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Abstract

This White Paper describes the architecture and interoperation of the Nuage Networks Software Defined Networking (SDN) product line and Cloud Platforms such as OpenStack and CloudStack.

The intent of this information is to provide insights into the underlying design philosophy, interoperation, and capabilities from both a high level (such as how it fits into a cloud ecosystem) and a detailed level (such as network diagrams).
Cloud Platforms and Nuage Networks

Overview
Cloud Platforms – such as OpenStack and CloudStack – provide orchestration across server, network, and storage layers. The promise of Cloud Platforms is to provide an open, flexible, and collaborative approach across all legacy and leading-edge IT assets in the data center. Cloud Platforms range from open source software such as OpenStack and CloudStack to proprietary packages such as VMware vCenter.

Nuage Networks and Open Source
As part of Nuage Network’s philosophy of openness, Nuage Networks is an active contributor to the Open Source community. Specifically, Nuage Networks is an active contributor to both CloudStack and OpenStack. For both platforms, Nuage Networks is providing code and plugins that enhance the scalability and robustness of the networking subsystems (i.e. OpenStack Neutron).

Unique Aspects of Cloud Platform Interoperation
At this writing, Nuage Networks Virtualized Services Platform (VSP) is unique in supporting multiple Cloud Platforms (such as OpenStack and CloudStack) from a single instance. Each Cloud Platform can utilize either the same or platform-specific policies to drive network provisioning, workload mobility, and quality of service (QoS).

Policy-Driven Configuration and Consumption
From a management perspective, VSP provides Cloud Platform administrators with the freedom to outline the networking requirements of their cloud applications in familiar IT constructs. For example, Cloud Platform administrators can establish policies that ensure the proper scope, security and integrity of application consumption in a manner consistent with enterprise and cloud service provider guidelines.
Cloud Platforms Orchestration

Overview

Nuage Networks provides plugins – written to the appropriate standards and interface – for each Cloud Platform. Once installed into the Cloud Platform, the plugin interoperates both to specify the appropriate network configuration as well as to define network consumption parameters.

In Lockstep with Orchestration

Looking at the figure below, a network configuration request can come from any one of the Cloud Platforms below, such as OpenStack, CloudStack, Mesos, or Kubernetes. Via a Nuage Networks plug-in to the appropriate Cloud Platform, the request can be sent directly to a key component of Nuage Networks VSP, the Nuage Networks Virtualized Services Directory (VSD). A given request can also be relayed from OpenStack to VMware vCenter to Nuage Networks VSD. In this fashion, key network configuration tasks – such as binding the appropriate port – can be handled in real-time.

Cloud Platform Interoperation

![Cloud Platform Interoperation Diagram](image)

Figure 1. Nuage Networks VSP enables full network programmability and automation for cloud platforms

For provisioning a new virtual machine (VM), the request can also be passed directly from the Cloud Platform to the appropriate hypervisor. Another component of the Nuage Networks VSP, the Nuage Networks Virtualized Routing & Switching (VRS) detects...
the new VM’s instantiation and works with another component of Nuage Networks VSP, the Nuage Networks Virtualized Services Controller (VSC) to ensure that all network settings are provisioned automatically and surely.

A similar process applies to provisioning for bare metal servers, appliances, and devices attached via Legacy VLANs. The process typically leverages a physical gateway – such as the Nuage Networks Virtualized Services Gateway (VSG), a software gateway – such as the Nuage Networks VRS-G, or a Top of Row (ToR) switch to provide connectivity to the resource.

**Operation Across Datacenters and Clouds**
Operationally, Nuage Networks VSP supports not only hybrid (public-private) cloud environments but also the ability to move workloads among various vendors’ cloud environments based on demand, performance needs, and other criteria.

**Version Information**
A current list of the supported cloud platforms, distributions, and applicable versions is in the Nuage Networks VSP Datasheet, accessible from the [Nuage Networks VSP product pages](http://www.nuagenetworks.net/products.virtualized-services-platform/).
OpenStack

Contributions
The OpenStack™ Neutron project provides an open framework that can be leveraged to build robust network services. Nuage Networks provides a plug-in that extends the capabilities of Neutron in terms of scalability, reliability, and robustness.

Nuage Networks supports the plug-in across multiple distributions:
- Open source version of OpenStack
- Red Hat
- Mirantis
- Canonical
- Oracle

Code and Documentation
A summary of our contributions to OpenStack:
- Our contributions to OpenStack are on the Github OpenStack-VSP page (https://github.com/nuagenetworks/nuage-openstack-neutron).
- Our plug-ins and driver for Nuage Networks VSP can be found on the OpenStack Marketplace (https://www.openstack.org/marketplace/drivers/).
CloudStack

Contributions
Nuage Networks contributed network modularity code to the Apache CloudStack™ code base. The code enables network plug-ins – from any vendor – to be installed and upgraded without having to recompile the entire CloudStack build. Leveraging the modularity code, the Nuage Networks VSP plug-in for CloudStack provides the network scalability needed for large-scale networking environments.

Code and Documentation
A summary of our contributions to CloudStack:

- The plug-in architecture is described in the CloudStack specification document (https://cwiki.apache.org/confluence/display/CLOUDSTACK/NuageVsp+Network+Plugin).


- The plug-in is integrated into the CloudStack 4.6 distribution and greater per the release notes (http://cloudstack-release-notes-ja.readthedocs.org/ja/latest/about.html).
VMware

Contributions
Nuage Networks VSP integrates seamlessly with VMware® vCenter via a standard plug-in.

Code and Documentation
The plug-in is available via our support site.
Summary

As part of our philosophy of openness, Nuage Networks is an active contributor to the Open Source community. With our contributions to both OpenStack and CloudStack, enterprises and service providers can confidently leverage cloud platforms in their solutions and services.

Taken as a whole, Nuage Networks makes the entire network infrastructure as readily consumable as its compute resources. With the capabilities described in this White Paper, the network transforms into a powerful, highly automated and scalable fabric that instantaneously responds to the dynamic demands of workloads and applications – as orchestrated by the Cloud Platform(s) of choice.
About

Nuage Networks (www.nuagenetworks.net) brings a unique combination of groundbreaking technologies and unmatched networking expertise to the enterprise and telecommunications industries. The Silicon Valley-based start-up has applied radically new thinking to the problem of delivering massively scalable and highly programmable SDN solutions with the security and availability required by business-critical environments. Nuage Networks, backed by the rapidly growing IP division of Alcatel-Lucent (Euronext Paris and NYSE: ALU), has the pedigree to serve the needs of the world’s biggest clouds. The cloud has made promises – the mission of Nuage Networks is to help you realize them.