framework for DC network virtualization with L2/3 NVE support
Architecture scalability	Federated SDN control architecture based on MP-BGP
Analytics engine	Fully programmable and extensible engine based on Hadoop® clusters with real-time analytics support