Nuviso Symphony Vivace Orchestration Suite

ETSI MANO NFV Management Platform

Nuviso Networks Inc.

What Does Nuviso Networks Do?

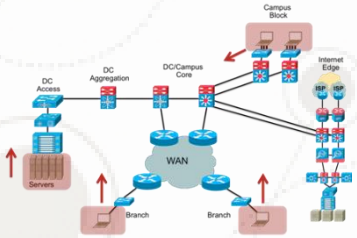
Enables Network Agility for Enterprise and Telco Operations

Simplicity Agility

Define

Deploy

Scale

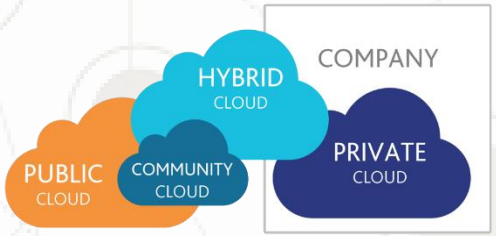


E2E Network

Core/Transport

Branch/Edge

Cloud/DC



Heterogeneous Environments

Physical

Virtual

Varied Deployments

Brownfield

Greenfield

The Problem – Enterprise and Telco Networks are Complex; Available Solutions are Fragmented

Current Enterprise and Telco Pain Points

IDC:

- *42% time spent on maintaining legacy systems*
- *5% time spent on business critical projects*

Complex Networks

Past	Present
• Physical End Points	• Physical & Virtual End Points
• Not Controller Based	• Legacy & Controller Based
• Adequate for legacy application needs	• Need to adapt rapidly to workloads
• Command Line based Management	• Programmability & Service abstractions / API-based management

Fragmented Solutions

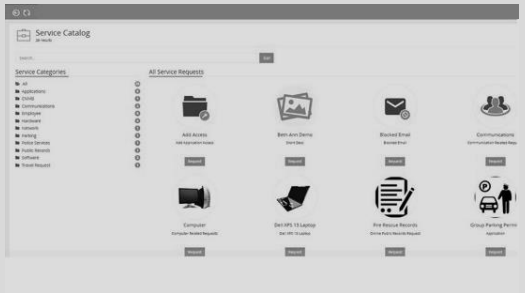
- **Telco/SP Pain Points**
  - **Rapid enablement of new services and technologies (MEC, 5G, RAN Management among others)**
  - **Lack of brown-field automation for easier infrastructure service deployment**
  - Need for Multi-vendor mediation for service and configuration
  - Problem of Orchestration support for multi-domains
  - No support for NFV Multi-cloud
  - No easy way of migration for managed services
- **Enterprise Pain Points**
  - **No intent Driven Configuration**
  - **No coherent IT Operations story (both Net and Sec Ops)**
  - **Complex branch Connectivity**
  - Silos of network Management
  - No easier Cloud migration

The Nuviso Solution – A Few Steps to Automate Operations Across Any Infrastructure

DRAG/DROP NETWORK SERVICES OR APPLICATIONS FROM CATALOG

STEP

1

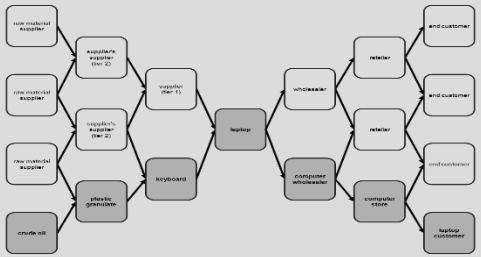


- *Applications*
- *Network Services*

CONNECT APPS AND NETWORK SERVICES

STEP

2

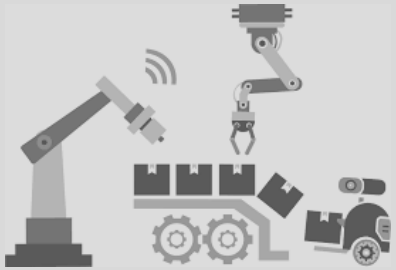


- *Stitching/Chaining*
- *Scale-out/Scale-in*
- *Analytics and Automation*

CLICK TO AUTO DEPLOY E2E NETWORK OR APPLICATION SERVICES

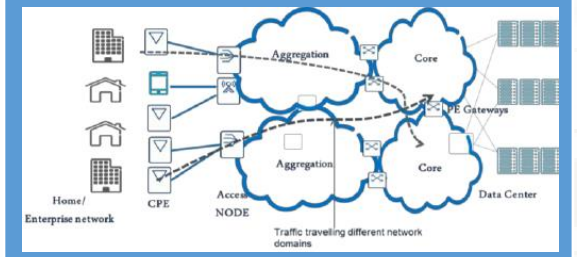
STEP

3



- *Deploy in any Domain*
- *Service Monitoring*
- *Auto Rollback*

SERVICE DEPLOYED



- *Private/Public/Hybrid Clouds and Campus*
- *Scale and Adapt*
- *Performance Assurance*
- *Service Continuity*

Nuviso Products/Technology - Symphony SW Suite
API Driven and Integration Ready

Symphony Suite

BGP/MPLS Service Orchestrator

Customer Specific Applications

TMF Resource Orchestration API

Network Mgmt Monitoring & Analytics

NCO(Concerto) SDWAN Controller

VNF Service Composer

Apps

Framework

NMO(Maestro) (Cross Domain Orchestrator)

NIA(Interlude) (Element & Service Config)

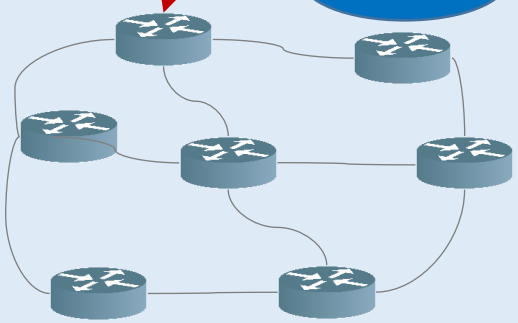
NVO(Vivace) (NFV MANO - ETSI)

NCA (Collection & Config Mgmt)

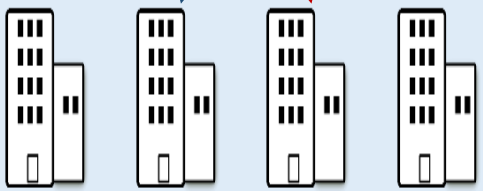
Consonance

App Market Place

EMS



IP / MPLS / Optical Networks (SP Core)



White-box based branch routing / Distributed NFV (Branch edge automation / SDWAN)

Virtual Infra Managers (OpenStack / Azure / Vmware)

Cloud & Virtual Networks (Public Cloud & Data Center)

End-to-end Services

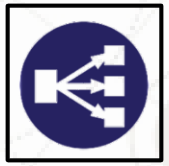
Nuviso Value Proposition – Manage & Automate Multi-Vendor Telco and Enterprise Networks with Agility

Nuviso Automation/Orchestration Suite

5G/MEC	Edge Computing	Enterprise Branch Connectivity	Cyber Security	DC & Cloud Orchestration

Open Network Services Model

Microservices Framework

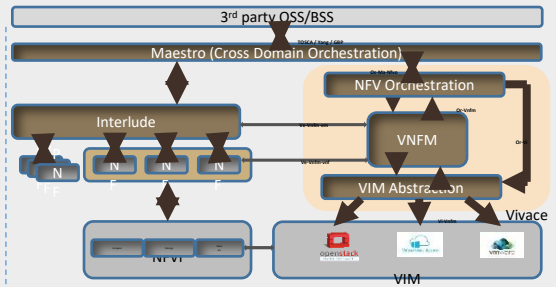


Software Defined

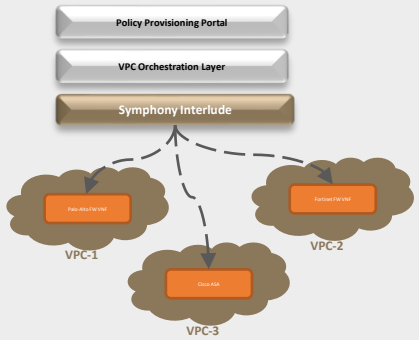
Granular Configuration	Configuration at Individual Network or Application Element level	*OSPF, BGP, MPLS, ACLs*
Service Automation	Service Automation Across Multiple Network Elements	*Layer 2, Layer 3, Multicast VPNs, Firewall Policies, VNFs*
Service Orchestration	Cross Domain Orchestration	*From Campus to SP Cloud to VNF in DC*
Heterogeneous Environment	Supports both brownfield and greenfield deployments	TOSCA/Yang, Open Config Yang, ETSI MANO

Some use cases addressed across Telcos and Enterprise Customers

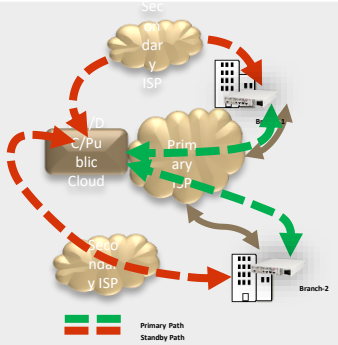
DC NFVI (Telco & Enterprise)



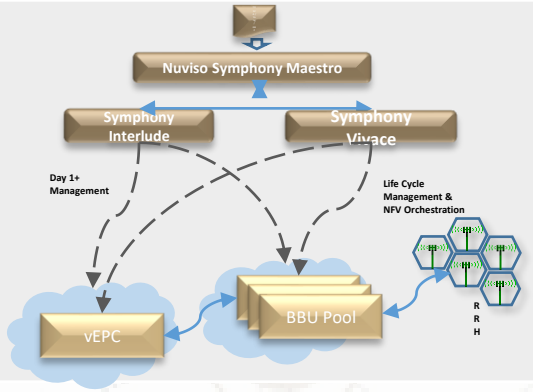
MULTI VENDOR ORCHESTRATION (Enterprise)



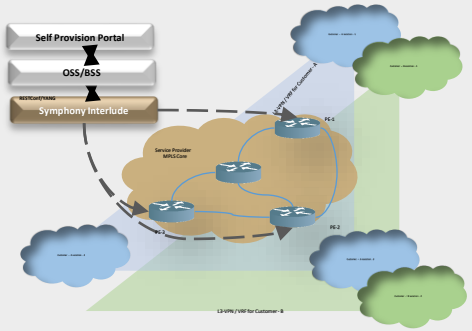
SD WAN / uCPE (Enterprise)



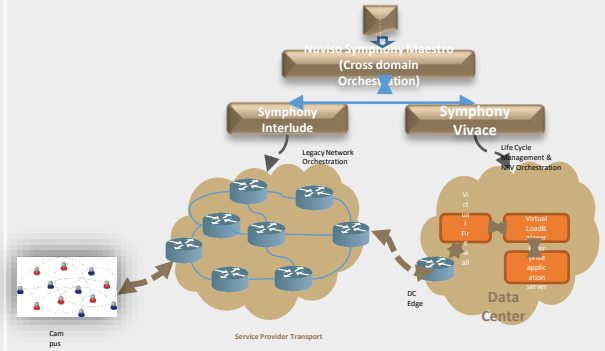
CRAN (Telco)



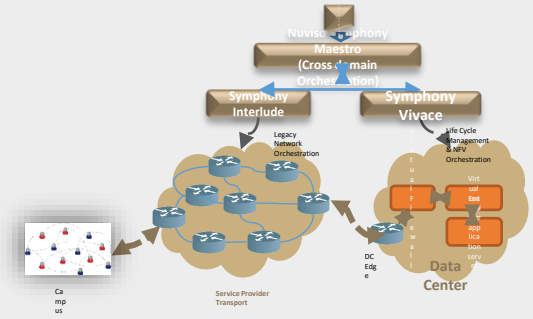
SP CORE (Telco)



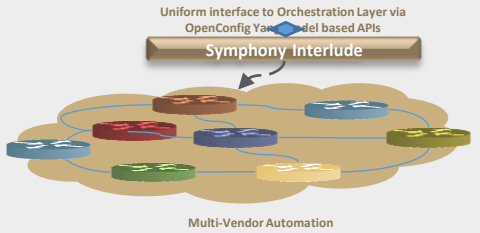
CAMPUS + CLOUD (Enterprise)



DC & PUBLIC CLOUD VPC (Telco & Enterprise)

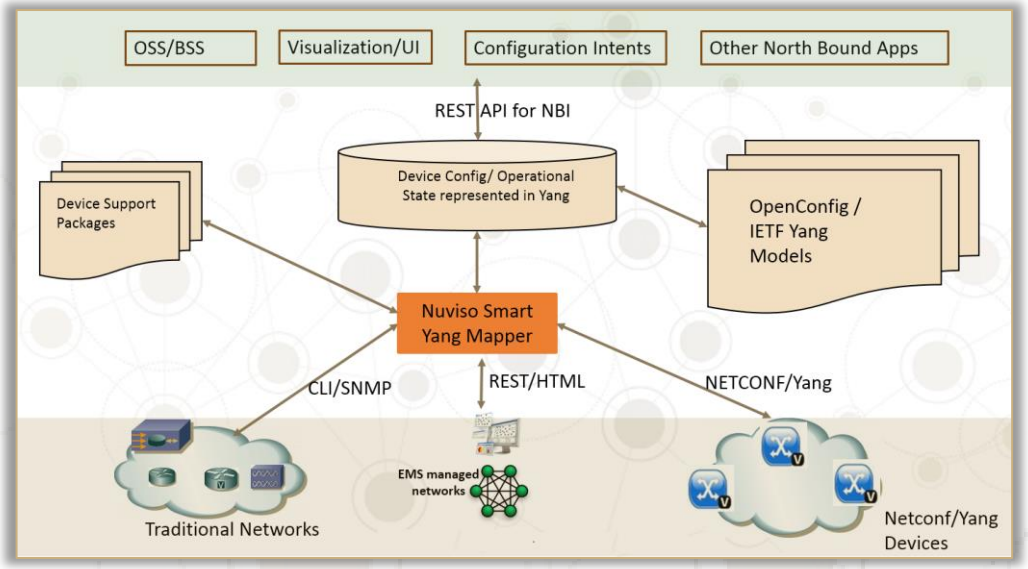


MULTI VENDOR AUTOMATION (Enterprise)

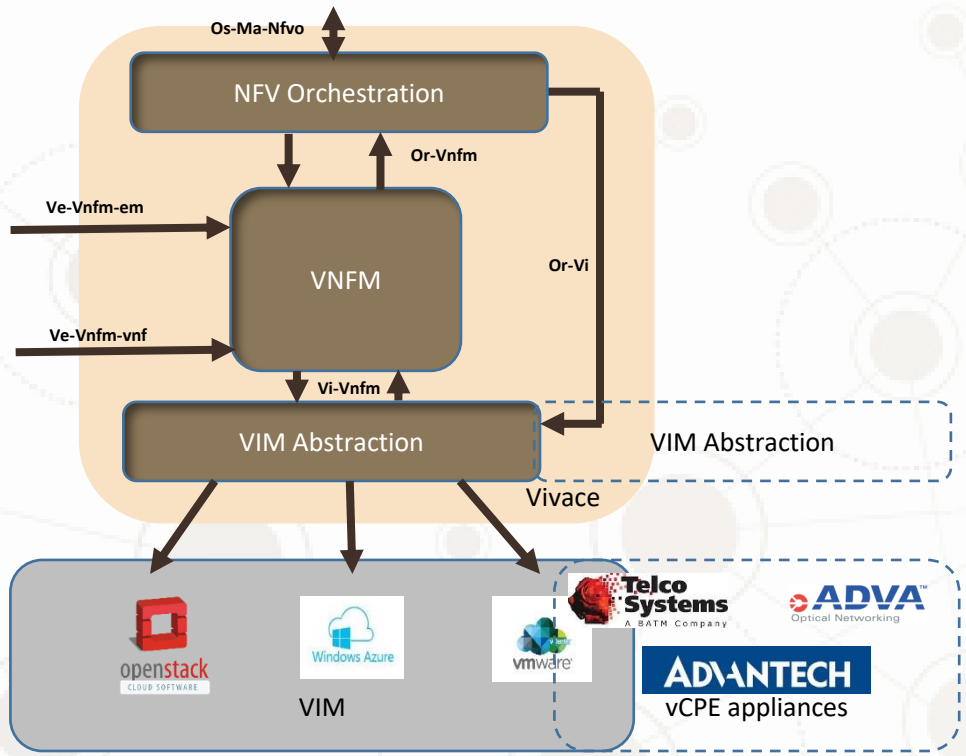


Solution Overview

Interlude



Vivace



- Orchestration support available at
  - Individual element level for feature configuration
    - OSPF, BGP, MPLS, ACLs etc
  - Service orchestration across multiple network elements
    - Layer 2, Layer 3, Multicast VPNs, Firewall Policies, VNFs
  - Cross domain orchestration (Hybrid)
    - Service originating in campus, traversing through SP cloud, and continuing through a VNF Service Function Chain in the Data-center

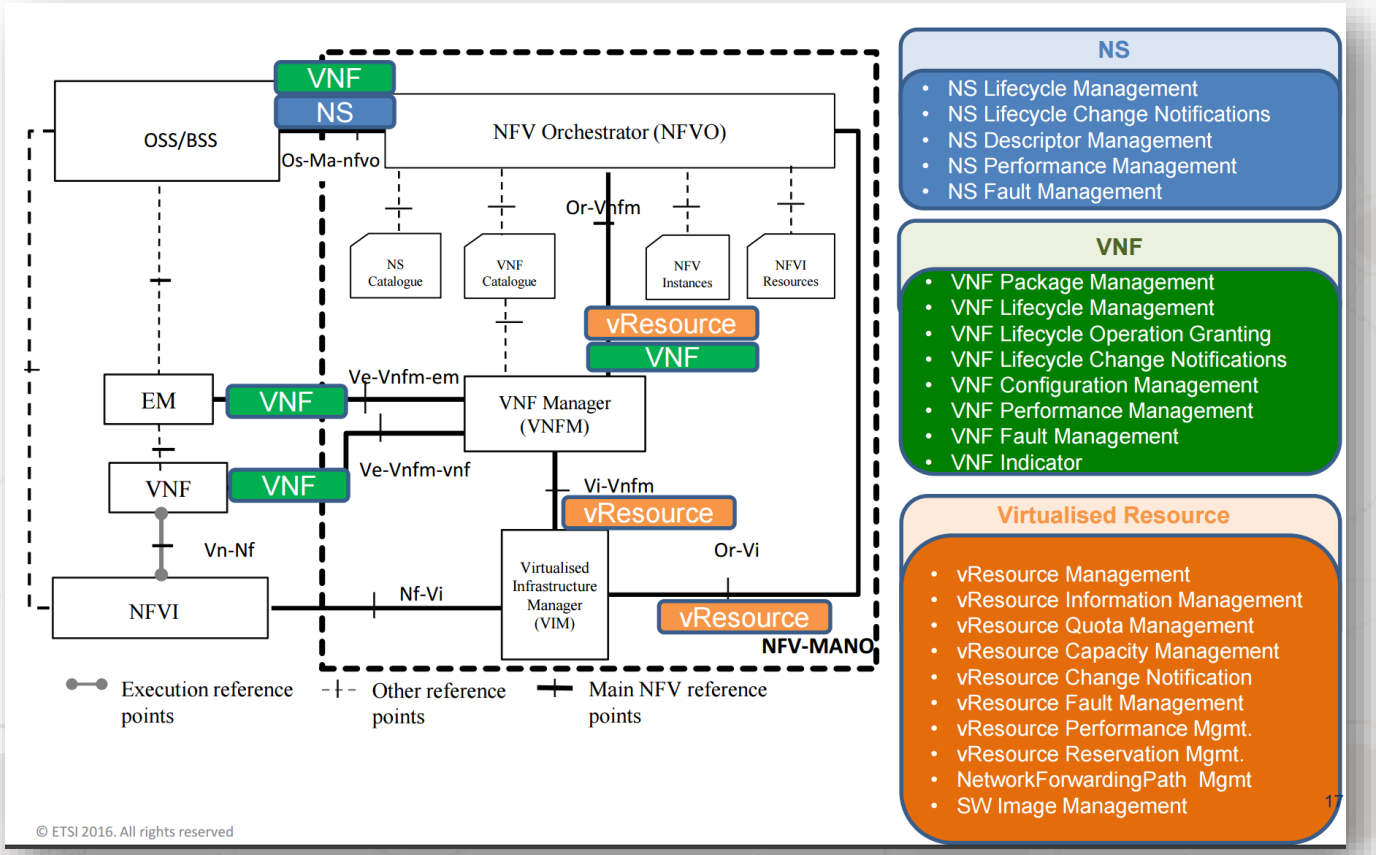
- Cross domain orchestrator with TOSCA/Yang model inputs
- Campus & SP-core networks orchestration using Openconfig Yang models
- Data Center Virtual Networks orchestration using ETSI MANO ref. arch.
  - With support for auto scale-in/scale out of VNF functions
  - Rich monitoring and analytics using streaming telemetry
  - VNF onboarding, Service definition work bench and forwarding graphs

Nuviso Vivace Overview

- Nuviso Vivace is an ETSI compliant MANO platform
- Works with Openstack, vCenter and Azure
- Abstracts cloud infrastructure platforms and provides a single interface to Symphony Maestro to enable true Cross Domain Orchestration
- Responsible for Complete VNF lifecycle management including:
  - Instantiation, Modification, Starting and Stopping for Virtual Services
  - Creation and Management of Virtual Machines used for hosting VNFCs
- Agentless Day0 provisioning of VNFs
- Works with Symphony Interlude component for Day-1/2 access to the VNF's deployed
- Supports Multi Site, Multi Tenant Cloud and Data Center Deployment
- Micro-Services Architecture for Managing different Types of VIMs without having to re-write anything in the Orchestration Logic

ETSI Architecture & Data Models

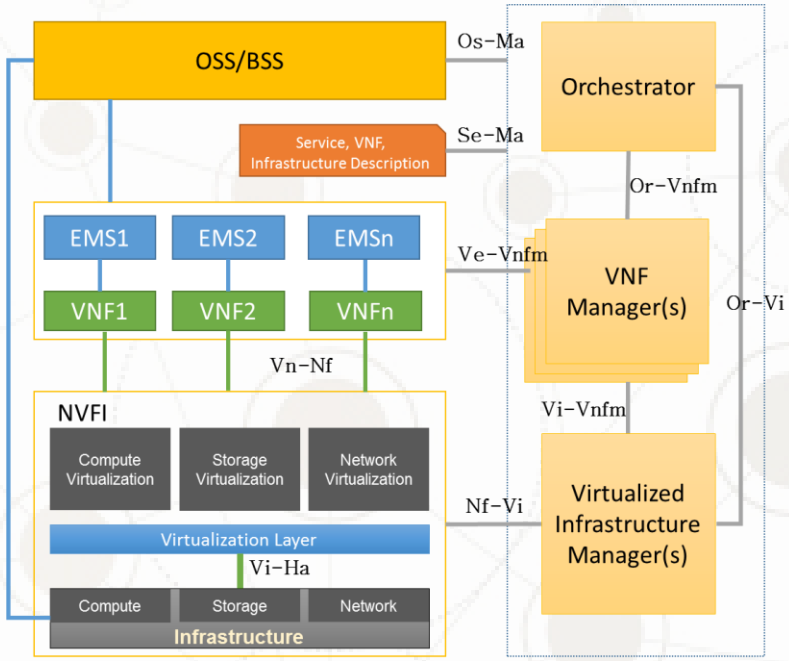
- NFVO
  - Manages the lifecycle of NS Exposes NS lifecycle management interfaces to the OSS/BSS
  - Sends NS lifecycle management notifications to the OSS/BSS Exposes virtualized resource management interfaces to the VNFM
  - Sends virtualized resource management notifications to the VNFM
  - Manages the VNF lifecycle via the interfaces exposed by the VNFM
  - Manages virtualized resources via the interfaces exposed by the VIM
- VNFM
  - Manages the lifecycle of VNFs Manages virtualized resources associated to the VNF it manages via the interfaces exposed by the VIM or NFVO
  - Exposes VNF lifecycle management interfaces/APIs to the VNF, EM and NFVO
  - Sends VNF lifecycle management notifications to the VNF, EM and NFVO
  - Manages VNF initial configuration via the interfaces exposed by the VNF



- VIM
  - Manages the NFV infrastructure resources (compute, network and storage) in one or more NFVI-PoPs.
  - Exposes virtualized resource management interfaces/APIs to the VNFM and NFVO
  - Sends virtualized resource management notifications to the VNFM and the NFVO

Architecture

ETSI Ref Architecture



3rd party OSS/BSS

TOSCA / Yang / GBP

Maestro (Cross Domain Orchestration)

Os-Ma-Nfvo

NFV Orchestration

Or-Vnfm

Interlude

Ve-Vnfm-em

VNFM

Or-Vi

PNF

VNF

VNF

VNF

Ve-Vnfm-vnf

VIM Abstraction

Vivace

Vi-Vnfm

Compute

Storage

Network

NFVI

openstack CLOUD SOFTWARE

Windows Azure

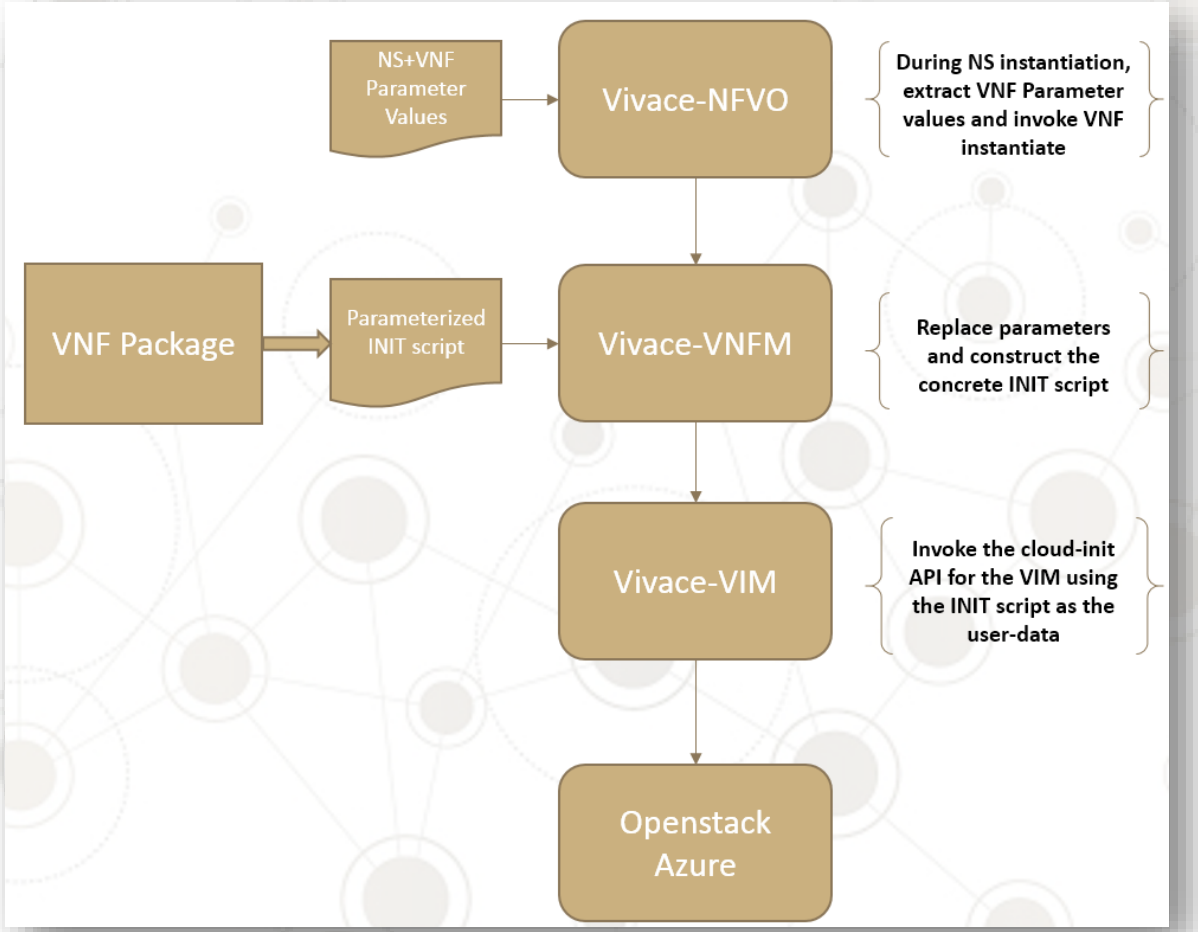
vmware

VIM

VNF Onboarding – multi-vendor packages

- There is no standardization for VNF packages. Multiple vendors package it differently. How can we homogenize and onboard them in a standardized fashion?

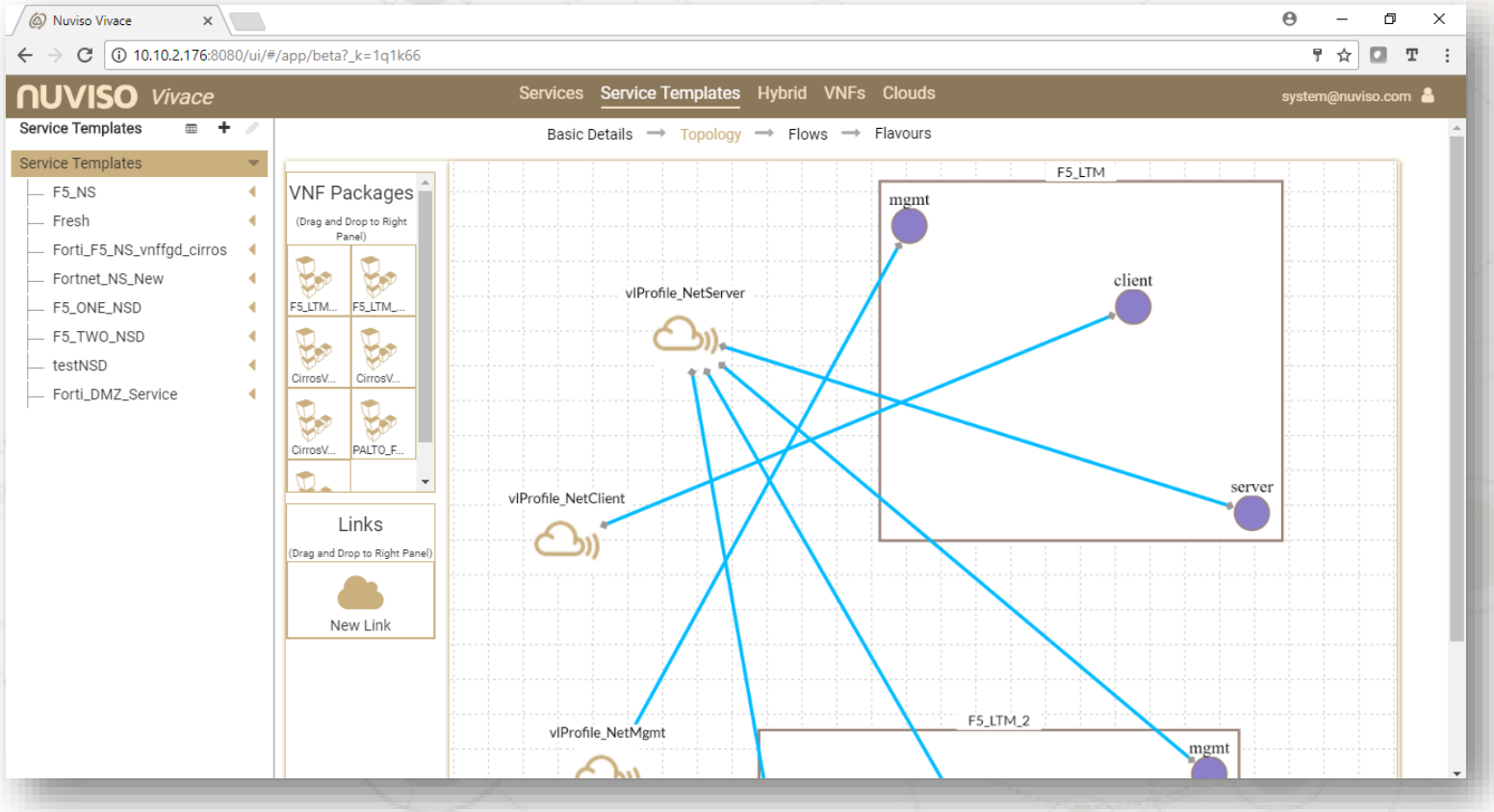
- Nuviso's generic VNF onboarding solution
  - Built over cloud-init. Cloudinit is the most widely accepted means of agentless VNF management and onboarding (Also adopted by EANTC for the 2016 VNF interop tests)
  - Where vendors do not natively support cloudinit, Nuviso can help to work with VNF vendor and add cloudinit support to the packages
  - Nuviso's VIM abstraction layer follows a modular approach. If in future, some other mechanism becomes popular, support for it can be seamlessly added
  - Nuviso's Symphony Vivace Workbench supports composition of VNF packages in a vendor neutral manner, and generates a ETSI compliant CSAR archive



Service Definition Workbench

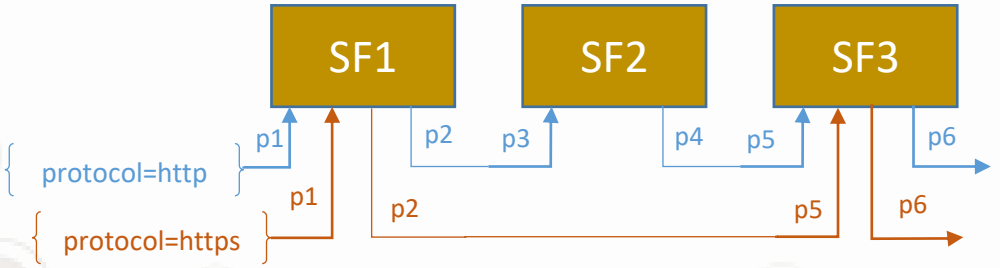
- How to ease the process of generating NSDs based on drag n drop UI that can support rich Service Function Chains (VNFFGs)?

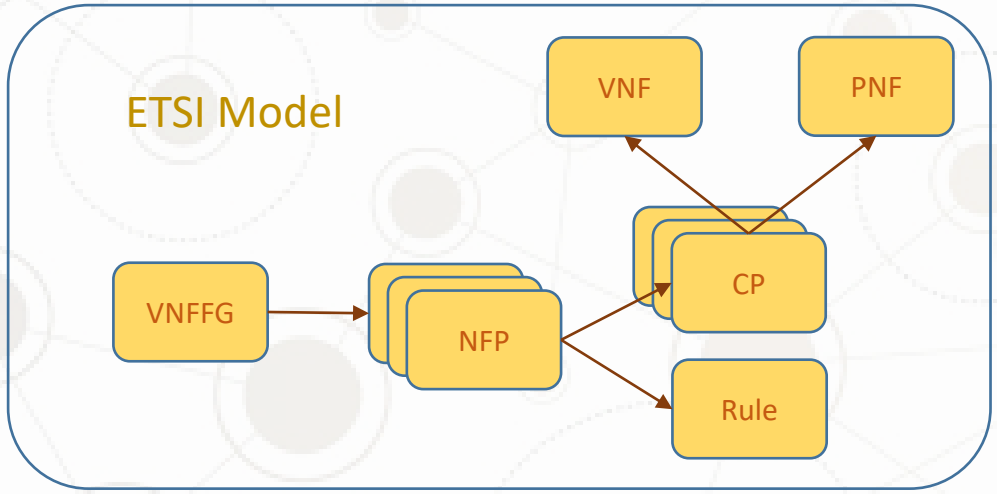
- Nuviso solution –
  - Symphony Vivace has a drag ‘n’ drop UI using which Network Service Descriptors can be constructed and added to catalogue.
  - Symphony Suite can support addition of static Service Function Chains, as well as Dynamic Chains based on classification rules
  - User can define Service Templates from the topology view using simple drag ‘n’ drop operations

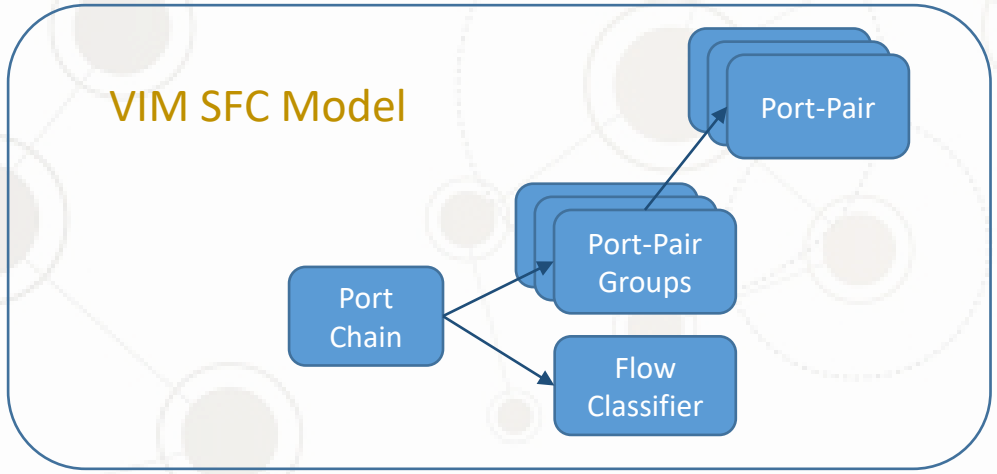


VNF Forwarding Graph

- Nuviso's Symphony Vivace implements ETSI defined graphs to represent service function chains
- Uses the common SFC model derived from Openstack's SFC as the VIM abstraction
- Abstracts network controller (ODL, Contrail) platforms and provides a single interface for SFC
- Functions
  - Both uni & bi-directional service chains
  - Load balance between service layers
  - Classifiers to decide which traffic enters the service chain
  - Multiple VNFFGs per network service
  - Traffic steering based on VIM ports
  - Ports can be both physical and virtual endpoints

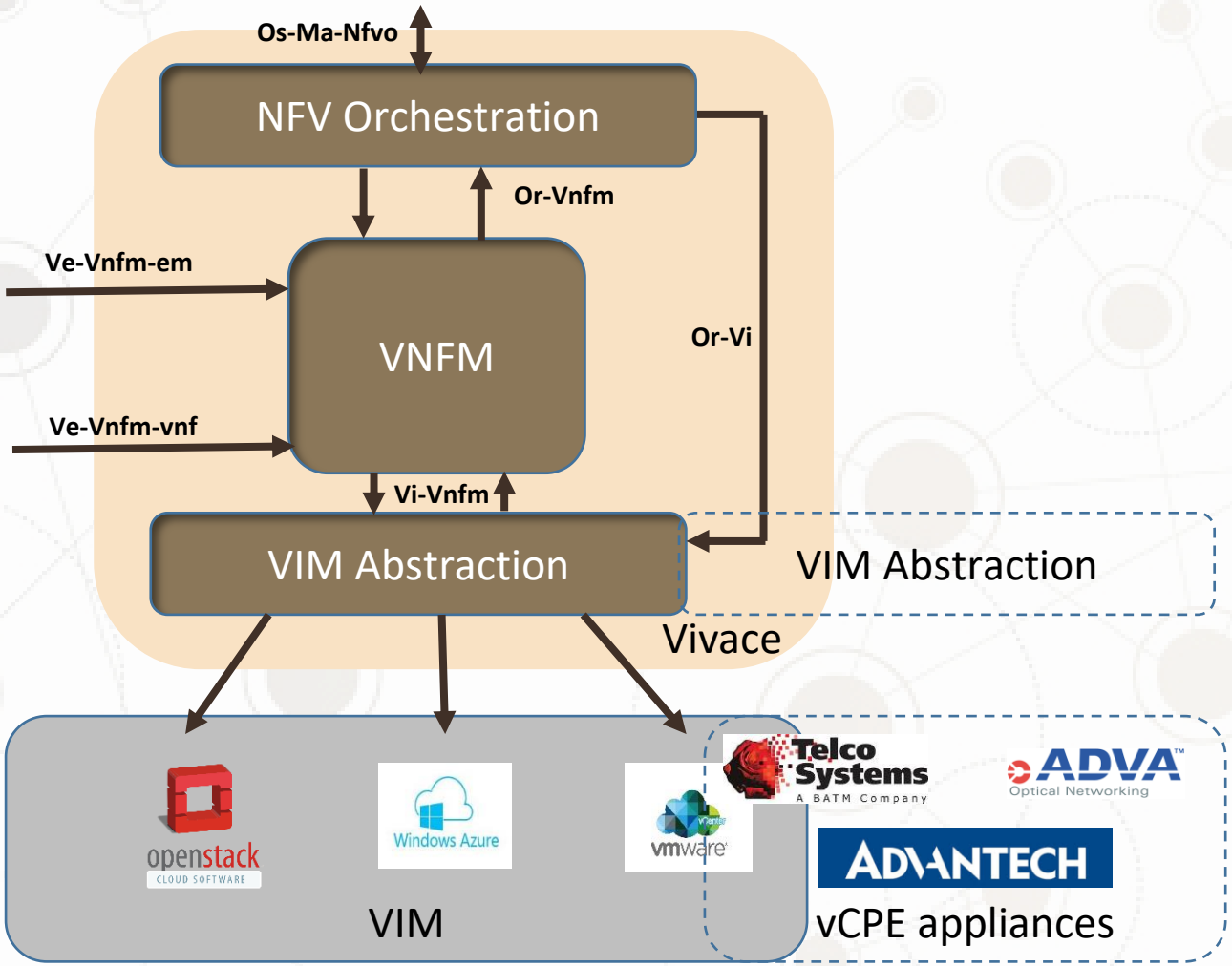






Orchestration support for VNF appliances

- Vendors like Telco Systems / ADVA / Advantech provide VNF appliances that are used in SD-WAN / vCPE kind of use cases. How can we extend the cloud management platform to manage these appliances?
- Nuviso solution
  - Extends the VIM abstraction layer to invoke APIs given by appliance vendors but still provide a uniform North Bound to the Orchestrator
  - Symphony Vivace already supports VIM abstraction. Need to write plugins for new appliances

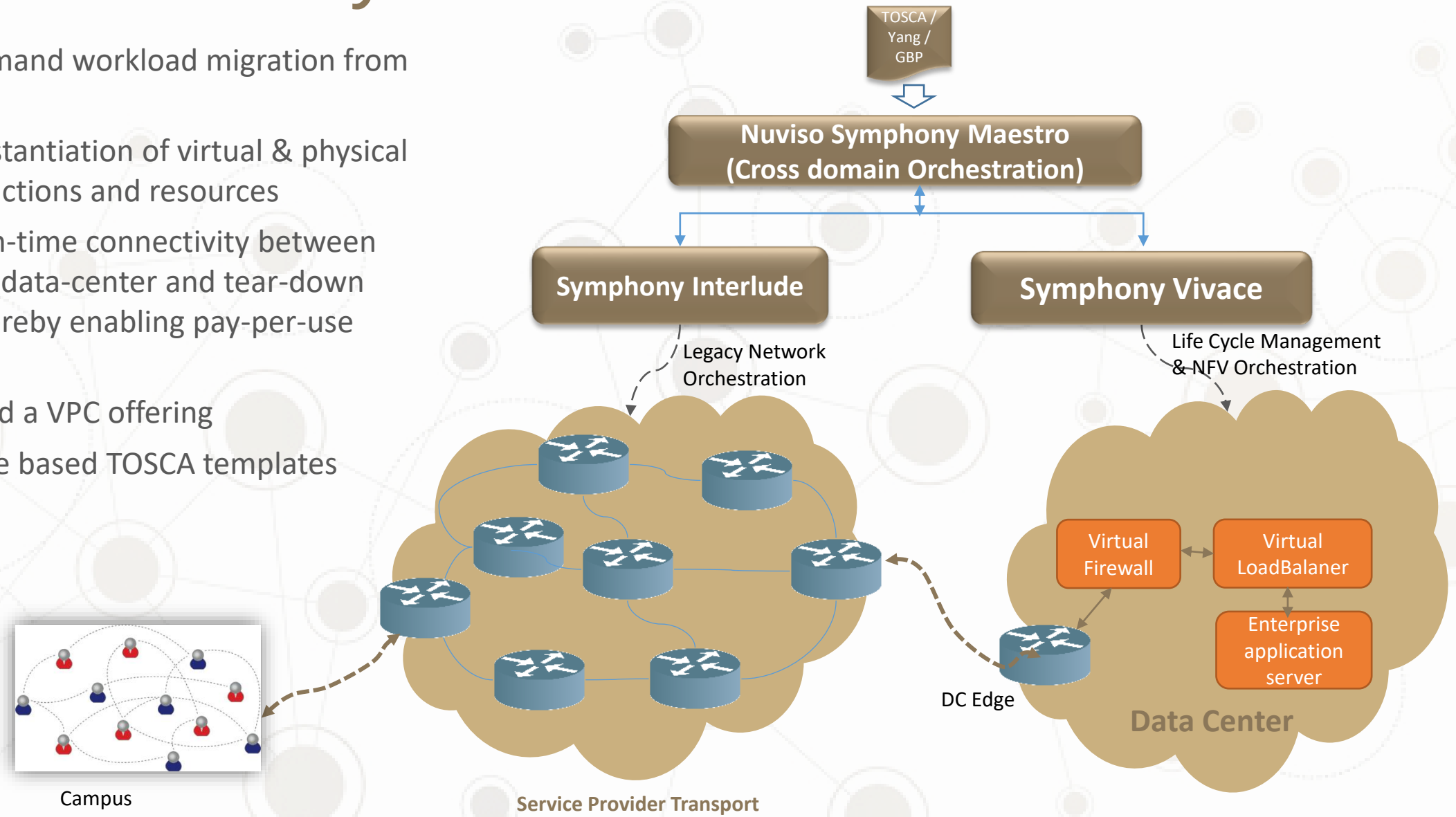


Vendor Neutral config interface for VNF

- Multiple VNF vendors follow different configuration mechanisms. This results in manual efforts to migrate policy/config from one vendor to another vendor
- Nuviso solution –
  - This problem is very similar to the legacy config unification problem. With different transport gear vendors supporting different models (Eg: Cisco vs Juniper), the popular choice is to use standard yang models
  - Nuviso solution manages vendor VNFs via well defined yang models so that vendor migration can be made seamless
  - Day-0 config can also be automated using yang compliant configuration sections in the NSD that are auto-applied during service instantiation
  - Already POC'd in a North American Tier-1 SP

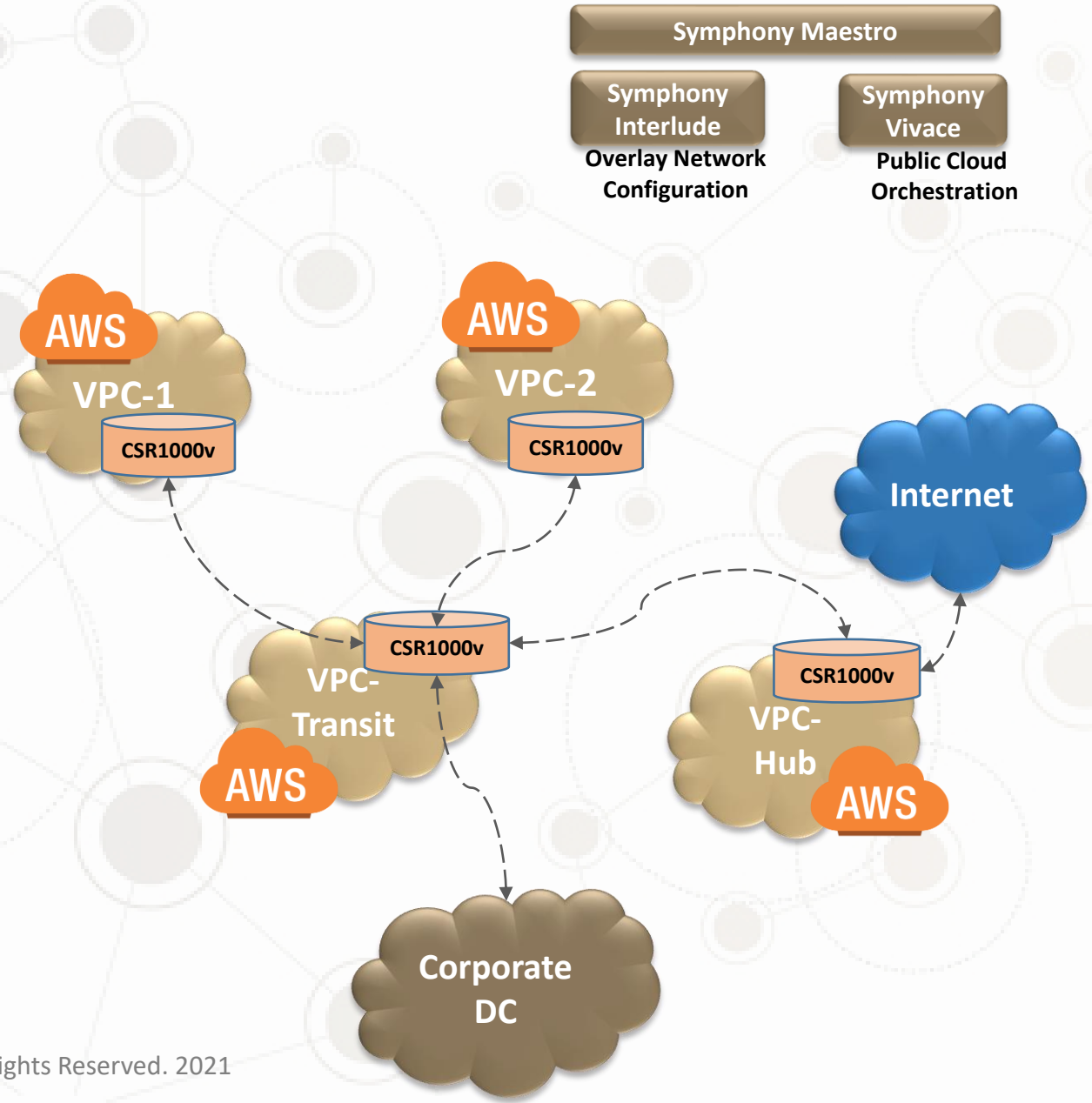
Use Case: DC Hybrid

- Enables on-demand workload migration from campus to DC
- On-demand instantiation of virtual & physical networking functions and resources
- Establish just-in-time connectivity between enterprise and data-center and tear-down post usage, thereby enabling pay-per-use models
- Enables SP build a VPC offering
- ETSI NFV profile based TOSCA templates

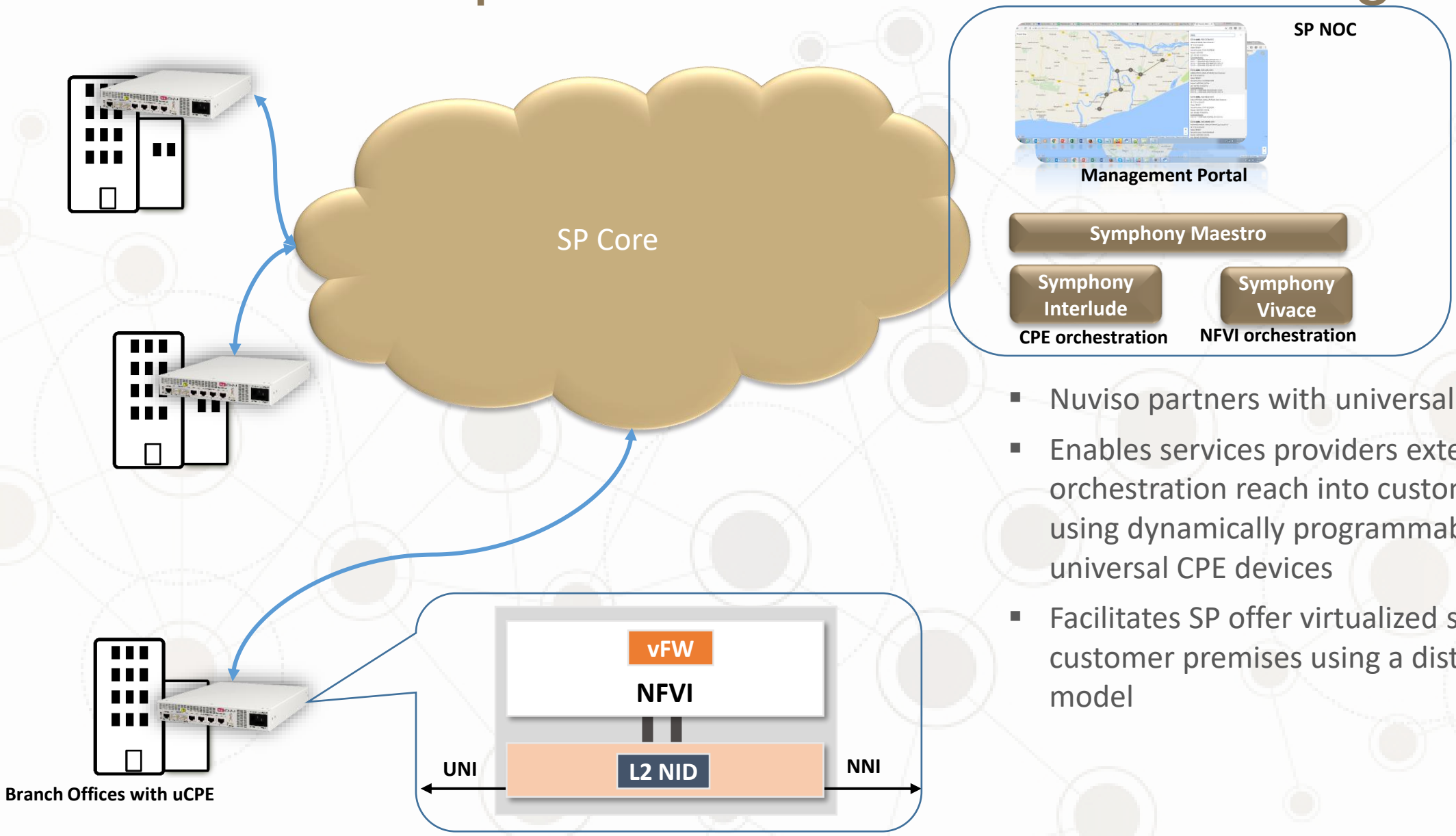


Use Case: Public Cloud VPC Orchestration

- Large global enterprises are having public cloud presence across multiple regions and geographies
- Public cloud providers offer VPCs across multiple regions and ability to connect VPNs across these VPCs
- Service automation workflow typically involves configuring both VPC instances via public cloud provider APIs, and tenant network configuration (in terms of IPSec VPN rules, or routing rules using virtual routing instances like CSR1000v)
- Nuviso Symphony suite can seamlessly automate multi-vpc scenarios end to end, and provide a single-pane-of-glass view for configuring both the underlay (public cloud) configuration and the overlay (customer routing instances)
- Enables enterprises enforce uniform policies across campus and cloud



Use Case: Campus NFV orchestration using vCPE



- Nuviso partners with universal CPE vendors
- Enables services providers extend their orchestration reach into customer premises using dynamically programmable/extendable universal CPE devices
- Facilitates SP offer virtualized services at customer premises using a distributed NFV model

NVO Benefits

- Vendor neutral VNF Manager
- Multi vendor VNF onboarding
- VNF Configuration Migration
- Auto Day zero & Day one configuration management for VNFs
- Drag and drop deployment of VNFs on multiple cloud platforms
- Easy to use service work bench, for creating multiple service chains and deploy
- 100% ETSI Compliant Solution


NUVISO