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Cisco SD-WAN as a Managed Service

BRKRST-2558

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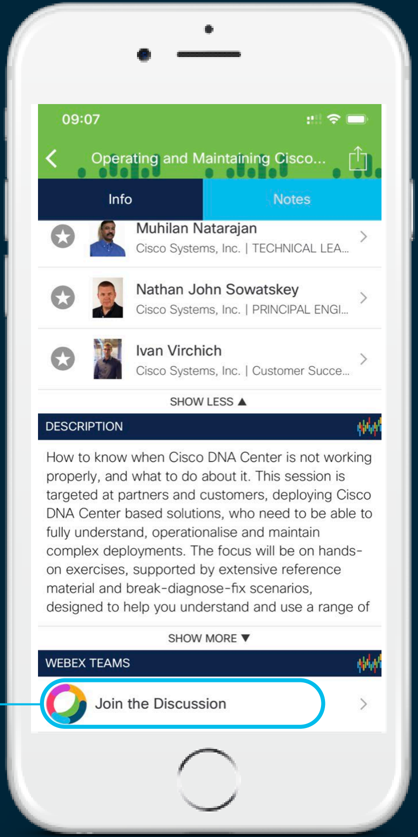

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DESCRIPTION

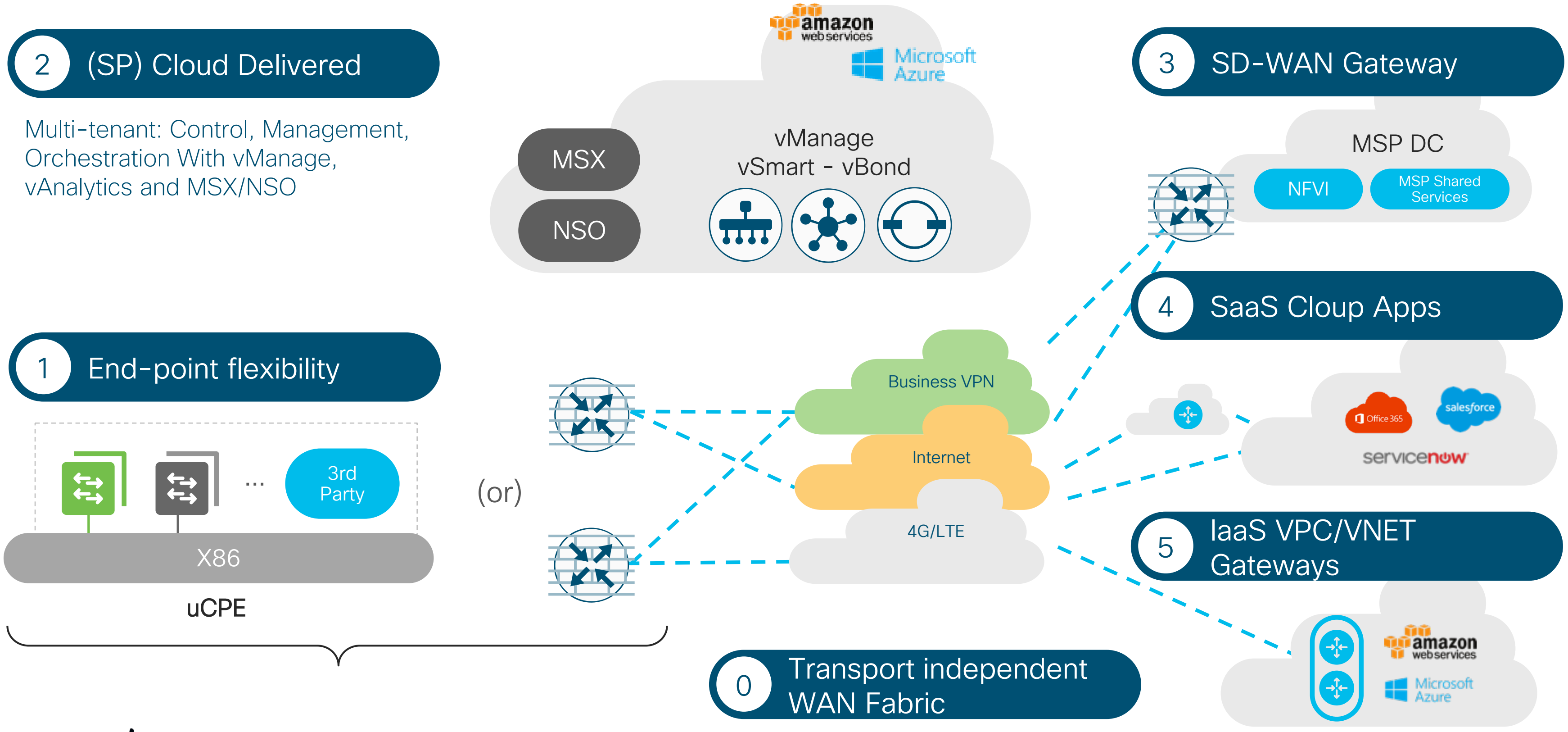
How to know when Cisco DNA Center is not working properly, and what to do about it. This session is targeted at partners and customers, deploying Cisco DNA Center based solutions, who need to be able to fully understand, operationalise and maintain complex deployments. The focus will be on hands-on exercises, supported by extensive reference material and break-diagnose-fix scenarios, designed to help you understand and use a range of

Agenda

- SD-WAN as a Service – Introduction
- Orchestration for MSPs
  - NSO, MSX
- Deploying Controllers
  - Cloud or On-Prem
  - Use NSO/MSX to deploy
- Device On-Boarding
  - Global PnP - Bootstrap File
  - Use NSO/MSX
- Deploying uCPE
  - NFVIS – Use NSO/MSX to deploy
- SD-WAN Virtualized Gateways - Regions
- Key Takeaways

Introduction

Network-as-a-Service: SD-WAN Offering



2 (SP) Cloud Delivered

Multi-tenant: Control, Management, Orchestration With vManage, vAnalytics and MSX/NSO

3 SD-WAN Gateway

4 SaaS Cloup Apps

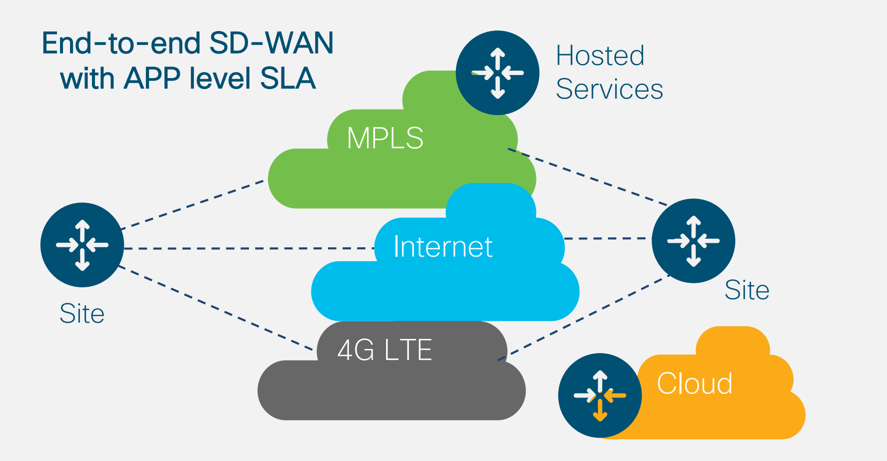
1 End-point flexibility

5 IaaS VPC/VNET Gateways

0 Transport independent WAN Fabric

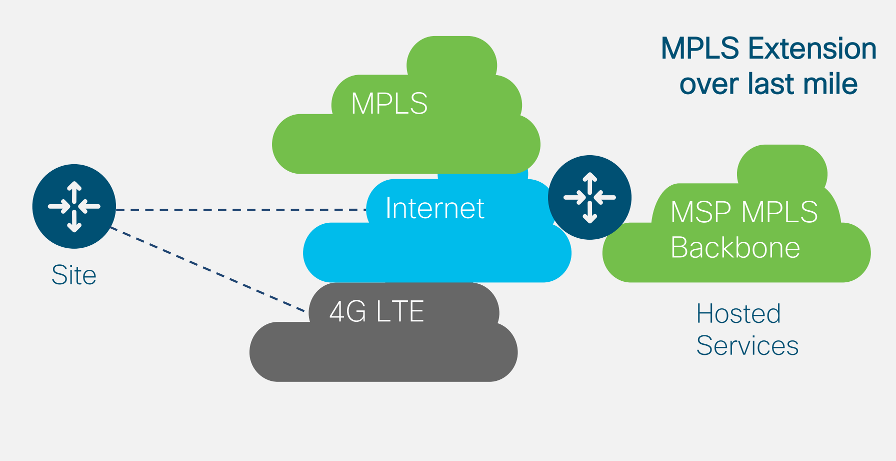
Connectivity and Overlay

End-to-end SD-WAN
with APP level SLA



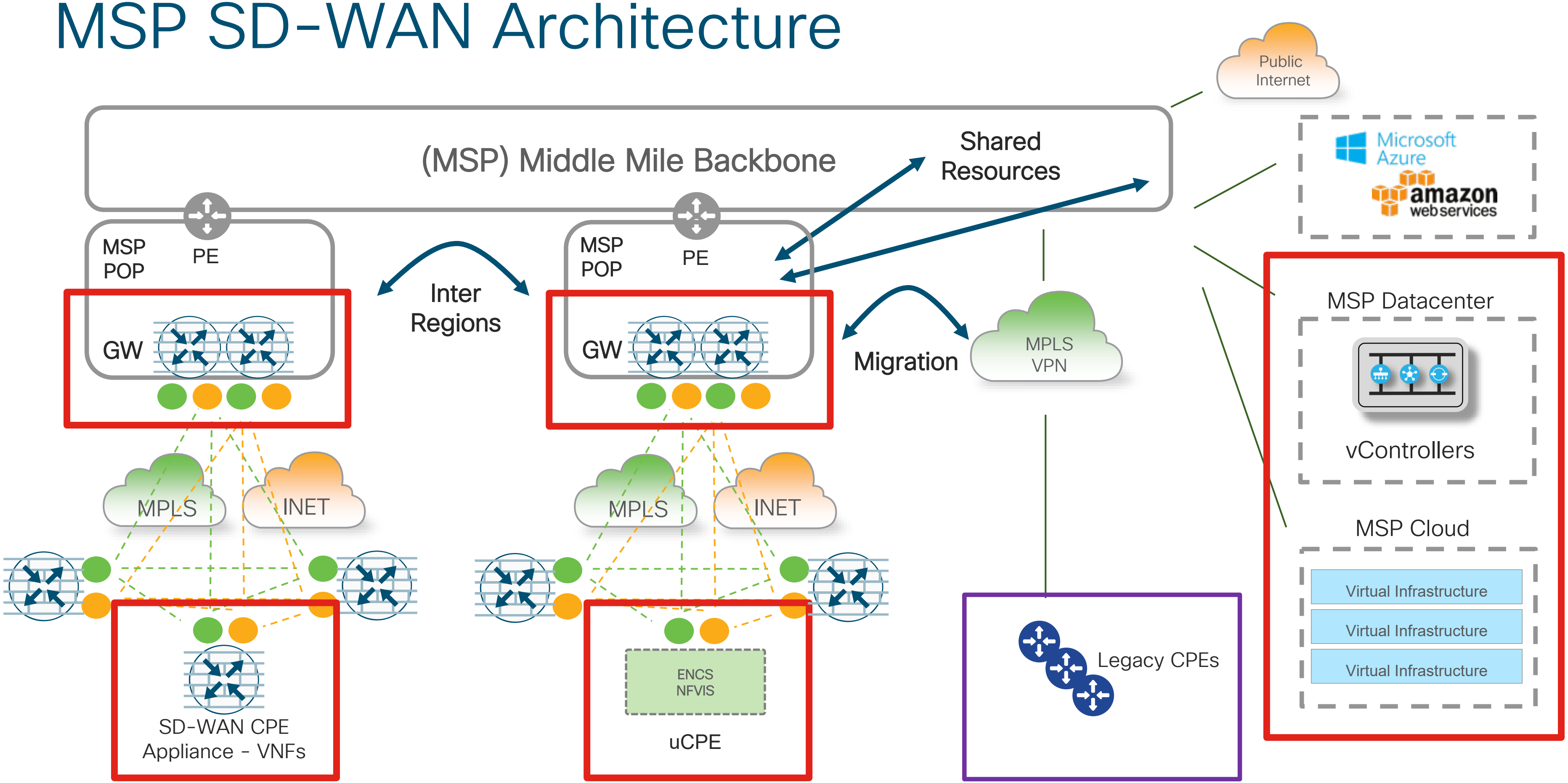
Transports Managed by SD-WAN MSP
But some/all could also be from another SP(s)

Business VPN Extension over Last Mile
Middle Mile Optimization

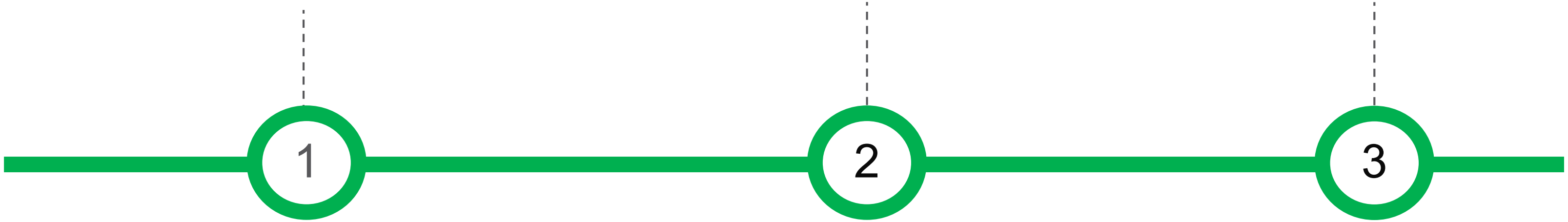


Expand Business VPN service over the last mile
MSP may not own the transport

MSP SD-WAN Architecture



Steps in Deploying SD-WAN Fabric



Deploy Management and Control Plane Elements
(SP Cloud or Public Cloud)

Instantiate controllers VMs
Add controllers to the system
Establish Controllers identities

Deploy SD-WAN Nodes
(Hardware or uCPE)

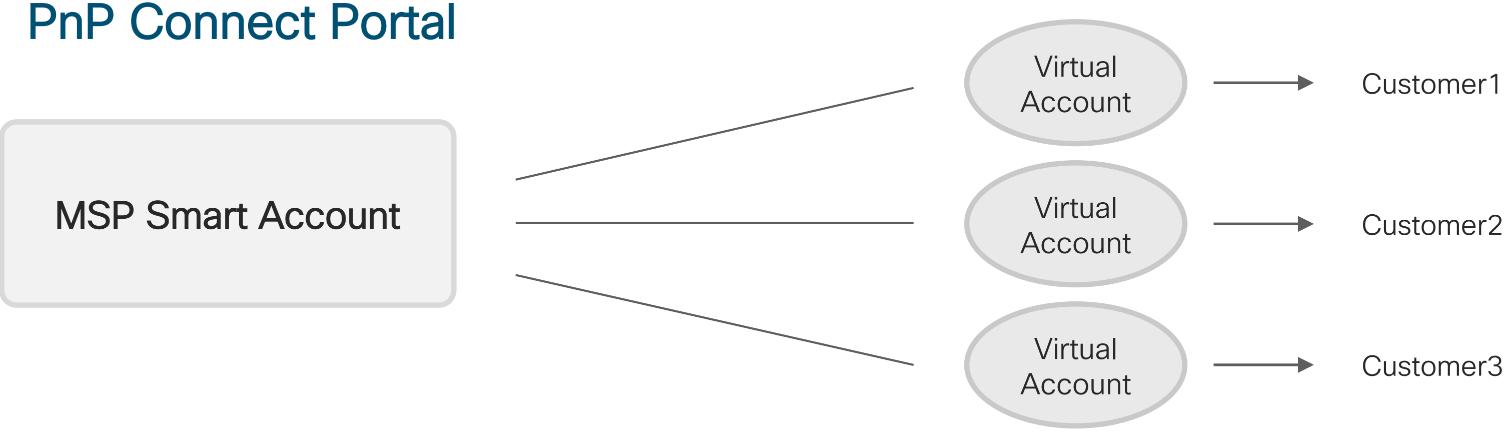
Update white-list
Attach configuration templates
ZTP/Cloud-Init

Control Fabric Behavior

Define/Activate policies
Cloud onRamp
Establish security posture

Smart Account (SA) / Virtual Account (VA)

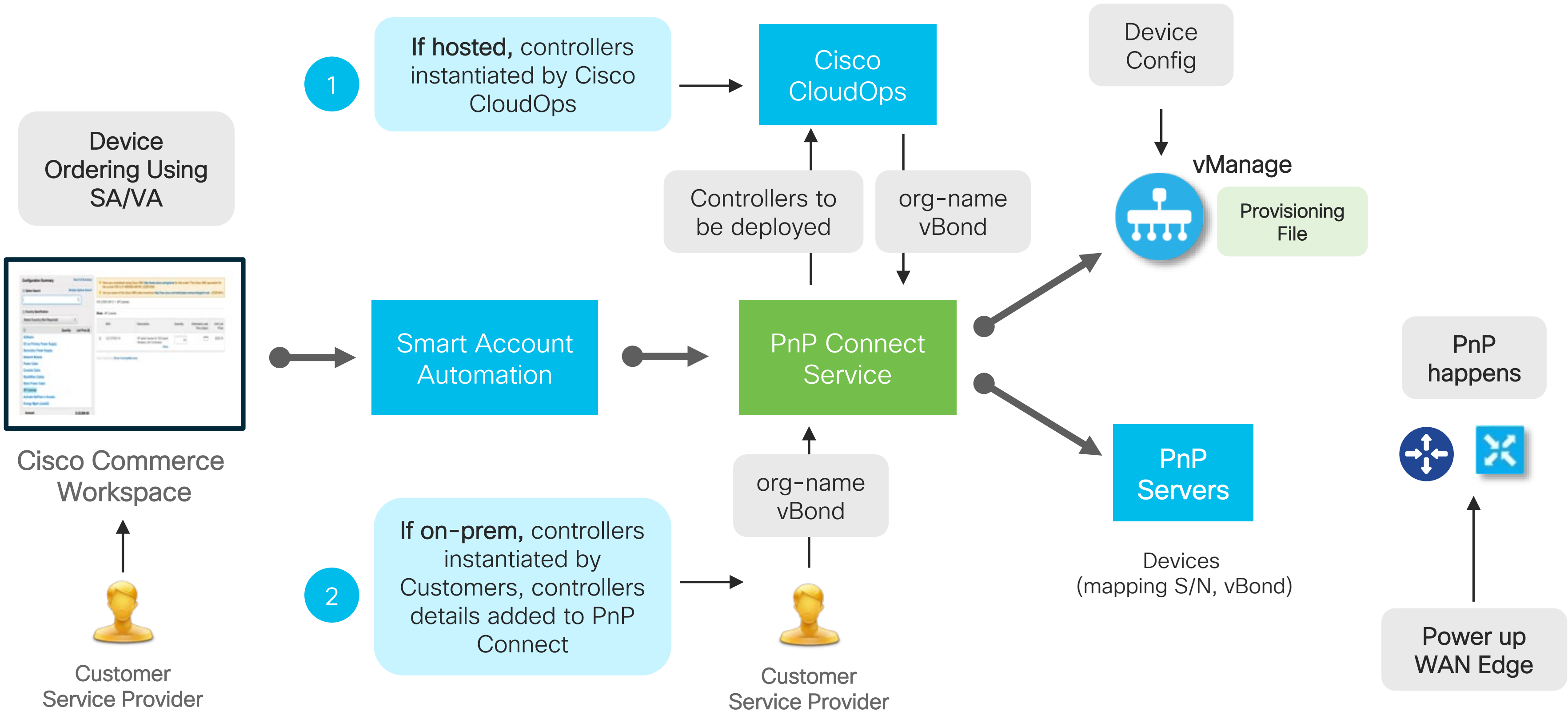
PnP Connect Portal



The Service Provider centralized account that provides full visibility and access control of Cisco Smart software licenses across customers.

- A customer **defined constructs**
- For SD-WAN – Mapped to a Customer Overlay
- Created and maintained by the Provider on the Cisco Smart Account Manager

Global Deployment Process Overview



Device Ordering Using SA/VA

Cisco Commerce Workspace

Customer Service Provider

Smart Account Automation

1

If hosted, controllers instantiated by Cisco CloudOps

Cisco CloudOps

Controllers to be deployed

org-name vBond

PnP Connect Service

2

If on-prem, controllers instantiated by Customers, controllers details added to PnP Connect

org-name vBond

Customer Service Provider

Device Config

vManage

Provisioning File

PnP Servers

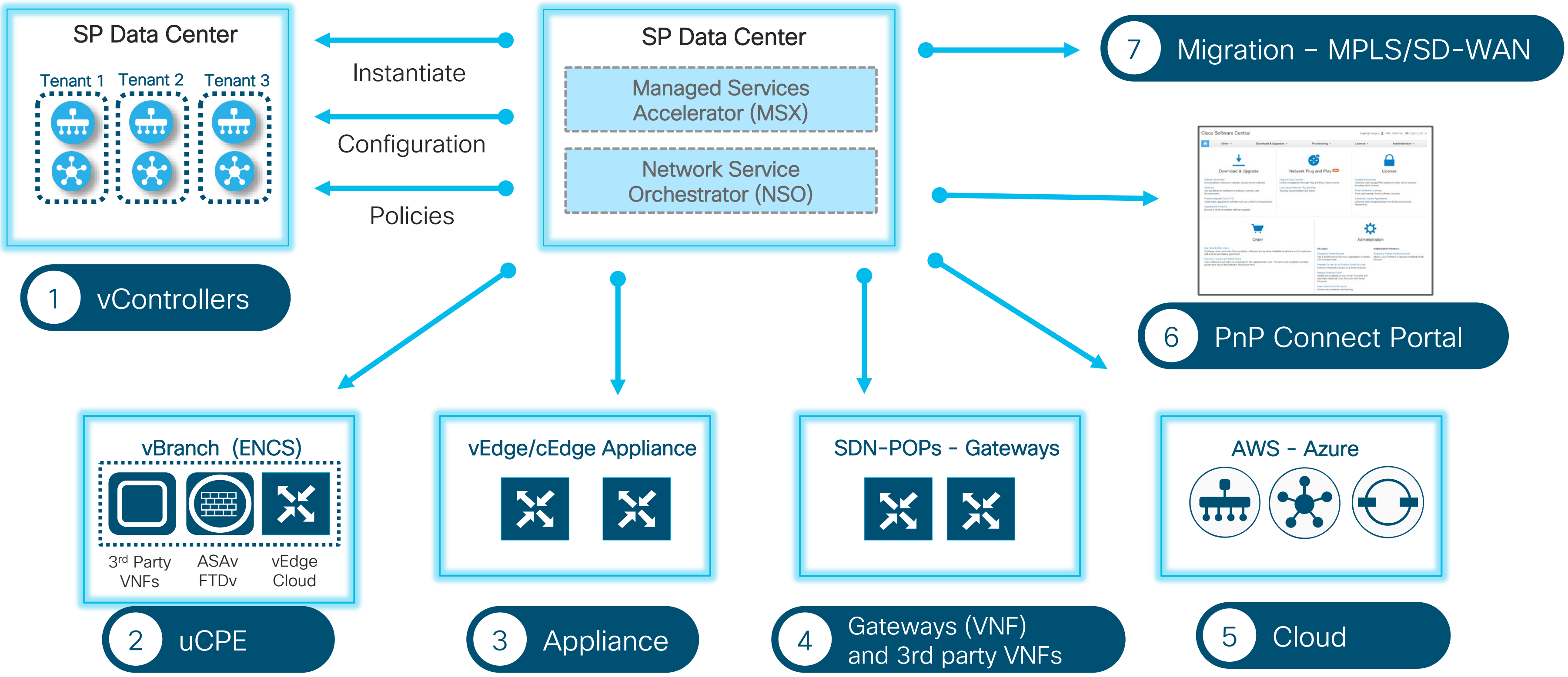
Devices (mapping S/N, vBond)

PnP happens

Power up WAN Edge

Orchestration

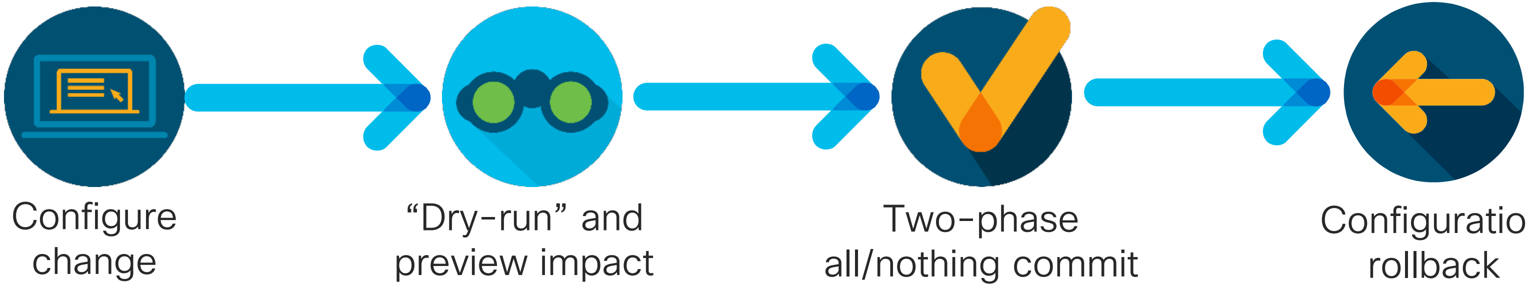
MSP Service Orchestration for Cisco SD-WAN



Network APIs - Transactions

Network API

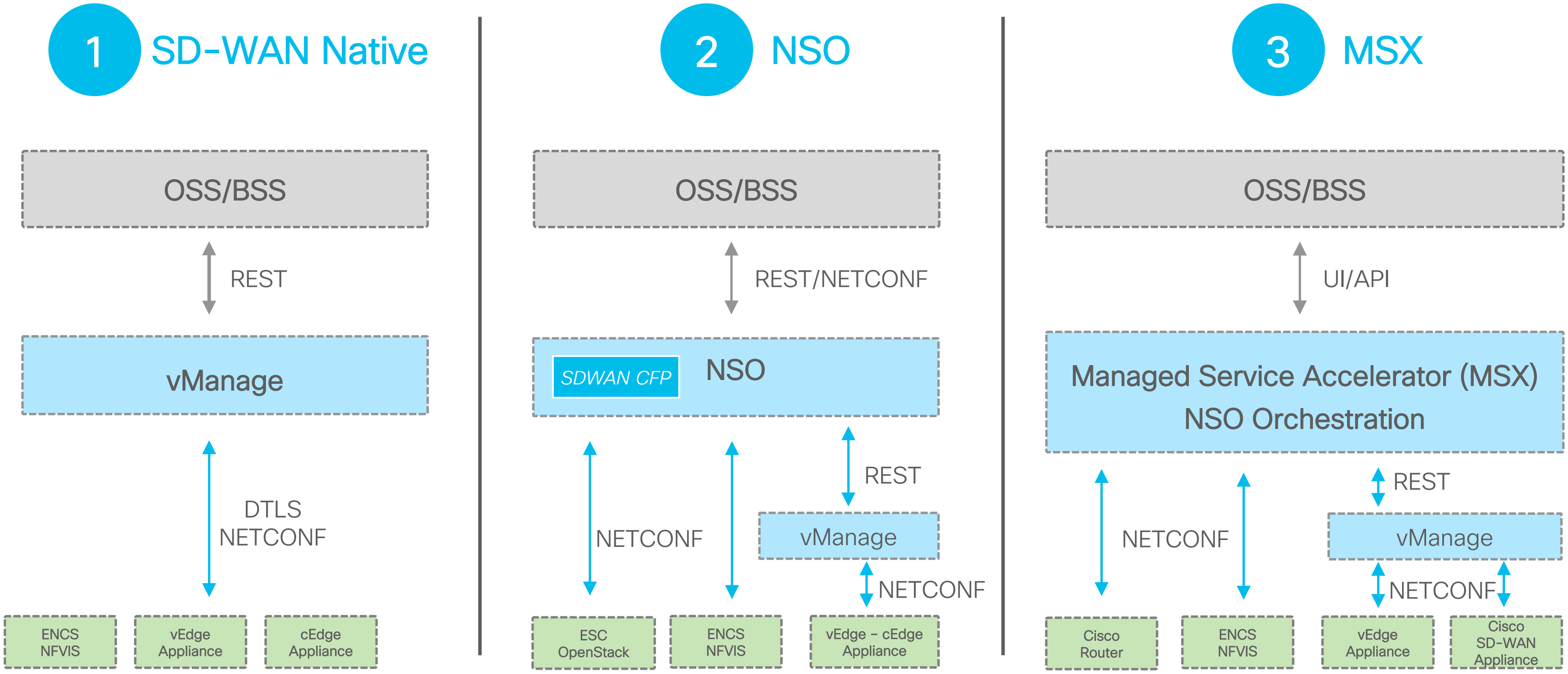
- Network Service Orchestrator (NSO)
- Managed Service Accelerator (MSX)



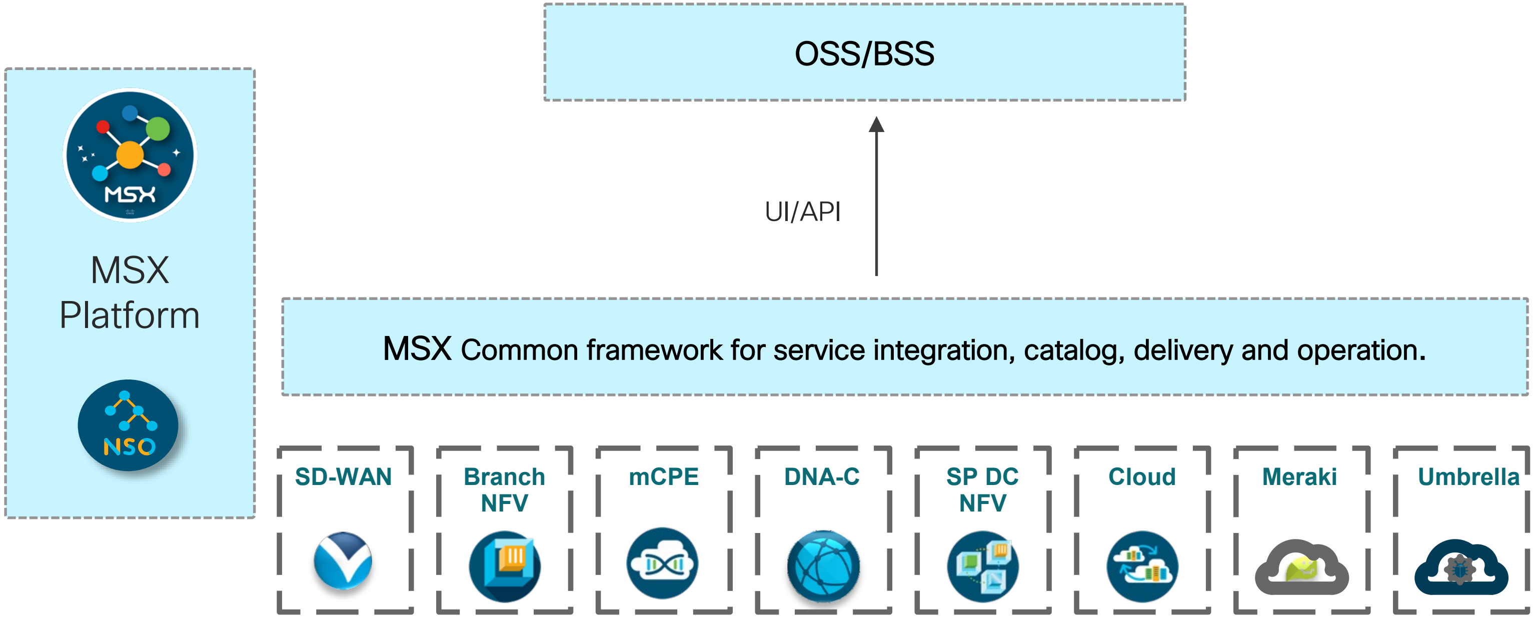
Configure change → "Dry-run" and preview impact → Two-phase all/nothing commit → Configuration rollback

- Provides a two-phase commit protocol to address distributed network atomicity
- Dry-run and rollback capabilities for changes

Service Orchestration – Various Requirements



Multi Domain Orchestration is also Required



OSS/BSS

UI/API

MSX Platform

MSX Common framework for service integration, catalog, delivery and operation.

SD-WAN

Branch NFV

mCPE

DNA-C

SP DC NFV

Cloud

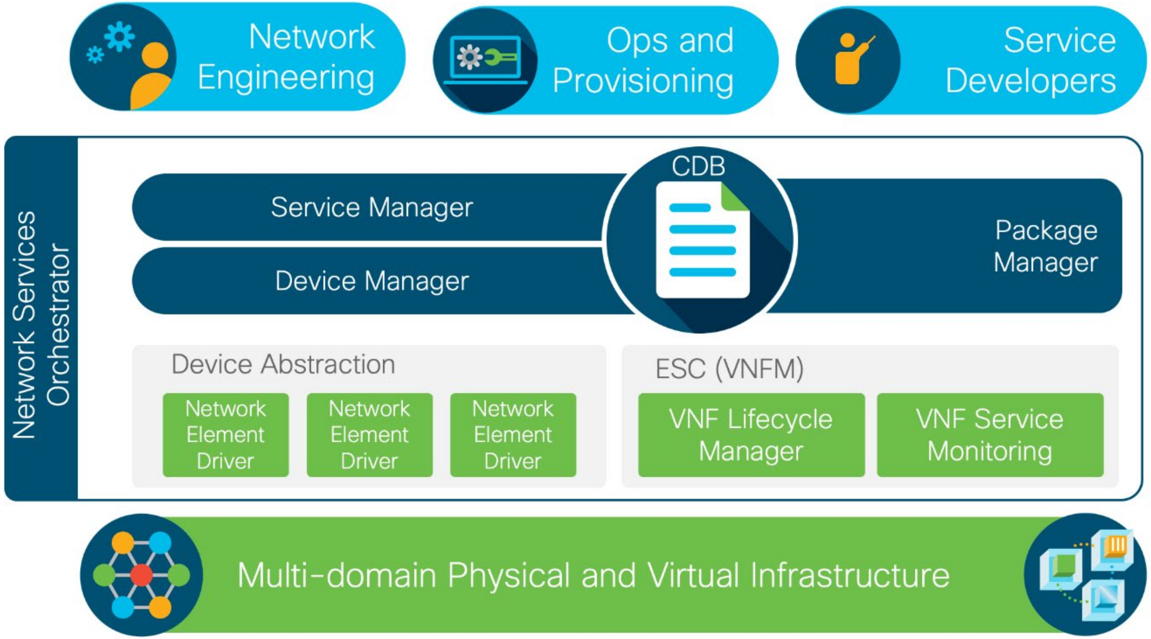
Meraki

Umbrella

Pre-built Core Function Packs reduce cost and complexity

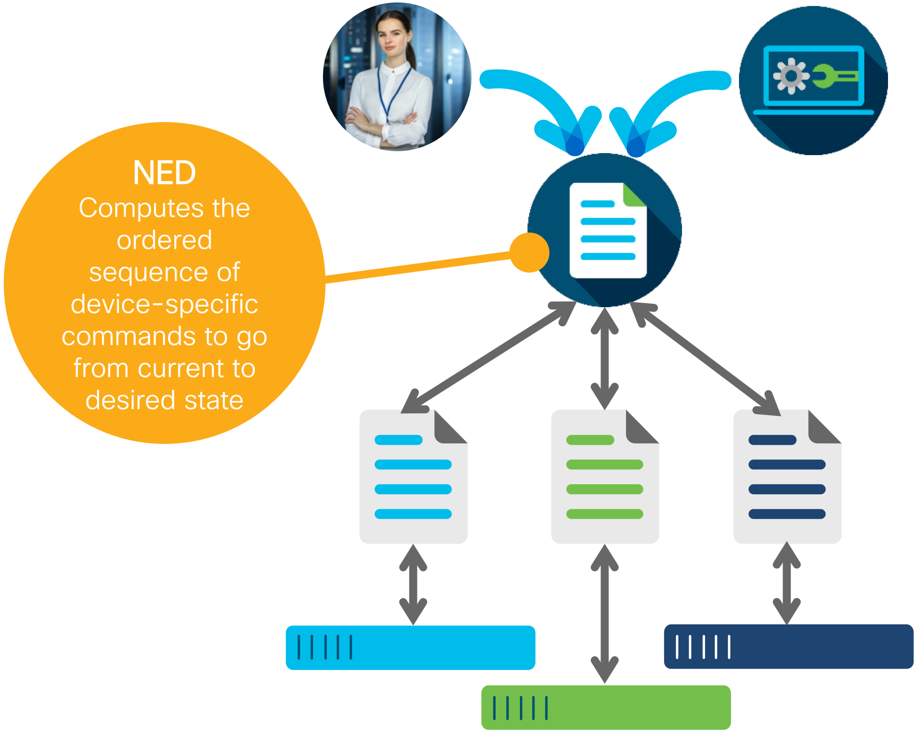
The cost to integrate and operate each additional service is decreased

NSO Architecture



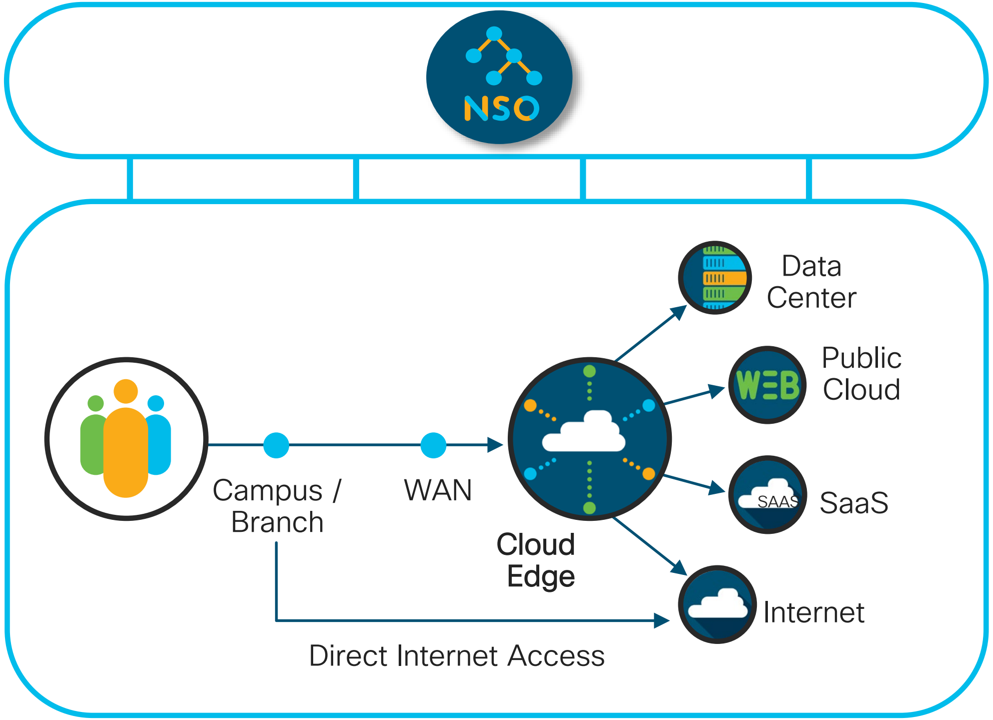
- Model-driven, end-to-end service lifecycle and customer experience focused
- Seamless integration with northbound tooling
- Loosely-coupled and modular architecture leveraging open APIs and standard protocols
- Orchestration across multi-domain and multi-layer for network-wide, centralized policy and services
- Multivendor abstraction through NEDs
- Multiple interfaces including CLI, REST, Java Python

NEDs tame multi-vendor complexity


NED
Computes the ordered sequence of device-specific commands to go from current to desired state

- Abstracts underlying protocol and data-models
- Normalizes error-handling across vendors
- Eliminates the device adapter problem
- Removes complex device logic from the service logic

Core Function Packs for Cisco NSO

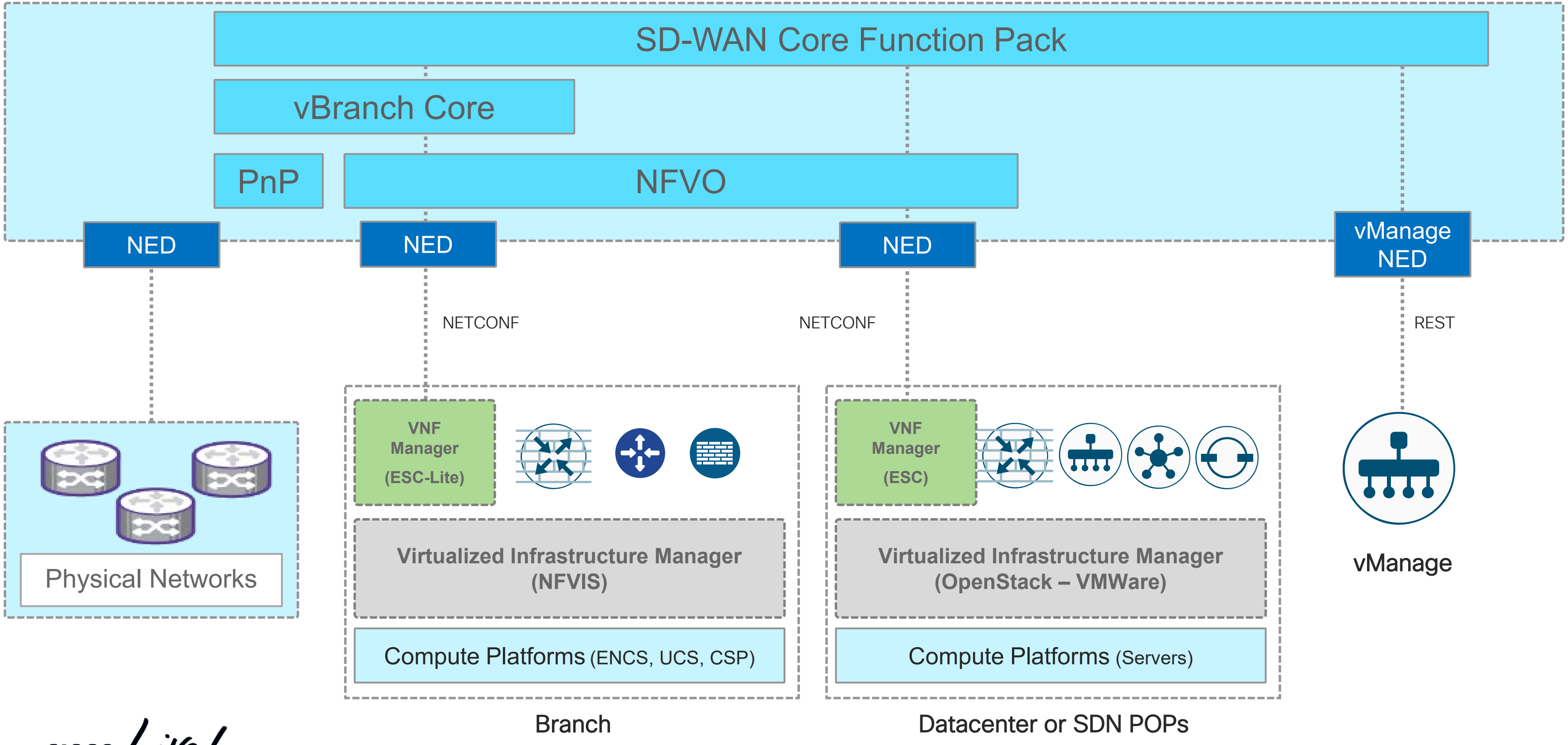


Core Function Packs can be customized and extended to fit your environment and your design guidelines

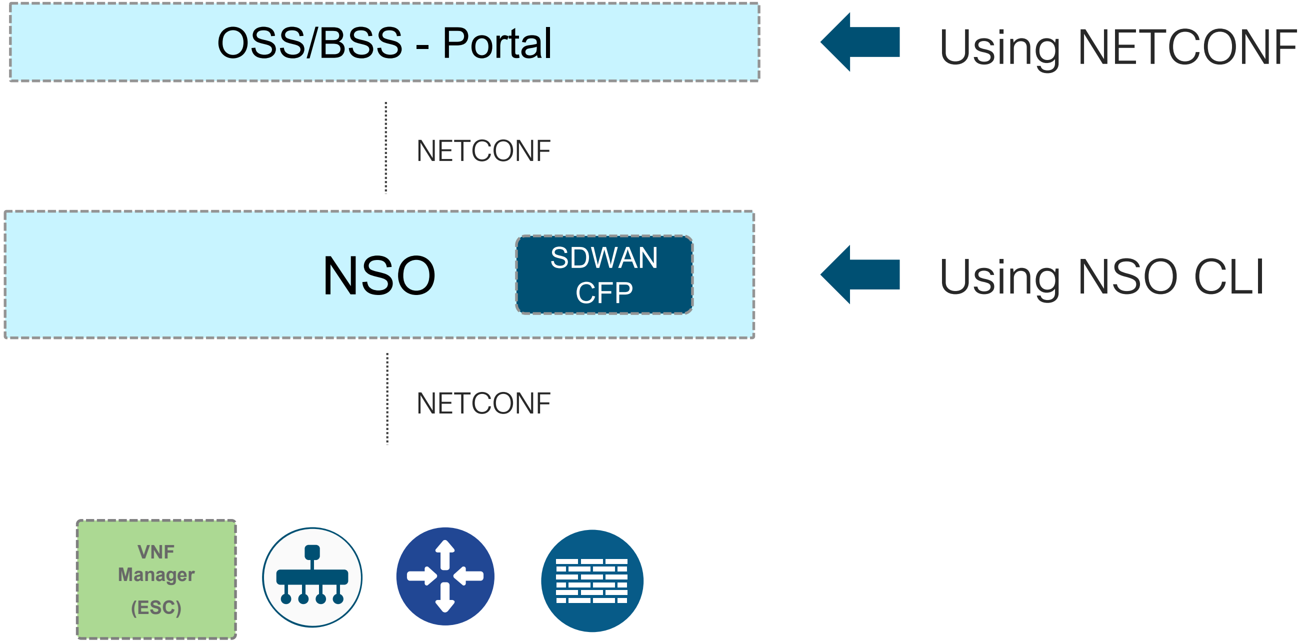
- vBranch Core FP
- SDWAN Core FP
- SAE Core FP
- NFVO Core FP

Commercially packaged automation applications for key Cisco use cases (CVDs). Productized, TAC supported.

SDWAN Core Function Pack Architecture

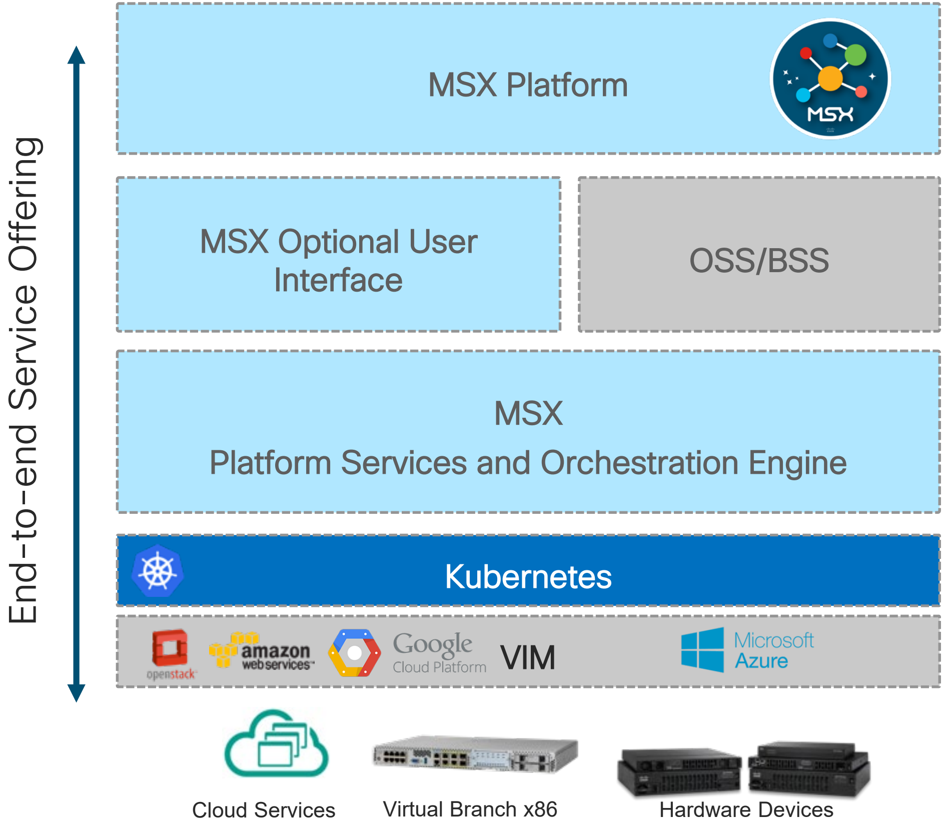

SD-WAN Core Function Pack
vBranch Core
PnP
NFVO
NED
NED
NED
vManage NED
NETCONF
NETCONF
REST
Physical Networks
VNF Manager (ESC-Lite)
Virtualized Infrastructure Manager (NFVIS)
Compute Platforms (ENCS, UCS, CSP)
Branch
VNF Manager (ESC)
Virtualized Infrastructure Manager (OpenStack – VMWare)
Compute Platforms (Servers)
Datacenter or SDN POPs
vManage

Using NSO


OSS/BSS - Portal
Using NETCONF
NETCONF
NSO
SDWAN CFP
Using NSO CLI
NETCONF
VNF Manager (ESC)

Managed Service Accelerator (MSX)

- MSX is a Cloud-Native Platform
- The MSX architecture employs:
  - Docker Containers
  - Kubernetes
  - Micro-service framework
  - Network Services Orchestrator (NSO)
  - Custom Service Templates
- REST APIs
- ... to deliver a rich catalog of Cloud Managed Services



cisco Live!

MSX Pre-Built Service Packs

SD-Branch (vBranch x86 based)

- Allows VNFs to be deployed on "universal CPE" running Cisco NFVIS
- Rich templating capabilities provide custom service chains and device configurations managed simply from the MSX Cloud

Cisco SD-WAN

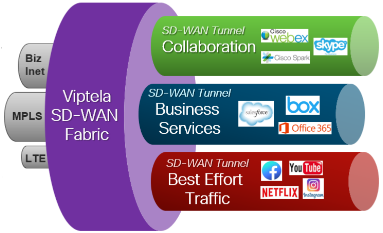
- Speeds deployment of multi-tenant SD-WAN environments based on Cisco Viptela technology
- Coordinates with vBranch service pack to deploy virtual vEdge on ENCS

Managed Device

- Quickly on-board new devices with Cisco Plug-and-Play technology
- Simply create custom templates for ANY managed service
- Rapidly deploy and manage new devices simply from the MSX Clo

Cisco SD-WAN powered by MSX

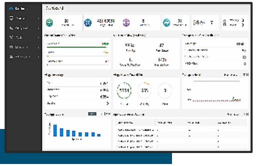
MSX provides multi-tenancy, multi-services, operational simplicity, and scale, for many SD-WAN devices…securely from the MSX Cloud



1. MSX provides multi-tenant, multi-service, platform with secure access controls
2. MSX creates and manages SD-WAN Control Planes for 100’s of tenant
3. MSX on-boards many SD-WAN Device types for 100’s of tenants
4. MSX manages Virtual Branches (ENCS) and Cloud Gateways running SD-WAN services
5. MSX simplifies site provisioning for 100’s of tenants (templates and CSV files)
6. MSX provides simplified Self-Service config changes for the most requested SD-WAN services

1 MSX Multi-tenant Platform

2 100’s SD-WAN Controllers

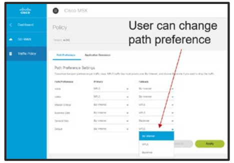


3 Many Device types

4 x86 Virtual Branch and Cloud

5 Template Site Provisioning

6 Customer Self-Service

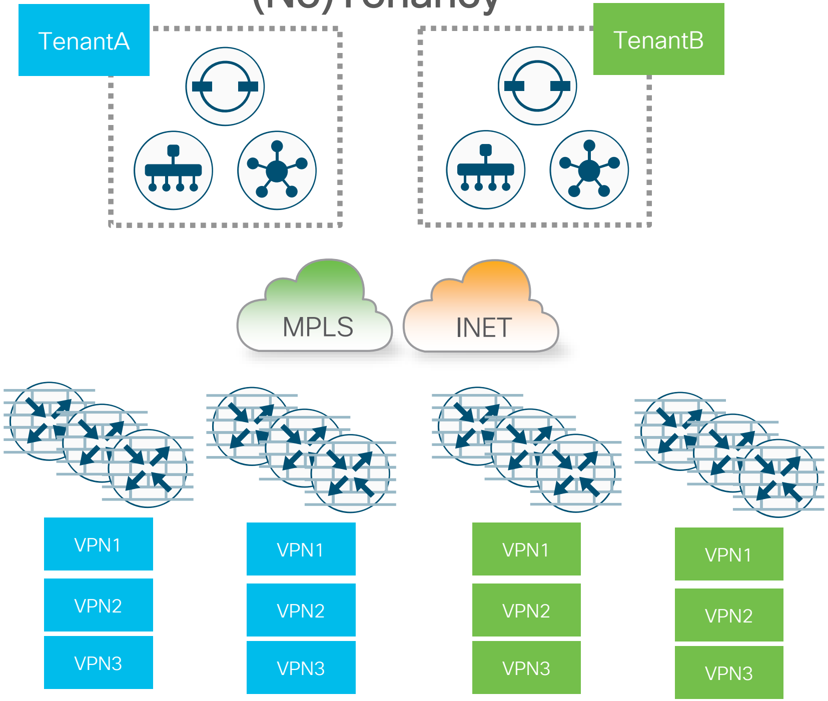


User can change path preference

Deploying Controllers

Controller Tenancy – Single Tenancy

Dedicated (No)Tenancy



TenantA

TenantB

MPLS

INET

VPN1

VPN2

VPN3

VPN1

VPN2

VPN3

VPN1

VPN2

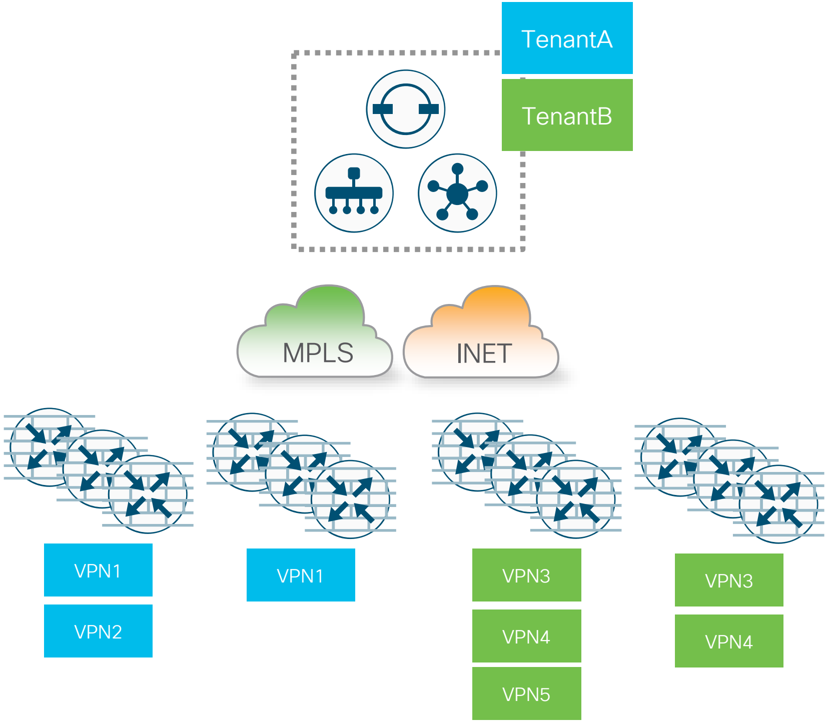
VPN3

VPN1

VPN2

VPN3

VPN Tenancy



TenantA

TenantB

MPLS

INET

VPN1

VPN2

VPN1

VPN3

VPN4

VPN5

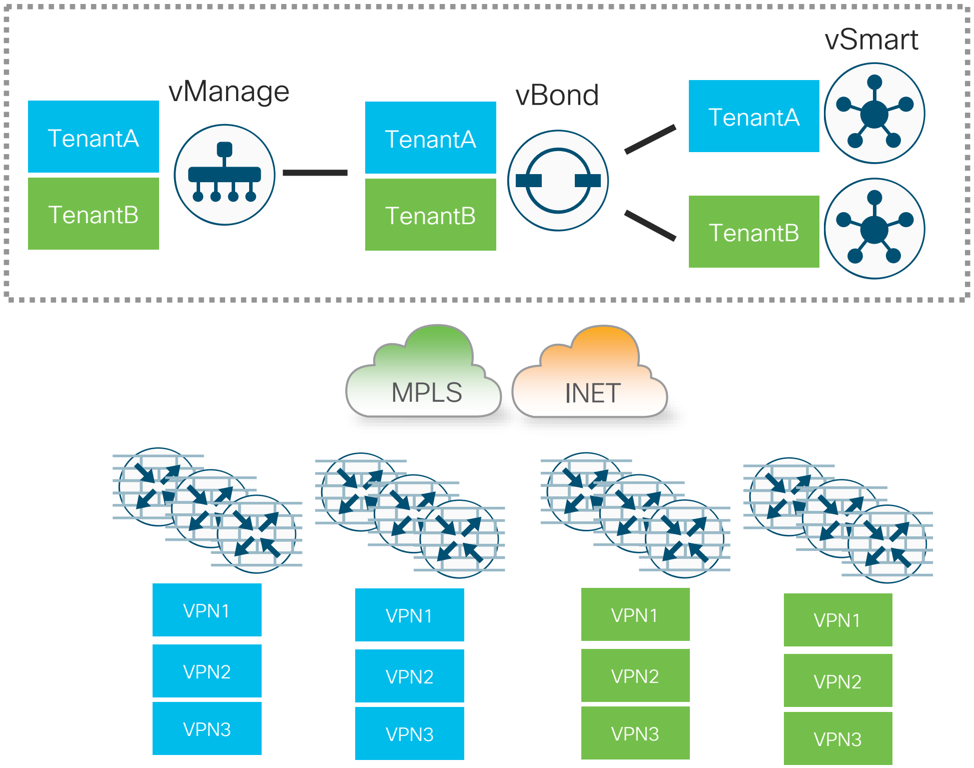
VPN3

VPN4

Controller Tenancy – Multi-Tenant Control Plane

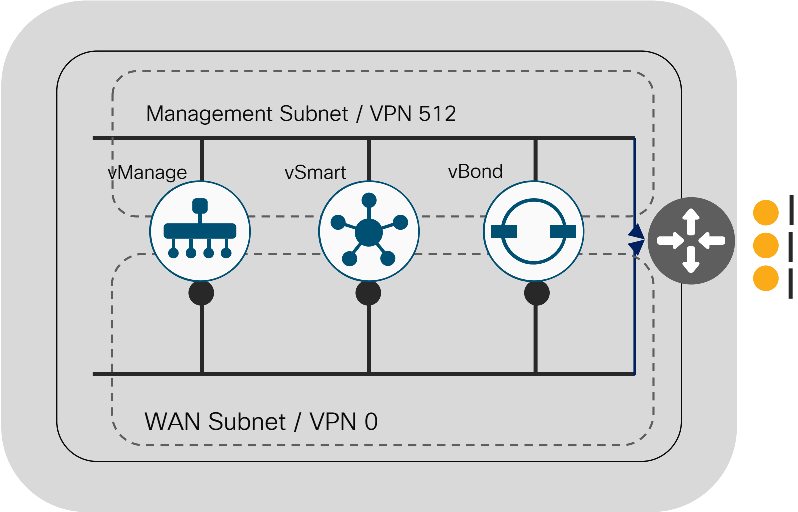
- Multi-Tenant vManage
  - Data Isolation in the DB
- Multi-Tenant vBond
  - Contains white-list for all tenants
- Single-Tenant vSmart
  - Containerized vSmarts
  - Isolation for the control-plane
- vOrchestrator / vMonitor used for provisioning and monitoring the deployment

Multi-Tenant Control Plane



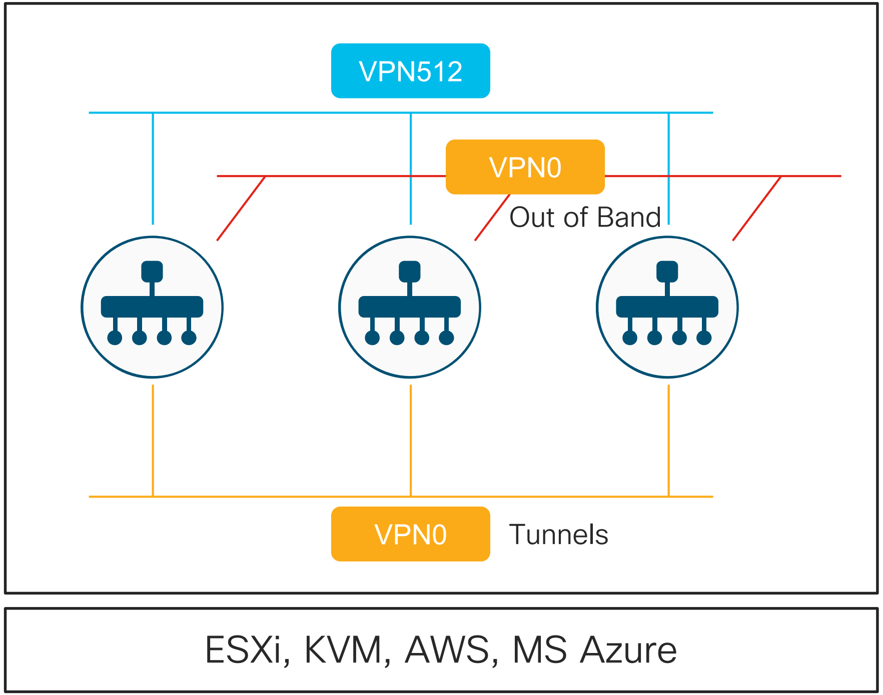
vManage, vBond, vSmart

- Virtual machines running on KVM, VMware ESXi, AWS, Azure
- Separate interfaces for control and management
- Separate VPNs for control and management
  - Zone-based security



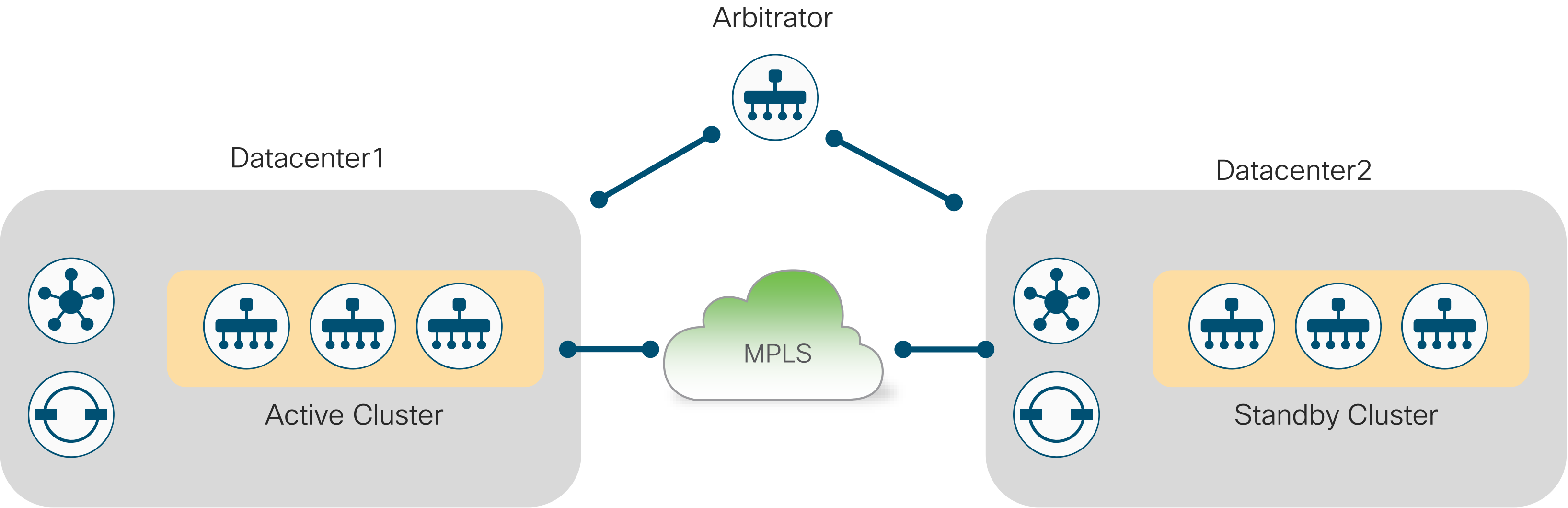
ESXi, OpenStack, KVM, AWS, MS Azure

vManage Cluster



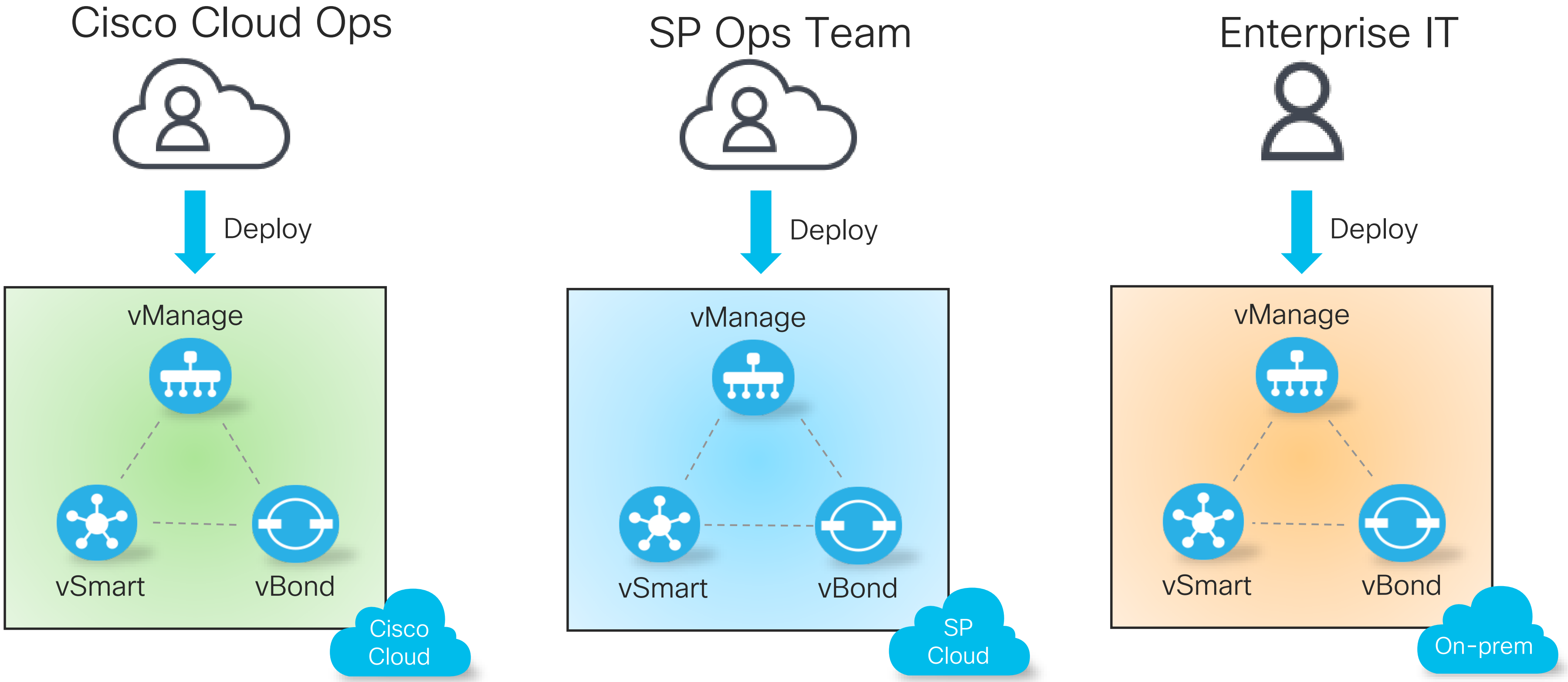
- There are various reasons do deploy a vManage cluster, including:
  - High availability and redundancy for fault tolerance
  - Managing greater than 2000 vEdges
  - Distributing NMS service loads
- The vManage cluster consists of at least three vManage devices
- Besides the interfaces used for VPN 0 and VPN 512, a separate dedicated interface will be used for communication between the vManage devices.
  - The bandwidth between the vManage devices on this interface should be at least 1 Gbps, and the latency should be less than 5 ms for a small or lab deployment. A 10 Gbps interface is recommended for production.

Disaster Recovery for vManage



- Introduced in 19.2
- vManage scales horizontally using Clustering
  - Add more vManage nodes to cluster in DC for Scale and local HA
- Add standby Cluster for Disaster Recovery

Controller Deployment Models



Cisco Cloud Ops

Deploy

vManage

vSmart

vBond

Cisco Cloud

SP Ops Team

Deploy

vManage

vSmart

vBond

SP Cloud

Enterprise IT

Deploy

vManage

vSmart

vBond

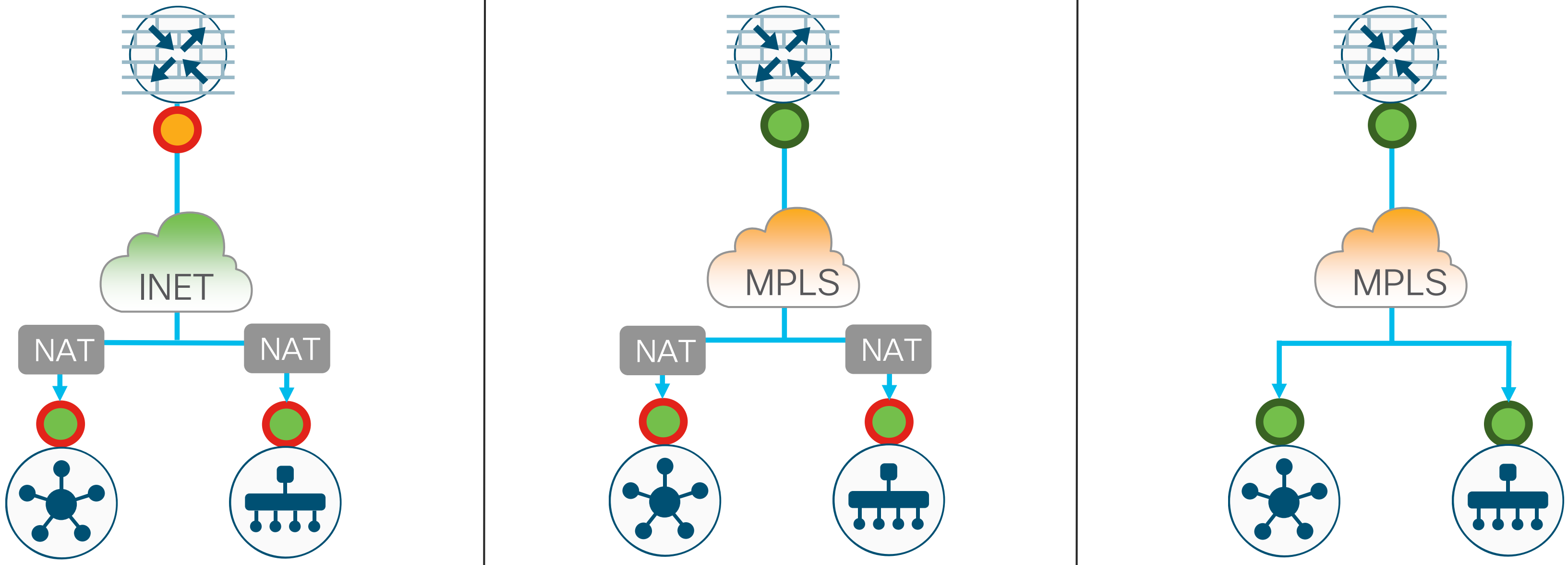
On-prem

Transport Colors and Control Connections

Local Color: Public
Controller Color: Public
Use: Public IP

Local Color: Private
Controller Color: Public
Use: Public IP

Local Color: Private
Controller Color: Private
Use: Private IP

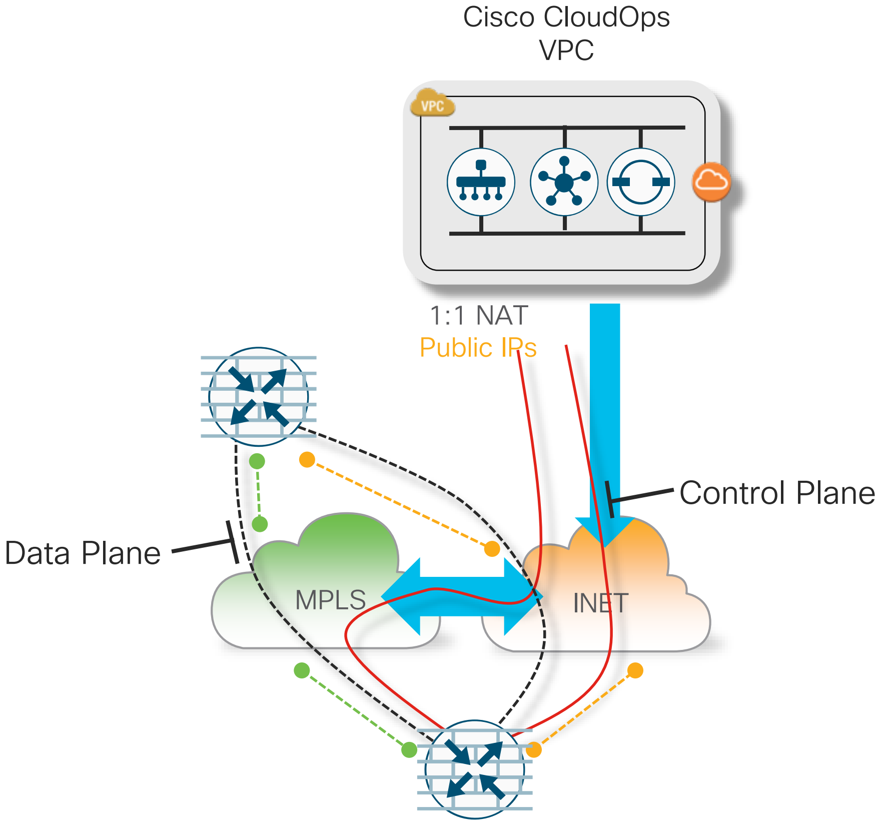


● Private IP/Port ○ Private color

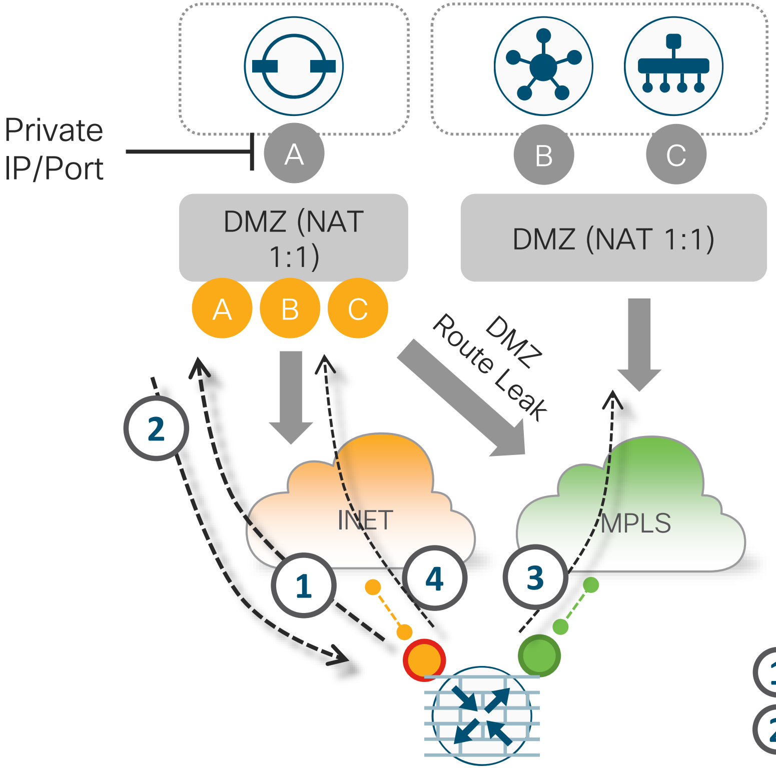
● Public IP/Port ○ Public color

Cisco Hosted Controllers over Internet

- Recommended mode of deployment
  - Spin up controllers in the cloud
  - Ease of deployment – Cisco orchestrated
  - No On-Prem design considerations
  - Easy to scale and to deliver redundancy / HA
- Provide the INET reachability via MPLS PE router to internet
  - Leak Controller Public IPs in MPLS
  - Do not make it all the way down to the branch router itself
- Control Plane Establishment to Controllers over MPLS and DT PE to Internet



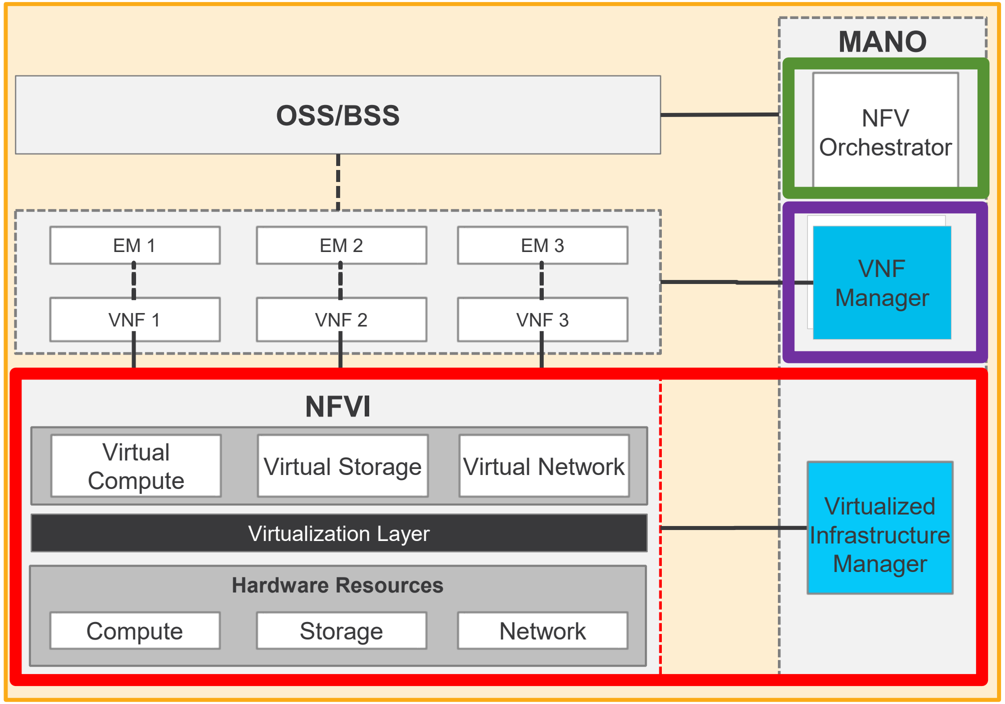
On-Prem Controllers Hybrid Deployment



- Controllers can support hybrid Private / Public transport connections
- Private transport using private IPs for communication. Prefix advertised in private domain
- Public transport using public IPs, generally assigned by provider
- Multi-homed WAN Edge capable of supporting both models concurrently

1	vBond Communication	3	MPLS Edge -> Controller Session
2	vBond Controller List	4	Internet Edge -> Controller Session

The ETSI NFV Reference Architecture



Hardware
+
Software
=
NFVI

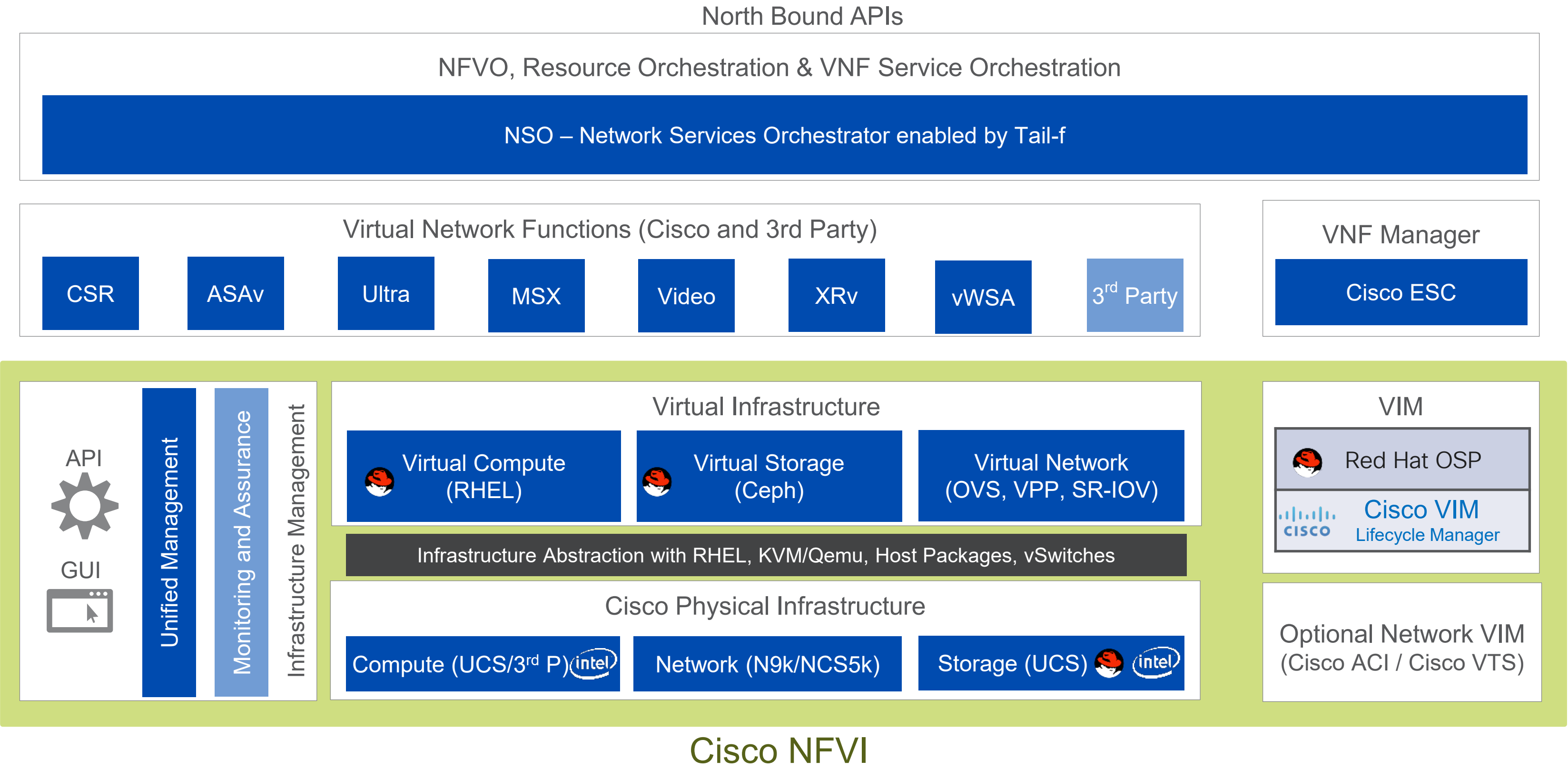
- **NFVI -** Network Function Virtualization Infrastructure is the totality of all hardware and software components that build the platform in which VNFs are deployed
- **VIM -** Virtualized Infrastructure Manager Controls and manages the NFVI compute, storage, and network resources. VIM is the NFVI software platform

Cisco NSO NFVO

Cisco ESC

Cisco VIM

Cisco NFV Solution Architecture



North Bound APIs

NFVO, Resource Orchestration & VNF Service Orchestration

NSO – Network Services Orchestrator enabled by Tail-f

Virtual Network Functions (Cisco and 3rd Party)

CSR

ASAv

Ultra

MSX

Video

XRv

vWSA

3rd Party

VNF Manager

Cisco ESC

API

GUI

Unified Management

Monitoring and Assurance

Infrastructure Management

Virtual Infrastructure

Virtual Compute (RHEL)

Virtual Storage (Ceph)

Virtual Network (OVS, VPP, SR-IOV)

Infrastructure Abstraction with RHEL, KVM/Qemu, Host Packages, vSwitches

Cisco Physical Infrastructure

Compute (UCS/3rd P) intel

Network (N9k/NCS5k)

Storage (UCS) intel

VIM

Red Hat OSP

Cisco VIM

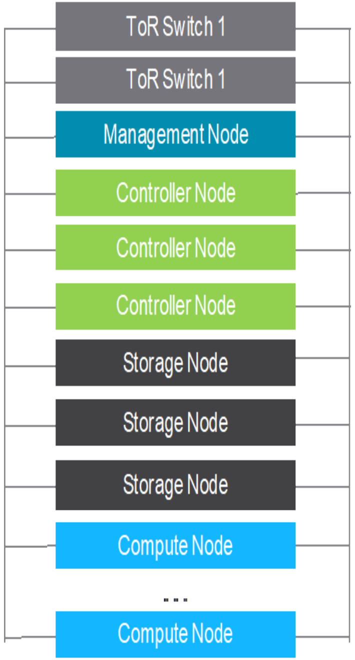
Lifecycle Manager

Optional Network VIM (Cisco ACI / Cisco VTS)

Cisco NFVI

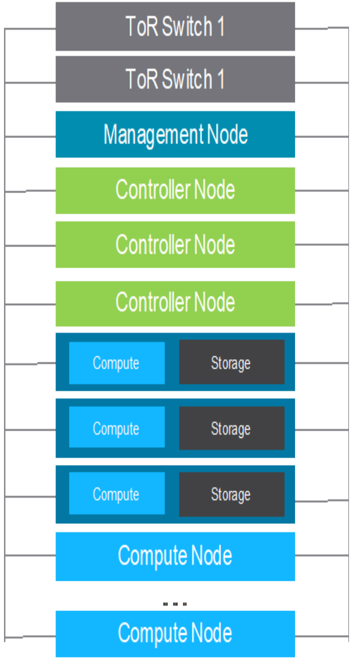
CVIM – POD Types

Full POD



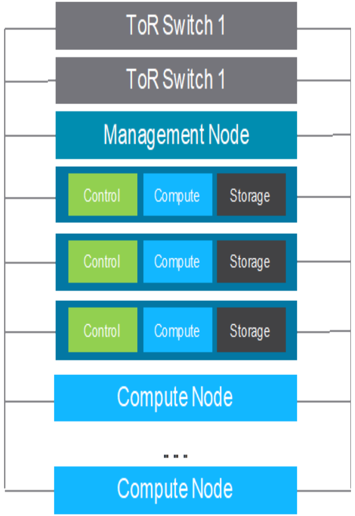
- Typical Use – Core network VNFs and applications in Central DCs
- Scales up to 128 nodes, with a max of 25 storage nodes

Hyper-Converged POD



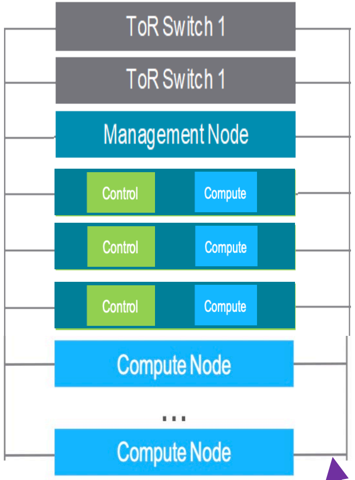
- Typical Use – Multi-access Edge Computing in Regional DCs
- Scales up to 64 nodes, with a max of 15 hyper-converged nodes

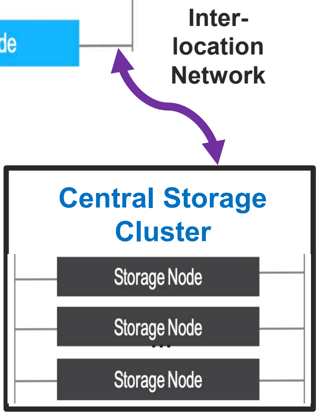
Micro POD



- Typical Use – Latency sensitive applications at Edge locations
- Scales up to 19 nodes, with a max of 16 compute-only nodes

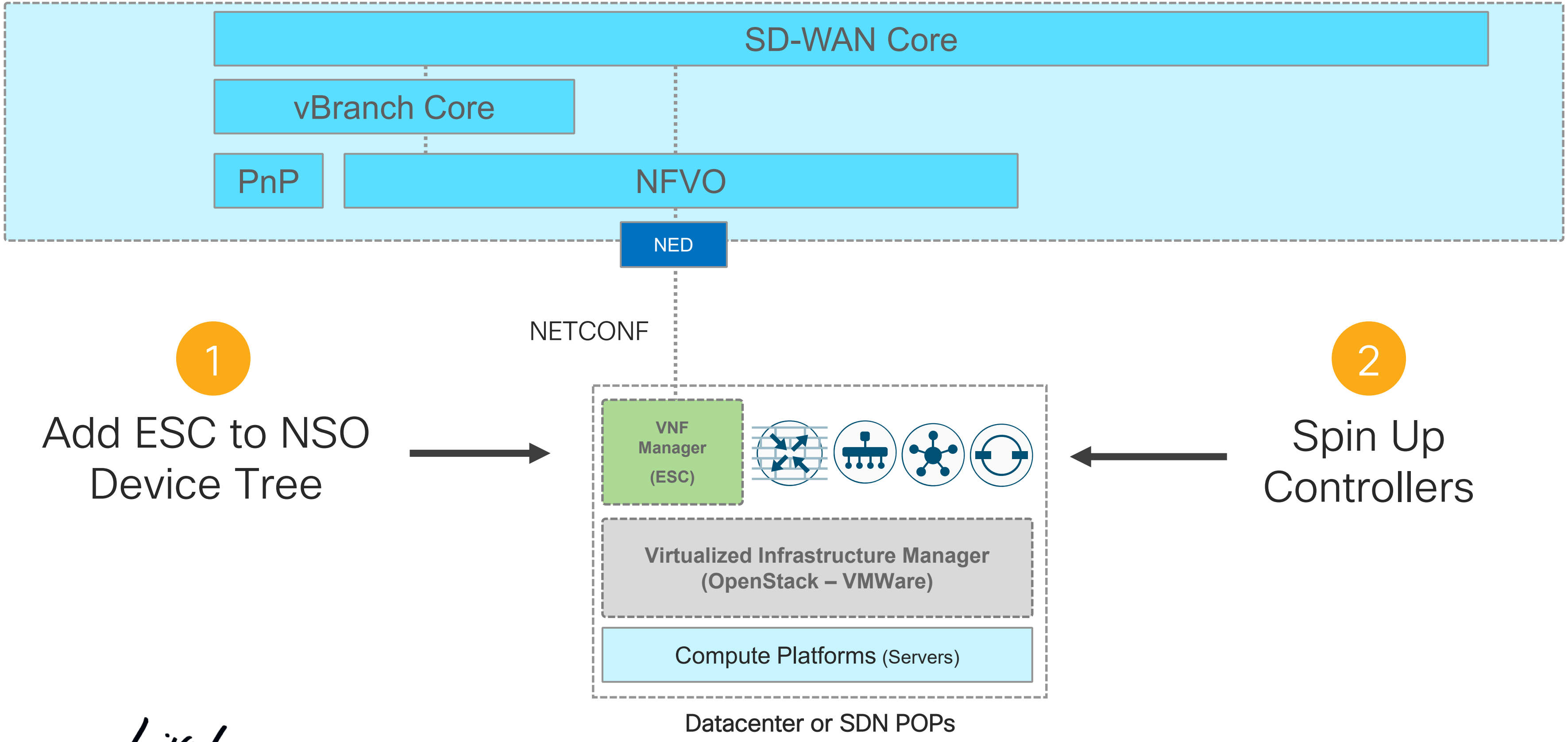
Edge POD





- Typical Use – Latency sensitive applications at Edge locations that don't require local persistent storage
- Scales up to 19 nodes, with a max of 16 compute-only nodes

Using NSO SDWAN Core Function Pack


SD-WAN Core
vBranch Core
PnP
NFVO
NED
NETCONF
1
Add ESC to NSO Device Tree
VNF Manager (ESC)
Virtualized Infrastructure Manager (OpenStack – VMWare)
Compute Platforms (Servers)
Datacenter or SDN POPs
2
Spin Up Controllers

SD-WAN Core Function Pack Building Blocks

VNFD	VNF Description
catalog	Catalog – VNFs, Platforms
NDU	vNIC / networks mapping – Service Chaining Definition
device	ENCS and vManage definitions
provider-infra	Create Provider and Assign a Catalog and vManage to be added as part of provider infrastructure
sdwan-site	Create uCPE with vEdgeCloud and additional VNFs (including 3rd party)

Add ESC to Device Tree

Using NETCONF Payload used

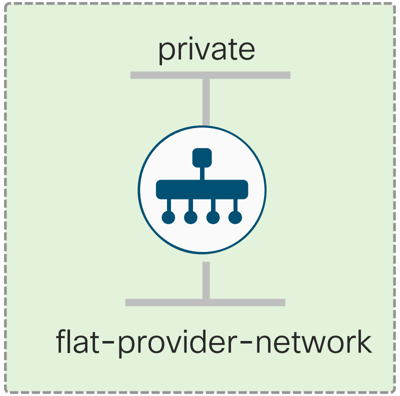
```
<config xmlns="http://tail-f.com/ns/config/1.0">
  <devices xmlns="http://tail-f.com/ns/ncs">
  <device>
    <name>esc1</name>
    <address>10.60.23.200</address>
    <port>830</port>
    <authgroup>esc-auth</authgroup>
    <device-type>
      <netconf>
      </netconf>
    </device-type>
    <state>
      <admin-state>unlocked</admin-state>
    </state>
  </device>
  </devices>
</config>
```

Create the Provider with root-cert

```
<config xmlns="http://tail-f.com/ns/config/1.0">
  <provider-infrastructure xmlns="http://com/cisco/corefpcommon">
    <provider>ProviderA</provider>
    <ca-cert xmlns="http://com/cisco/nso/corefp/sdwan/vedge">-----BEGIN CERTIFICATE-----
MIIDijCCAnKgAwIBAgIBATANBgkqhkiG9w0BAQUFADB5MQswCQYDVQQGEwJVUzEL

[SNIP]

pHYqJD27D4KBakKzDX94fLBQ97Br9XmHrWRatglsUc9Njta1Zr/zNvVJYP7qOg==
-----END CERTIFICATE-----</ca-cert>
    <catalog xmlns="http://cisco.com/ns/branch-infra-common">Gold</catalog>
    <catalog xmlns="http://com/cisco/corefpcommoncatalog">CatalogEsc</catalog>
    <vbond-ipaddress xmlns="http://com/cisco/nso/corefp/sdwan">172.23.80.43</vbond-ipaddress>
    <vbond-port xmlns="http://com/cisco/nso/corefp/sdwan">12345</vbond-port>
    <alias xmlns="http://com/cisco/nso/corefp/sdwan/vedge">ADT Labs Paris</alias>
  </provider-infrastructure>
</config>
```

NDU – Mapping Controllers vNIC / Network

vControllers NDU



```
<config xmlns="http://tail-f.com/ns/config/1.0">
  <ndus xmlns="http://com/cisco/nso/corefp/sdwan">
    <name>sdwan_ESC_vController_ndu</name>
    <network>
      <name>flat-provider-network</name>
    </network>
    <network>
      <name>private</name>
    </network>
    <nic>
      <id>0</id>
      <network>flat-provider-network</network>
    </nic>
    <nic>
      <id>1</id>
      <network>private</network>
    </nic>
  </ndus>
</config>
```

eth0 – vpn512

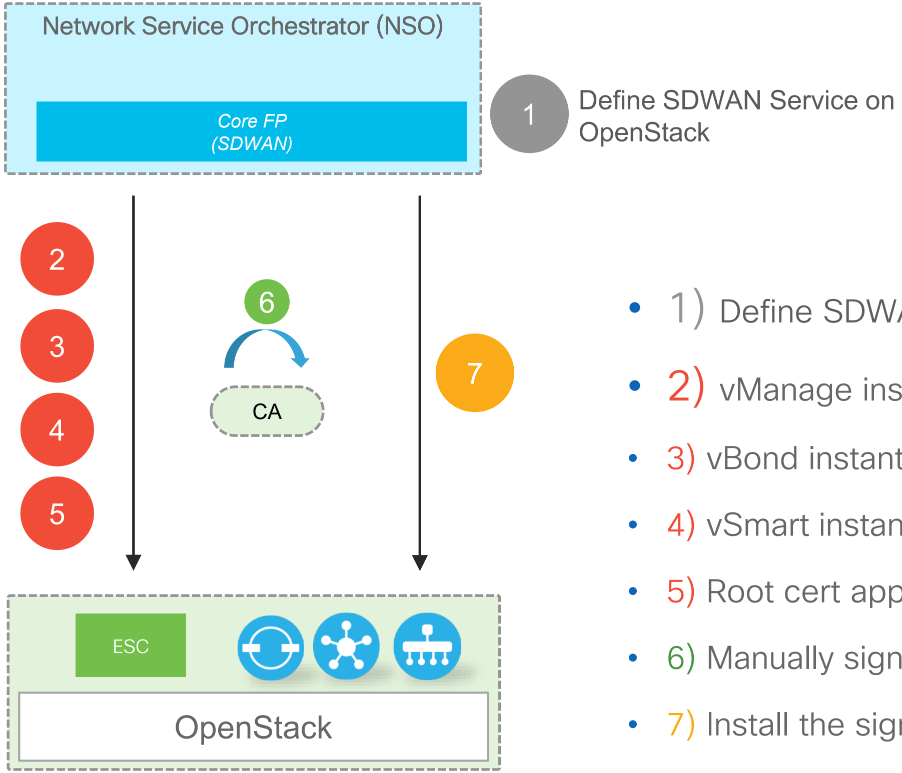
ge0/0 – vpn0

Spin up vManage, vBond, vSmart one by one

```
<config xmlns="http://tail-f.com/ns/config/1.0">
   <sdwan-site xmlns="http://com/cisco/nso/corefp/sdwan">
      <site-name>vmanage-site</site-name>
      <provider>ProviderA</provider>
      <infrastructure>
         <type>esc</type>
         <esc>
            <name>esc1</name>
         </esc>
      </infrastructure>
      <member-vnfs>
         <vnf>esc-vmanage123</vnf>
         <type>vController</type>
         <username>admin</username>
         <password>admin</password>
         <deployment>vManageDeployment</deployment>
         <vnfd>vManage</vnfd>
         <vdu>vManage</vdu>
         <ip>172.23.80.40</ip>
         <mask>255.255.255.0</mask>
         <gtw>172.23.80.1</gtw>
         <host-name>iamvmanage</host-name>
         <day-0>
            <cfg-file>vmanage_day0_template.cfg</cfg-file>
         </day-0>
```

```
         <vController>
            <personality>vManage</personality>
            <system-ip>10.10.10.4</system-ip>
            <site-id>720</site-id>
         </vController>
         <ndu>
            <ndu-id>sdwan_ESC_vController_ndu</ndu-id>
            <management>0</management>
         </ndu>
      </member-vnfs>
   </sdwan-site>
</config>
```

Controllers Provisioning



Network Service Orchestrator (NSO)
Core FP
(SDWAN)
1
Define SDWAN Service on OpenStack
2
3
4
5
6
CA
7
ESC
OpenStack

- 🟠 Value added services provided by sdwan
- 🔵 Viptela callback activity
- 🔴 Virtual device infra
- 🟢 External System

- 1) Define SDWAN Service payload
- 2) vManage instantiated with day-0 file and added to the device tree
- 3) vBond instantiated with day-0 file and added to vManage
- 4) vSmart instantiated with day-0 file and added to vManage
- 5) Root cert applied and CSRs generated for all controllers
- 6) Manually sign the certificates with the certificate server
- 7) Install the signed certificates using install-certificate action

Add vManage Device into the Device Tree

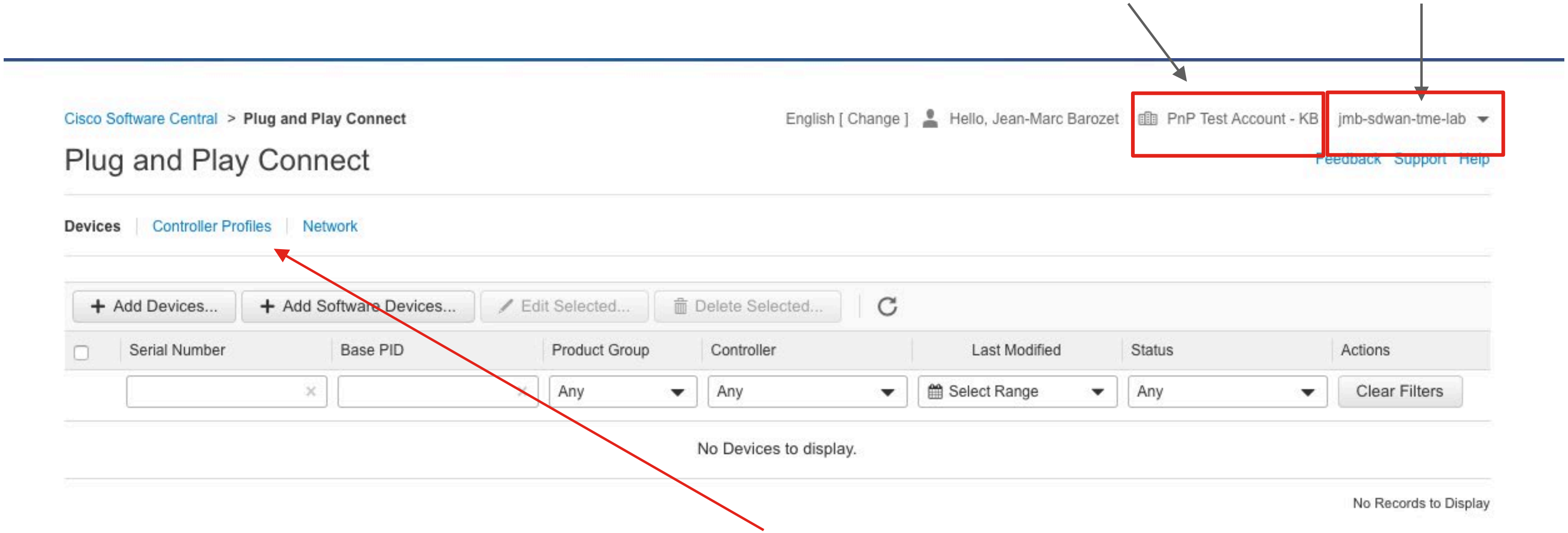
```
<devices xmlns="http://tail-f.com/ns/ncs">

<!-- vManage -->

  <device>
    <name>vmanage-1</name>
    <address>10.60.23.133</address>
    <port>8443</port>
    <authgroup>vmanage-auth</authgroup>
    <device-type>
      <generic>
        <ned-id xmlns:viptela-vmanage-id="http://tail-f.com/ned/viptela-vmanage-id">viptela-vmanage-id:viptela-vmanage</ned-id>
      </generic>
    </device-type>
    <connect-timeout>30</connect-timeout>
    <read-timeout>30</read-timeout>
    <write-timeout>30</write-timeout>
    <trace>raw</trace>
    <ned-settings>
      <viptela-vmanage xmlns="http://tail-f.com/ned/viptela-vmanage/meta">
        <connection>
          <ssl>
            <accept-any/>
          </ssl>
          <api-base-url>/dataservice</api-base-url>
        </connection>
      </viptela-vmanage>
    </ned-settings>
    <state>
      <admin-state>unlocked</admin-state>
    </state>
  </device>

</devices>
```

Plug and Play Connect Portal

https://software.cisco.com/#module/pnp

Smart Account (SA)

Virtual Account (VA)



Cisco Software Central > **Plug and Play Connect**

English [Change] Hello, Jean-Marc Barozet PnP Test Account - KB jmb-sdwan-tme-lab

Feedback Support Help

Plug and Play Connect

Devices | Controller Profiles | Network

+ Add Devices... | + Add Software Devices... | Edit Selected... | Delete Selected...

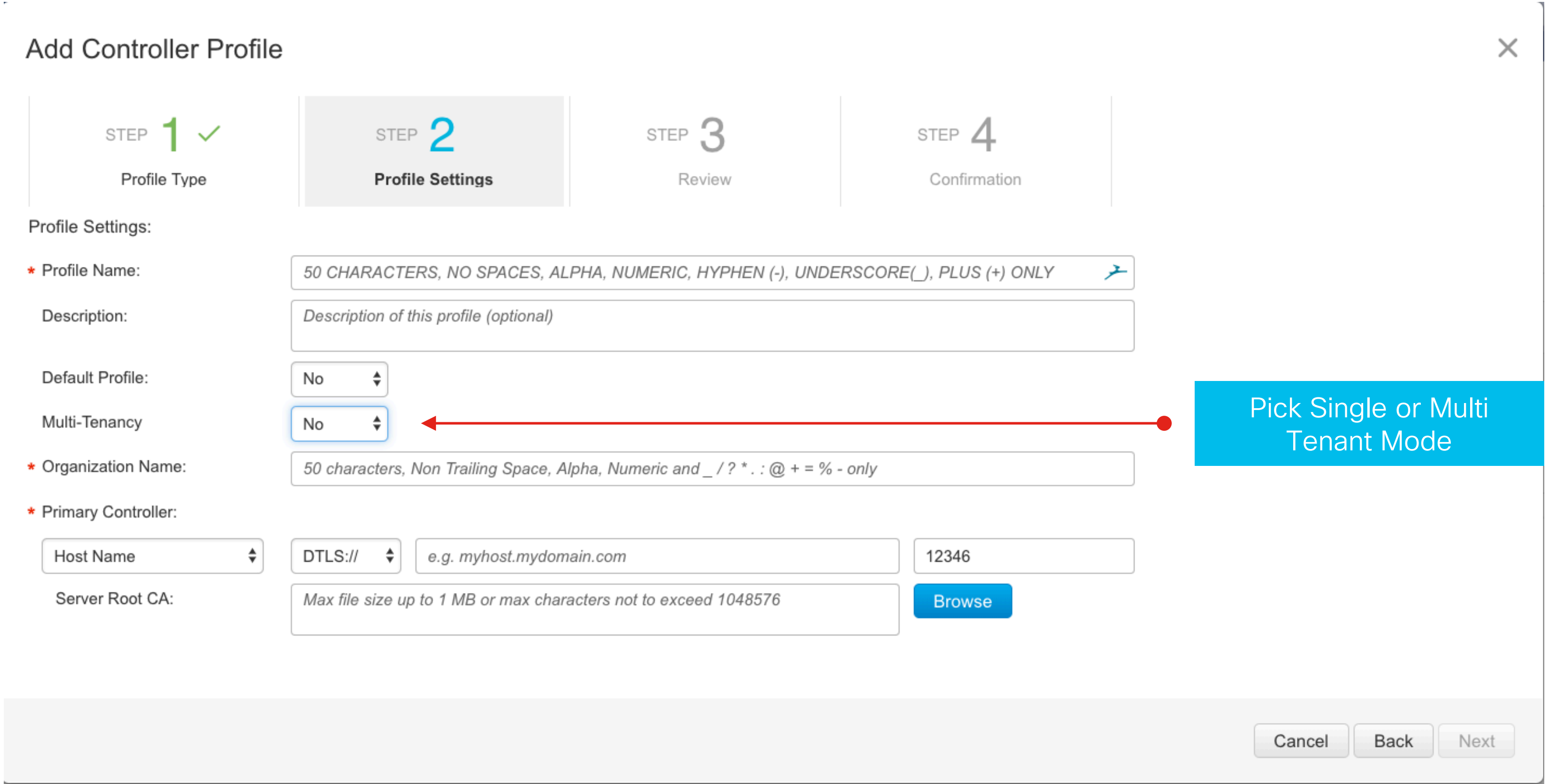
□	Serial Number	Base PID	Product Group	Controller	Last Modified	Status	Actions
			Any	Any	Select Range	Any	Clear Filters

No Devices to display.

No Records to Display

Click here to add On-Prem Controllers

Single Tenant Mode



Add Controller Profile

Profile Settings:

* Profile Name: 50 CHARACTERS, NO SPACES, ALPHA, NUMERIC, HYPHEN (-), UNDERSCORE(_), PLUS (+) ONLY

Description: Description of this profile (optional)

Default Profile: No

Multi-Tenancy: No

* Organization Name: 50 characters, Non Trailing Space, Alpha, Numeric and _ / ? * . : @ + = % - only

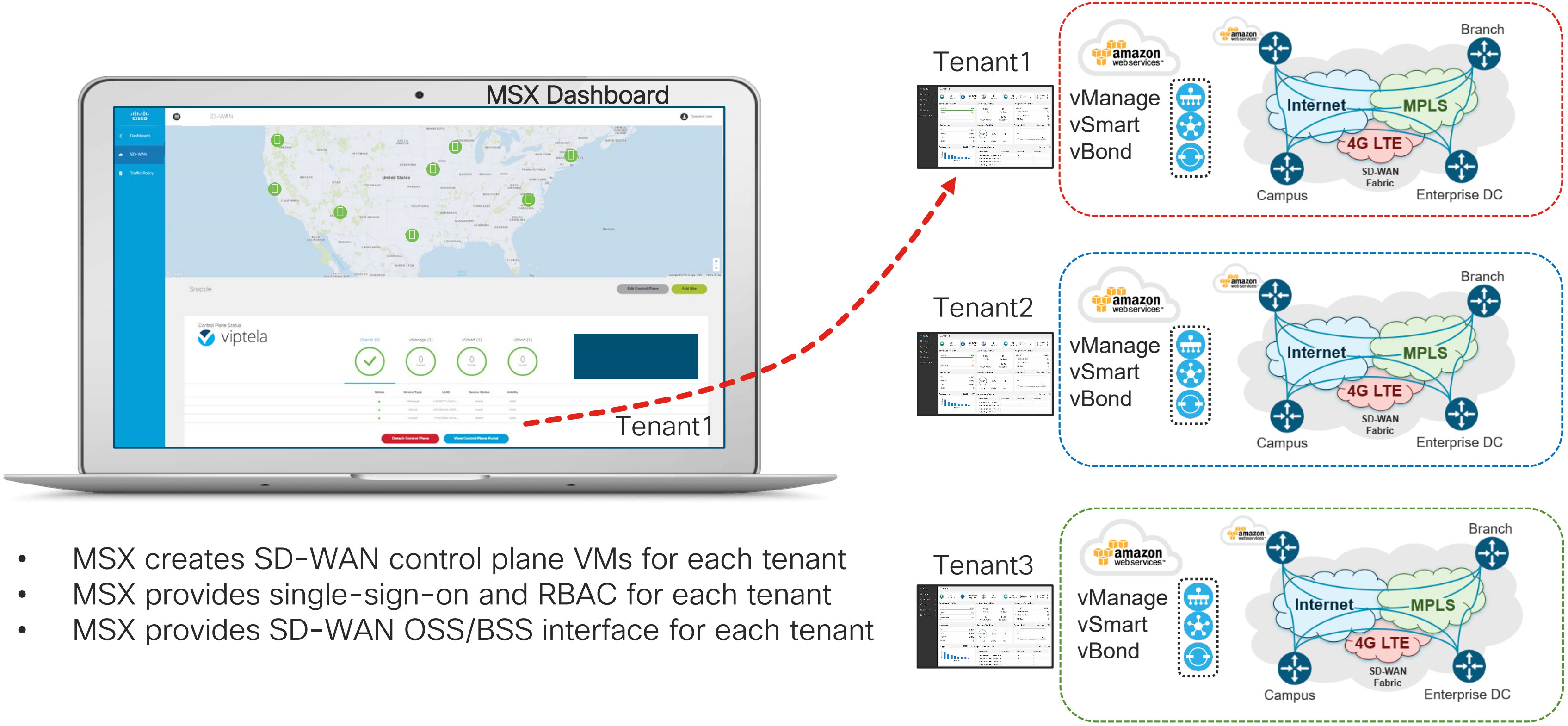
* Primary Controller:

Host Name | DTLS:// | e.g. myhost.mydomain.com | 12346

Server Root CA: Max file size up to 1 MB or max characters not to exceed 1048576

Pick Single or Multi Tenant Mode

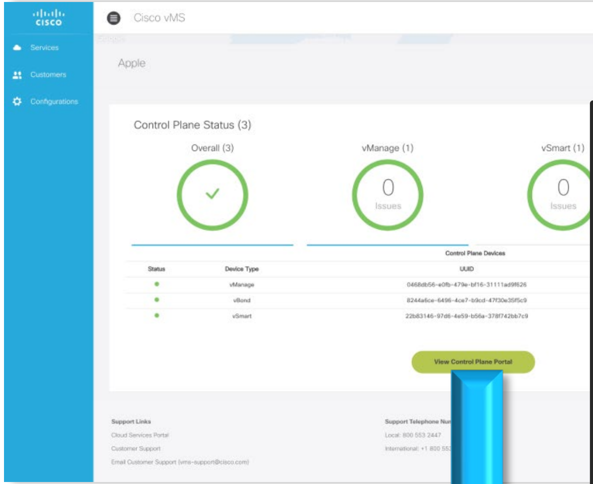
MSX creates and manages SD-WAN Control Planes for 100's of tenants



- MSX creates SD-WAN control plane VMs for each tenant
- MSX provides single-sign-on and RBAC for each tenant
- MSX provides SD-WAN OSS/BSS interface for each tenant

Launch vManage for a specific Tenant

Simply with a single click from MSX



Cisco vMS

Operator User

Services

Customers

Configurations

Apple

Add Control Plane

Add Site

Control Plane Status (3)

Overall (3)

vManage (1)
0
Issues

vSmart (1)
0
Issues

Control Plane Devices

Status	Device Type	UUID
●	vManage	0468db56-e0fb-479e-bf16-31111ad9f626
●	vBond	8244a6ce-6496-4ce7-b9cd-47f30e35f5c9
●	vSmart	22b83146-97d6-4e59-b56a-378f742bb7c9

View Control Plane Portal

Support Links

Cloud Services Portal

Customer Support

Email Customer Support (vms-support@cisco.com)

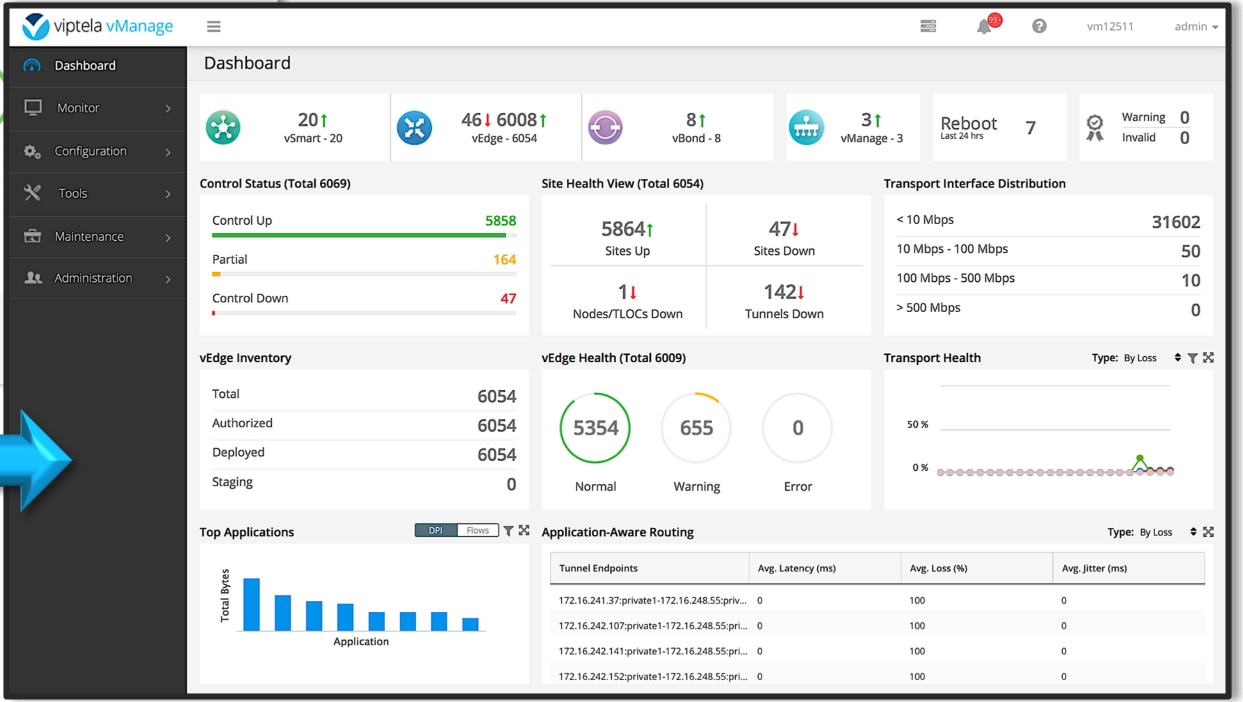
Support Telephone Nu

Local: 800 553 2447

International: +1 800 553

MSX can cross launch to the vManage for a Viptela tenant with a simple click of a button ☺

MSX Tenants are simply mapped to Viptela Controllers: vManage, vSmart, vBond



Dashboard

20↑ vSmart - 20

46↓ 6008↑ vEdge - 6054

8↑ vBond - 8

3↑ vManage - 3

Reboot Last 24 hrs 7

Warning 0

Invalid 0

Control Status (Total 6069)

Control Up	5858
Partial	164
Control Down	47

Site Health View (Total 6054)

5864↑ Sites Up

47↓ Sites Down

1↓ Nodes/TLOCs Down

142↓ Tunnels Down

Transport Interface Distribution

< 10 Mbps	31602
10 Mbps - 100 Mbps	50
100 Mbps - 500 Mbps	10
> 500 Mbps	0

vEdge Inventory

Total	6054
Authorized	6054
Deployed	6054
Staging	0

vEdge Health (Total 6009)

5354 Normal

655 Warning

0 Error

Transport Health

Type: By Loss

Top Applications

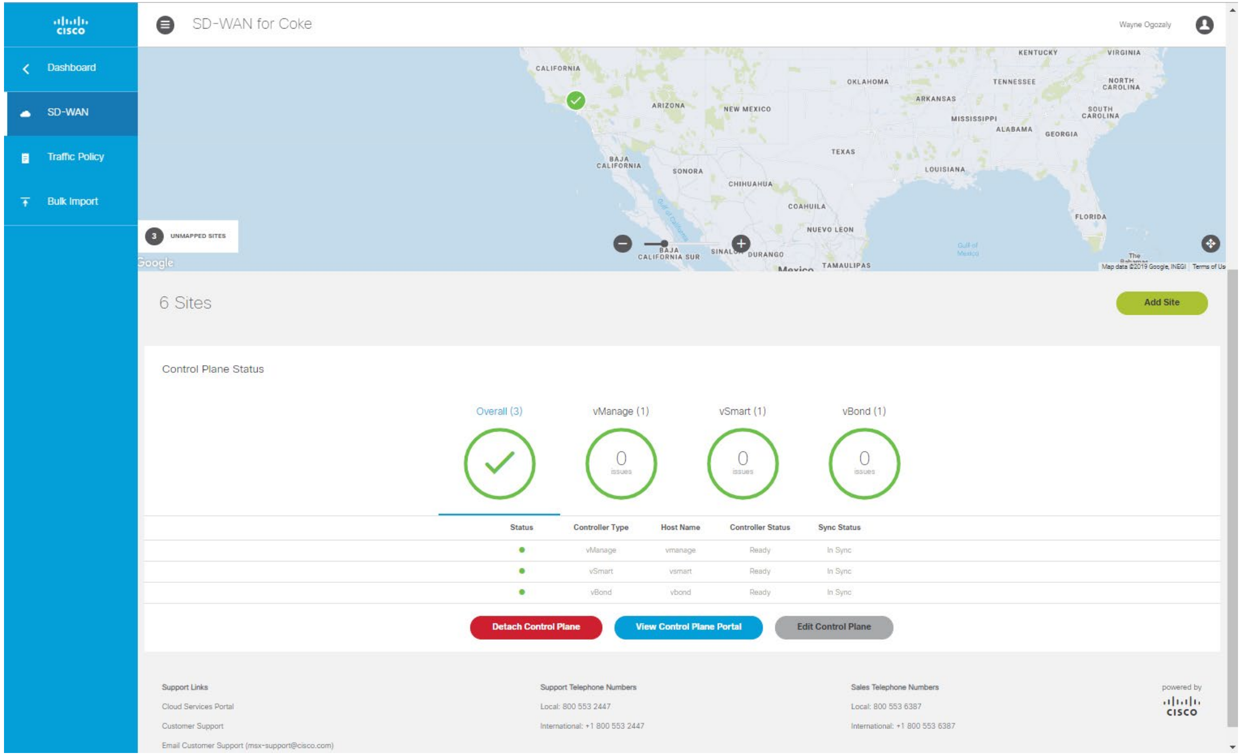
Application-Aware Routing

Type: By Loss

Tunnel Endpoints	Avg. Latency (ms)	Avg. Loss (%)	Avg. Jitter (ms)
172.16.241.37:private1-172.16.248.55:priv...	0	100	0
172.16.242.107:private1-172.16.248.55:pri...	0	100	0
172.16.242.141:private1-172.16.248.55:pri...	0	100	0
172.16.242.152:private1-172.16.248.55:pri...	0	100	0

cisco Live!

Attach to an existing SD-WAN Control Plane



6 Sites

Control Plane Status

Overall (3) ✓ — vManage (1) 0 issues — vSmart (1) 0 issues — vBond (1) 0 issues

Status	Controller Type	Host Name	Controller Status	Sync Status
●	vManage	vmanage	Ready	In Sync
●	vSmart	vsmart	Ready	In Sync
●	vBond	vbond	Ready	In Sync

Support Links
Cloud Services Portal
Customer Support
Email Customer Support (msx-support@cisco.com)

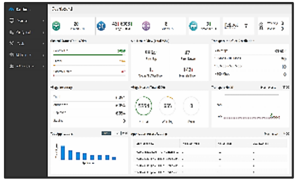
Support Telephone Numbers
Local: 800 553 2447
International: +1 800 553 2447

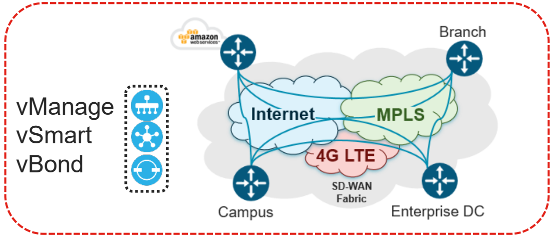
Sales Telephone Numbers
Local: 800 553 6387
International: +1 800 553 6387

powered by cisco

Tenant1 SD-WAN service up and running, bring Tenant1 under MSX mgt

Tenant1





Attach an existing SD-WAN customer to MSX using a simple workflow

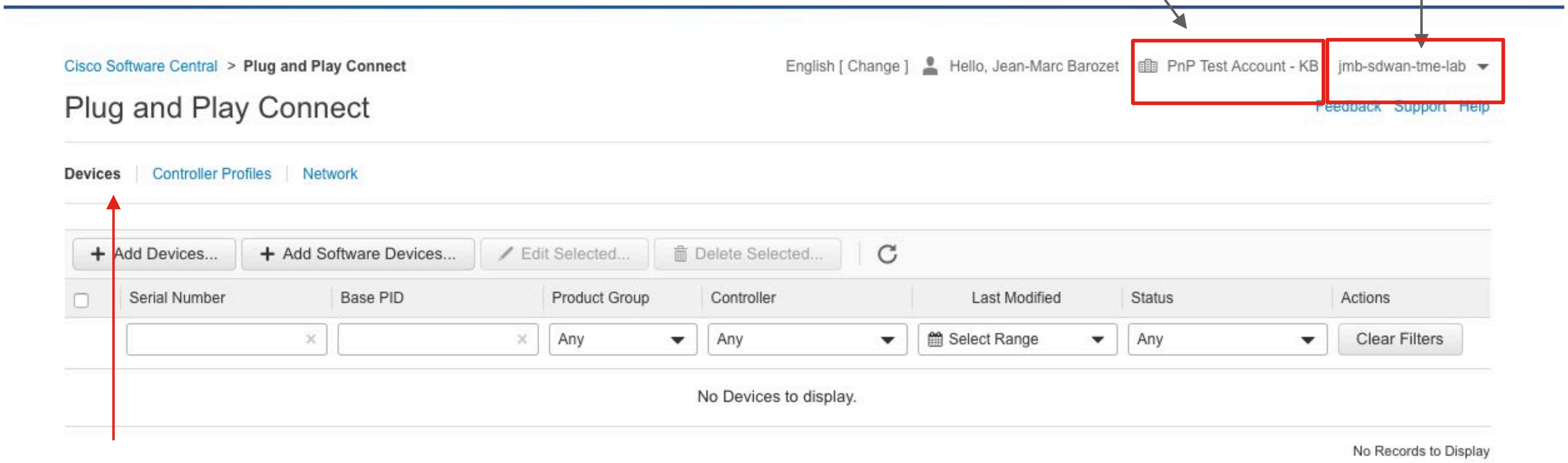
On-Boarding Hardware Devices

Plug and Play Connect Portal

https://software.cisco.com/#module/pnp

Smart Account (SA)

Virtual Account (VA)



Cisco Software Central > **Plug and Play Connect**

English [Change] Hello, Jean-Marc Barozet PnP Test Account - KB jmb-sdwan-tme-lab

Feedback Support Help

Plug and Play Connect

Devices | Controller Profiles | Network

+ Add Devices... + Add Software Devices... Edit Selected... Delete Selected...

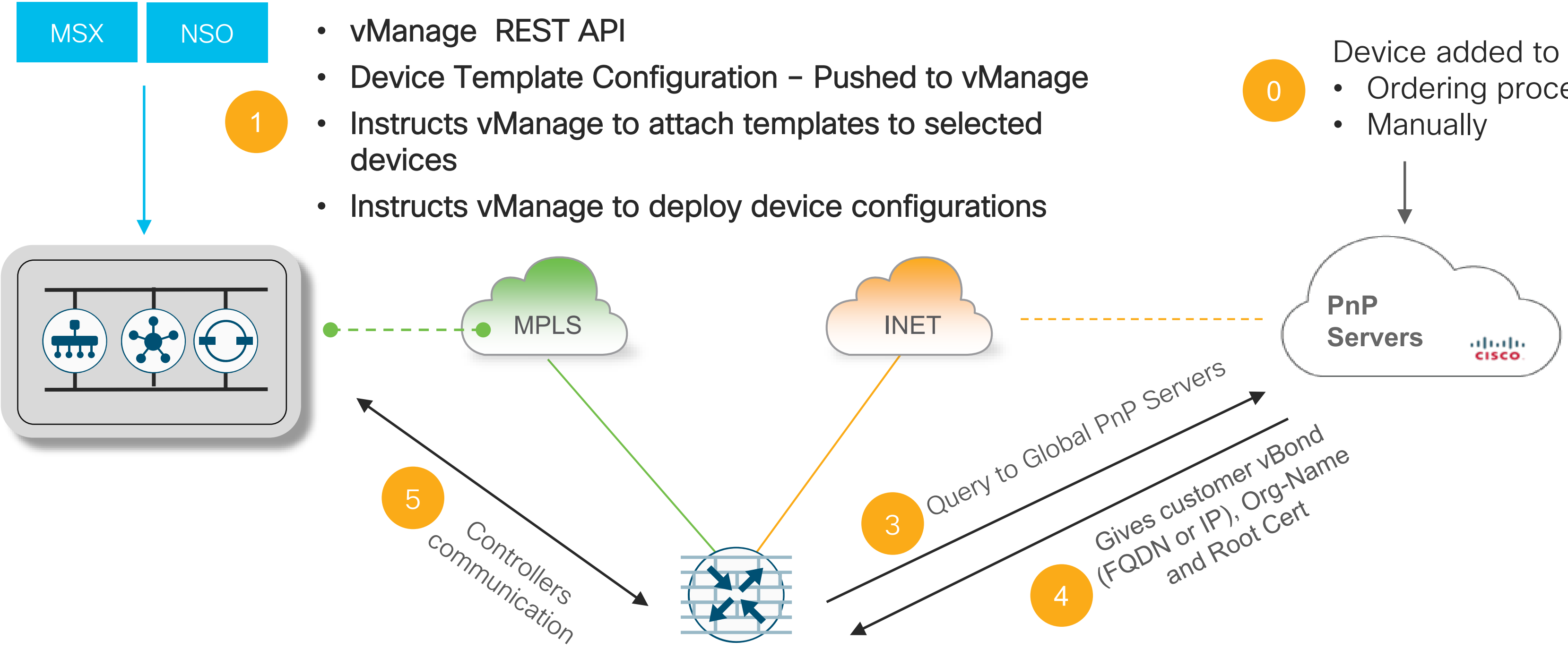
□	Serial Number	Base PID	Product Group	Controller	Last Modified	Status	Actions
			Any	Any	Select Range	Any	Clear Filters

No Devices to display.

No Records to Display

Click here to manually
add devices

On Boarding using Global PnP – Overview



1

- vManage REST API
- Device Template Configuration – Pushed to vManage
- Instructs vManage to attach templates to selected devices
- Instructs vManage to deploy device configurations

0 Device added to PnP:

- Ordering process
- Manually

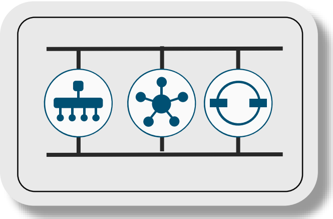
2 The router contacts a DHCP server and receives its IP address from the server. Resolves devicehelper.cisco.com

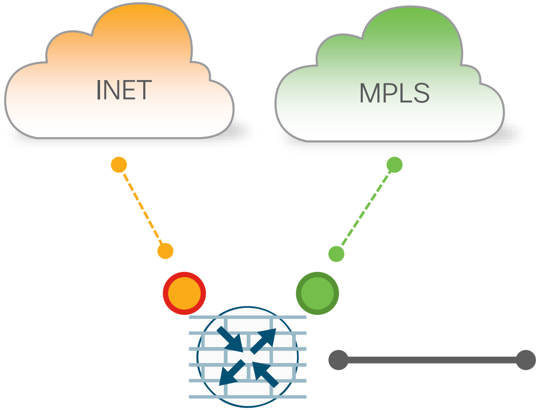
3 Query to Global PnP Servers

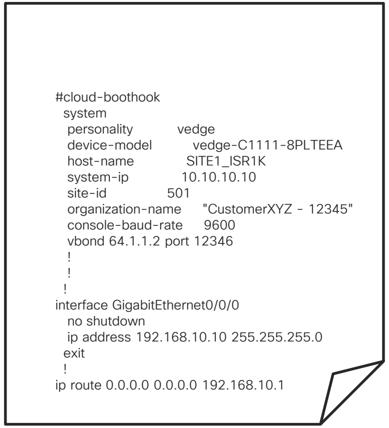
4 Gives customer vBond (FQDN or IP), Org-Name and Root Cert

5 Controllers communication

Using Bootstrap Config







```
#cloud-boothook
 system
  personality          vedge
  device-model          vedge-C1111-8PLTEEA
  host-name            SITE1_ISR1K
  system-ip            10.10.10.10
  site-id           501
  organization-name      "CustomerXYZ - 12345"
  console-baud-rate      9600
  vbond 64.1.1.2 port 12346
  !
  !
 !
interface GigabitEthernet0/0/0
  no shutdown
  ip address 192.168.10.10 255.255.255.0
 exit
 !
ip route 0.0.0.0 0.0.0.0 192.168.10.1
```

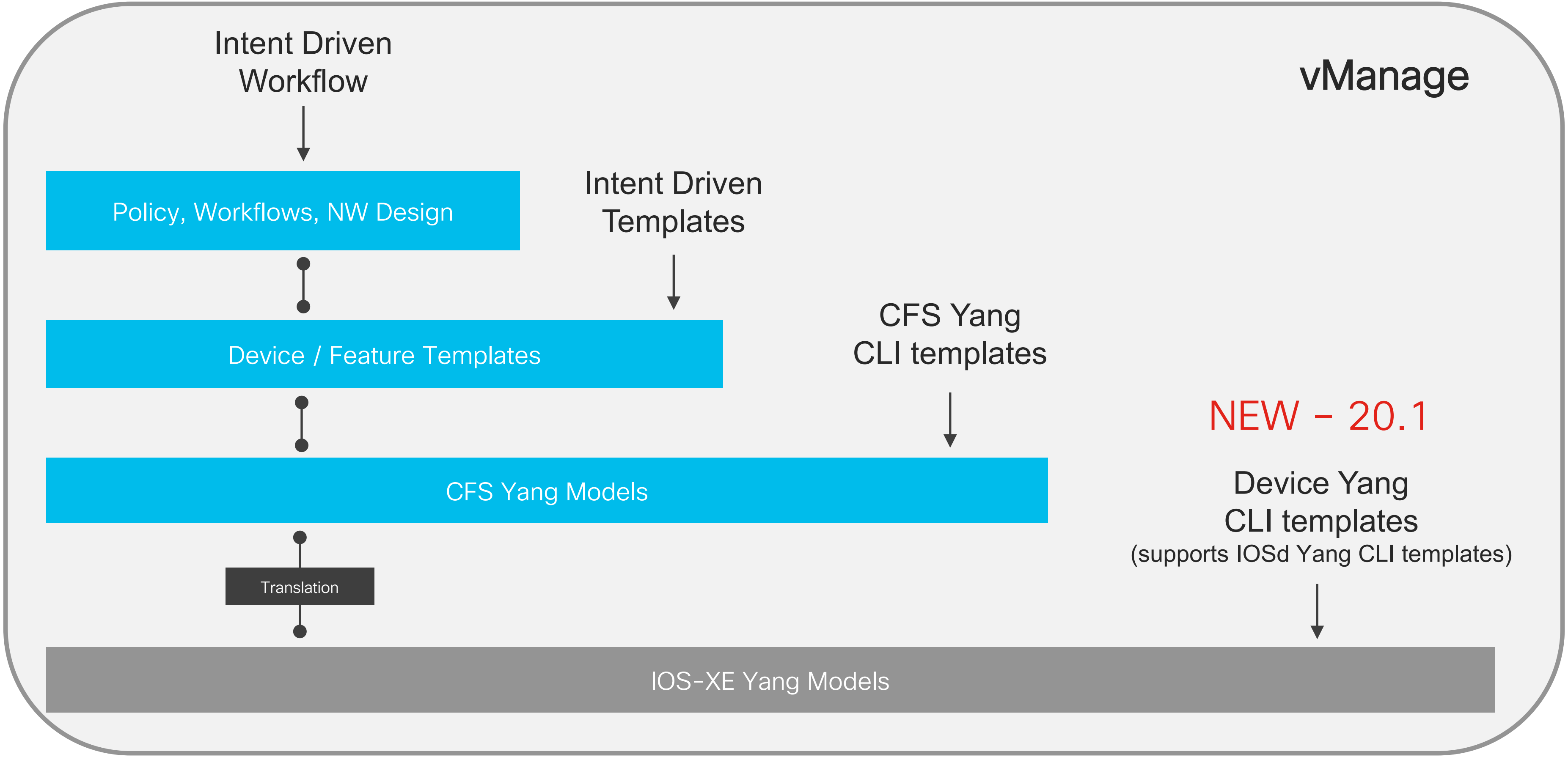
https://sdwan-docs.cisco.com/Product_Documentation/Getting_Started/Hardware_and_Software_Installation/On-Site_Bootstrap_Process_for_SD-WAN_Devices

- Supported on SD-WAN XE only
- DHCP is not enabled on CE to PE link (MPLS transport)
- Upon bootup, SD-WAN XE router will search bootflash: or usbflash: for filename:
  - ciscosdwan.cfg (ISR1k, ISR4k, ASR1k)
  - ciscosdwan_cloud_init.cfg (ASR1002X)
- Config file (which includes basic interface configuration, Root CA, Organization Name, vBond information, etc.) is fed into the PnP process
- Router has all required information to connect to vBond

Notes on CLI Template

- Always create a Device Template (even a basic one) and apply to the device UUID you want to deploy
- CLI Templates:
  - CLI Templates can be attached to vEdge/cEdge routers
  - Variables are used for rapid bulk configuration rollout with unique per-device settings
  - Local configuration changes are not allowed
- For cEdge
  - vEdge like CLI style with documentation for comparable cEdge configuration
  - IOS-XE CLI Template support coming (March CY20)

cEdge Configuration – vManage Interfaces



vManage

Intent Driven Workflow

Policy, Workflows, NW Design

Intent Driven Templates

Device / Feature Templates

CFS Yang CLI templates

CFS Yang Models

Translation

NEW – 20.1

Device Yang CLI templates (supports IOSd Yang CLI templates)

IOS-XE Yang Models

Using NSO – Create Device Template

- Create a Device Template
- Pushed to vManage using vManage NED (REST API)

```
<sdwan-template xmlns="http://com/cisco/nso/corefp/sdwan/template">
  <id>nso-vedge-branch</id>
  <provider>Provider-Customer1</provider>
  <tenant>SingleTenant</tenant>
  <description>vEdge Branch</description>
  <configuration>system
 host-name                {{HOSTNAME}}
 system-ip                {{SYSTEM_IP}}
 site-id                  {{SITE_ID}}
 admin-tech-on-failure
 no route-consistency-check
 sp-organization-name     "{{SPORGNAME}}"
 organization-name        "{{ORGNAME}}"
 vbond 10.60.23.134
 aaa
  auth-order local radius tacacs
  usergroup basic
   task system read write
   task interface read write
  !
  usergroup netadmin
  !

[SNIP]

</configuration>
  <alias>nso-vedge-branch</alias>
</sdwan-template>
```

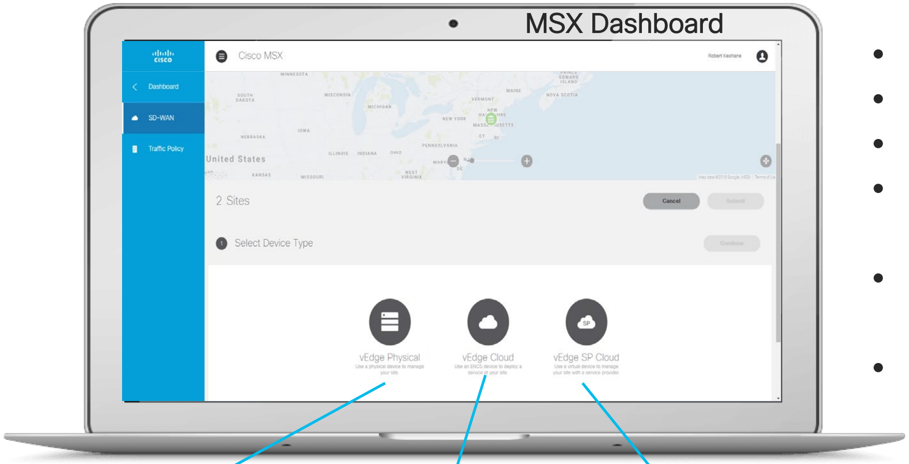
NSO – Attach Device Template

- Attach Device Template to a device using its UUID
- Pushed to vManage using vManage NED (REST API)

```
<sdwan-apply-template xmlns="http://com/cisco/nso/corefp/sdwan/template">
  <id>vEdgeParis</id>
  <provider>Provider-Customer1</provider>
  <tenant>SingleTenant</tenant>
  <uuid>01ee8315-415d-5030-b58b-ef3db0a63fef</uuid>
  <template>nso-vedge-branch</template>
  <variables>
    <name>HOSTNAME</name>
    <value>vEdgeParis</value>
  </variables>
  <variables>
    <name>SYSTEM_IP</name>
    <value>10.0.0.91</value>
  </variables>
  <variables>
    <name>SITE_ID</name>
    <value>9</value>
  </variables>
  <variables>
    <name>ORGNAME</name>
    <value>ADT Labs Paris</value>
  </variables>
 <variables>
    <name>SPORGNAME</name>
    <value>ADT Labs Paris</value>
  </variables>
</sdwan-apply-template>
```

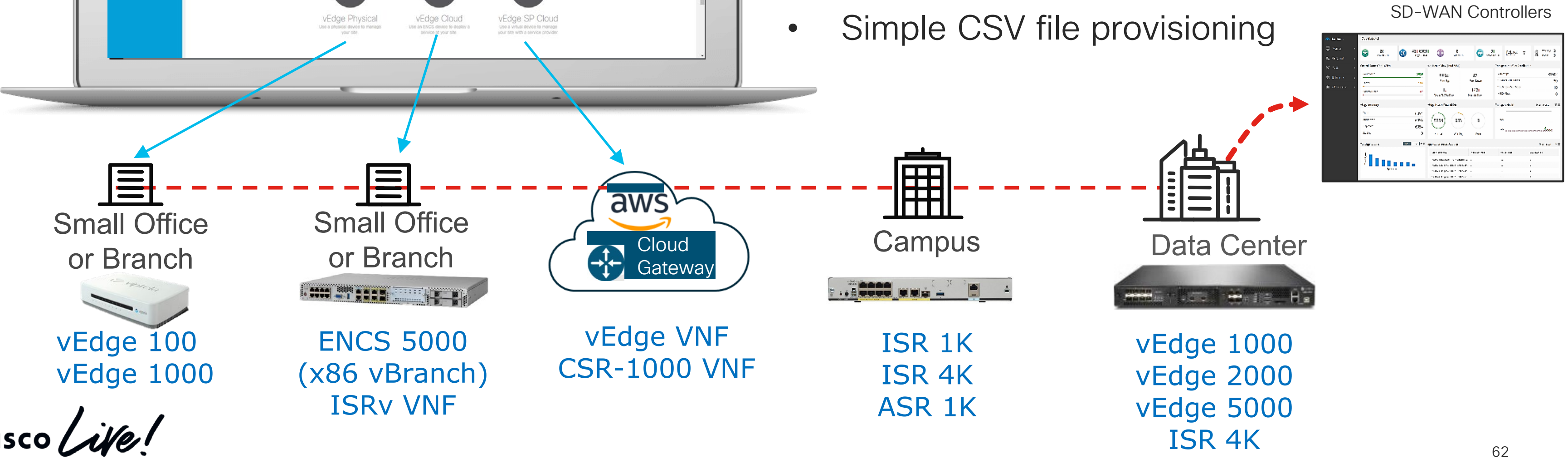
MSX - on-board SD-WAN devices

Physical and virtual


MSX Dashboard

- On-board SD-WAN physical devices
- On-board SD-WAN VNFs in virtual branches
- On-board SD-WAN VNFs in the Cloud
- Manage licenses, images, secure mgt tunnels

- Register devices with correct SD-WAN Control Plane for each tenant
- Simple CSV file provisioning



vEdge 100
vEdge 1000

ENCS 5000
(x86 vBranch)
ISRv VNF

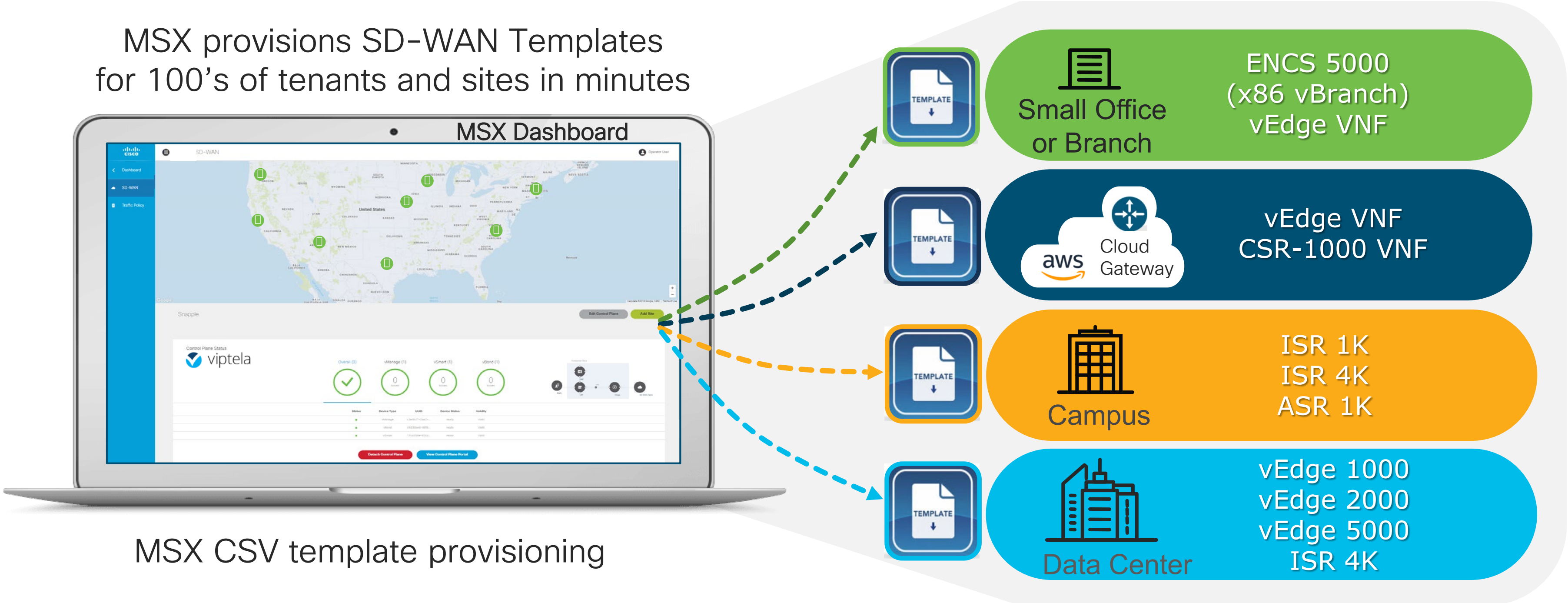
vEdge VNF
CSR-1000 VNF

ISR 1K
ISR 4K
ASR 1K

vEdge 1000
vEdge 2000
vEdge 5000
ISR 4K

MSX provides simple site provisioning using SD-WAN templates and CSV Files

MSX provisions SD-WAN Templates for 100’s of tenants and sites in minutes



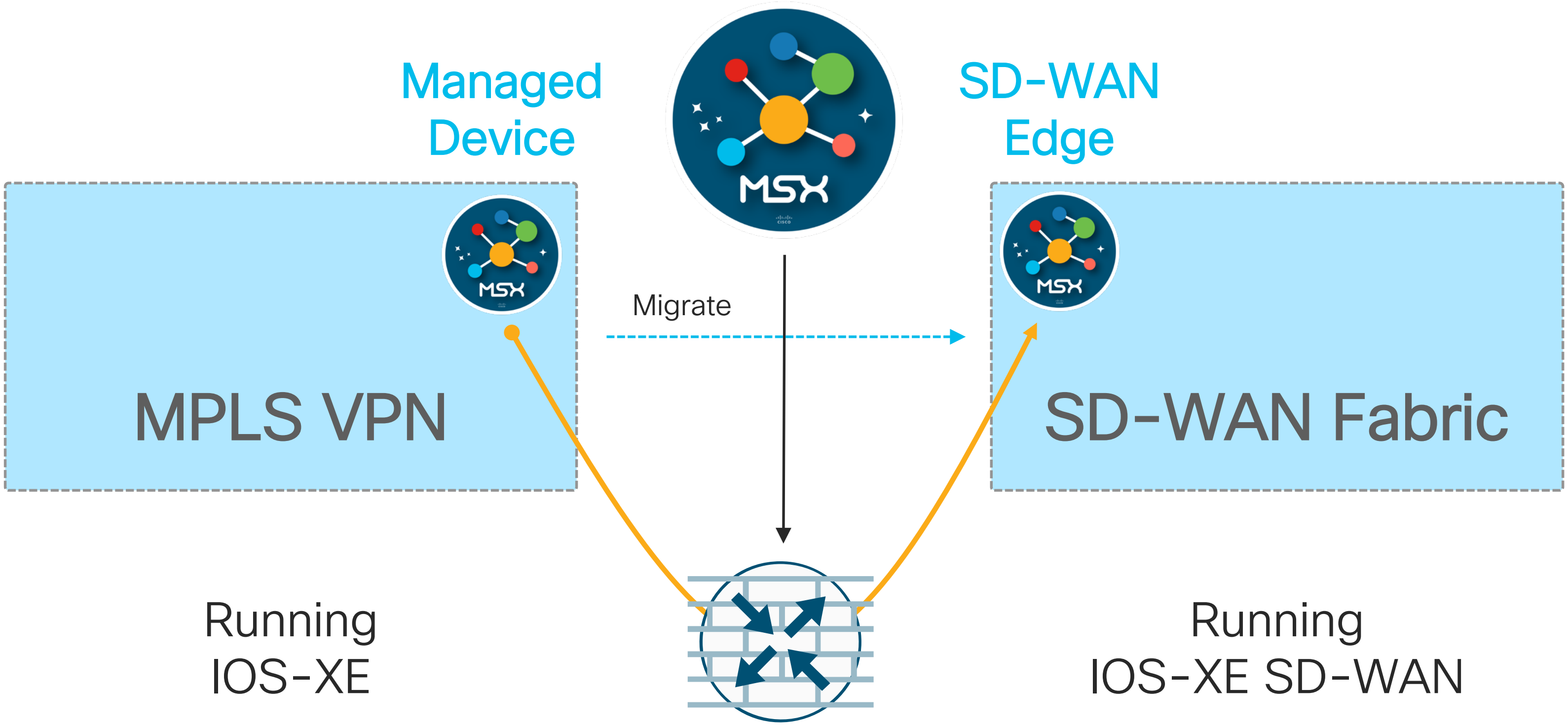
MSX CSV template provisioning

MSX simplifies multi-tenant SD-WAN provisioning from the Cloud

MSX Device Templates ”Blueprints”

- New - Store device templates in MSX inventory and push them to vManage
- Template re-use across tenants
- Pull a vManage template into MSX and then push it as a new template into another vManage

Migrating Legacy Site to SD-WAN



Managed Device

SD-WAN Edge

MPLS VPN

SD-WAN Fabric

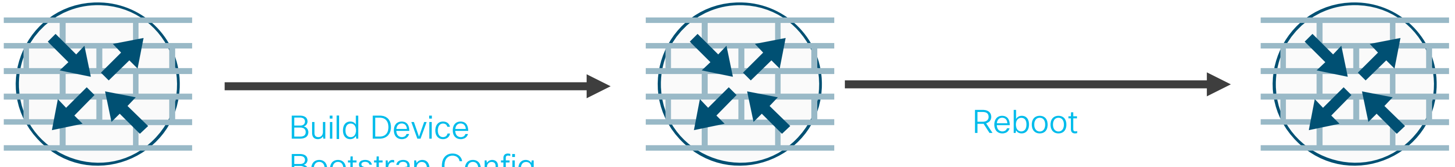
Running IOS-XE

Running IOS-XE SD-WAN

MSX Workflow Driven

Migrating Legacy Site to SD-WAN

Without Global PnP



IOS-XE

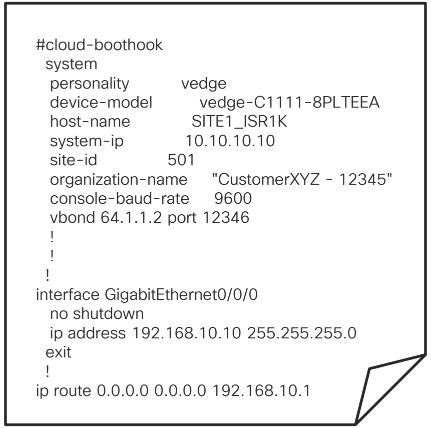
Build Device Bootstrap Config and download to router flash

IOS-XE

Reboot

IOS-XE SD-WAN

Legacy CPE running IOS-XE, connected to MPLS Service



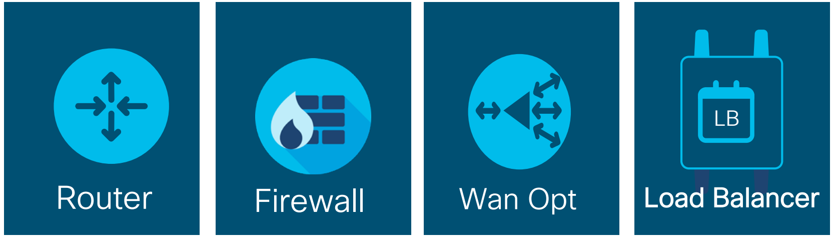
```
#cloud-boothook
 system
  personality          vedge
  device-model          vedge-C1111-8PLTEEA
  host-name            SITE1_ISR1K
  system-ip           10.10.10.10
  site-id          501
  organization-name     "CustomerXYZ - 12345"
  console-baud-rate     9600
  vbond 64.1.1.2 port 12346
  !
  !
 !
interface GigabitEthernet0/0/0
  no shutdown
  ip address 192.168.10.10 255.255.255.0
 exit
 !
ip route 0.0.0.0 0.0.0.0 192.168.10.1
```

ciscosdwan.cfg (ISR1k, ISR4k, ASR1k)
ciscosdwan_cloud_init.cfg (ASR1002X)

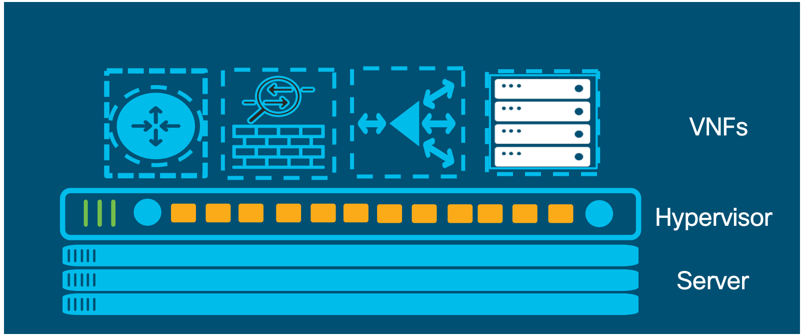
Upon bootup, SD-WAN XE router will search bootflash: or usbflash: for filename ciscosdwan.cfg (case sensitive) or ciscosdwan_cloud_init.cfg (ASR1002X)

Deploying uCPE

Deploying Universal CPE (uCPE)



Physical Branch



Virtual Branch

Advantages of Virtualized offering

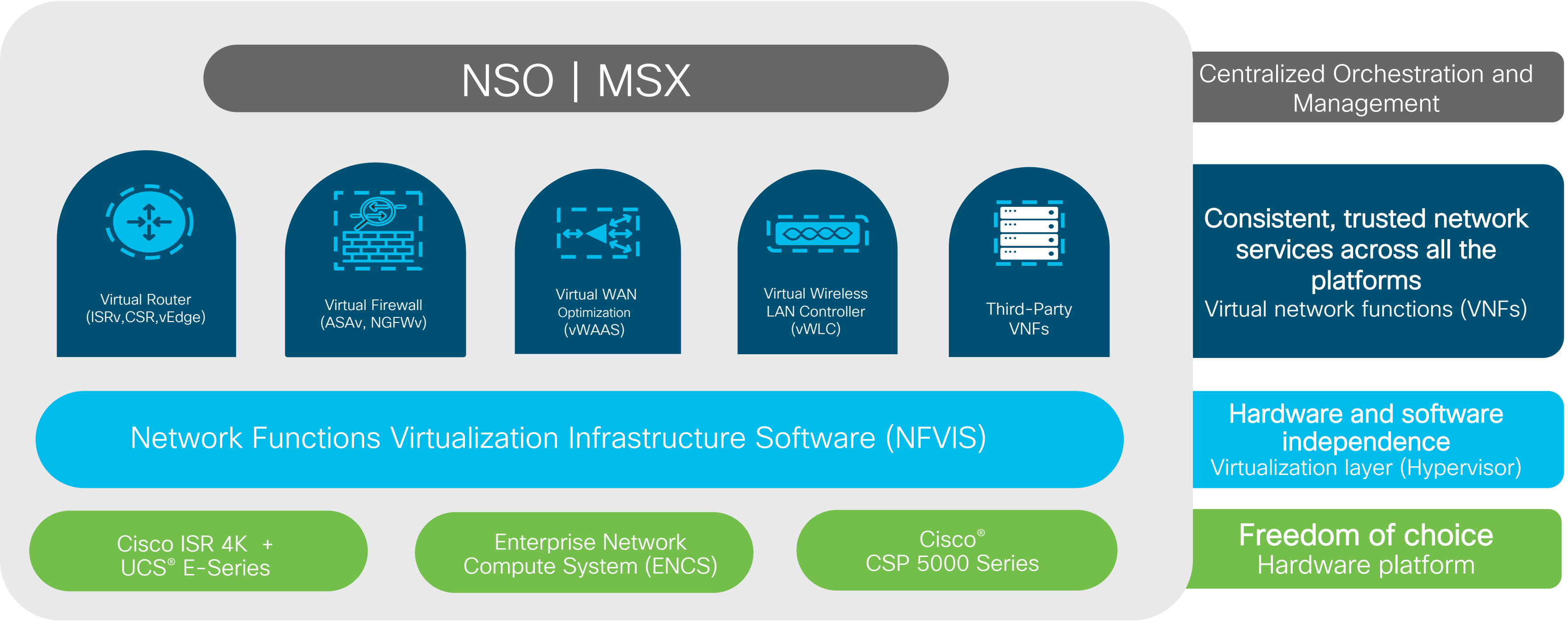
- Flexibility
- Less Devices, more VNFs
- Quick rollout time

- Service Agility
- Efficient Resource Utilization
- Opex savings

Cisco’s Virtualization is available for both Traditional Routing as well as SD-WAN routing

Network Services on Any Platform

Cisco's Virtualization stack



NSO | MSX

Centralized Orchestration and Management

Virtual Router (ISRv,CSR,vEdge)

Virtual Firewall (ASAv, NGFWv)

Virtual WAN Optimization (vWAAS)

Virtual Wireless LAN Controller (vWLC)

Third-Party VNFs

Consistent, trusted network services across all the platforms
Virtual network functions (VNFs)

Network Functions Virtualization Infrastructure Software (NFVIS)

Hardware and software independence
Virtualization layer (Hypervisor)

Cisco ISR 4K + UCS® E-Series

Enterprise Network Compute System (ENCS)

Cisco® CSP 5000 Series

Freedom of choice
Hardware platform

NFVIS Software Stack

NFVIS

PnP Agent

- PnP Agent must automatically configure WAN Interface
- Must download platform Profile

Lifecycle Management (ESC Lite)

- Provide Northbound interface for Management/Orchestration
- Provide System level information
- Provide VNF management - Create, Modify, Delete
- Provide interface with onboard LAN switch
- Performance Monitoring of VNF’s

CLI/WebUI Agent

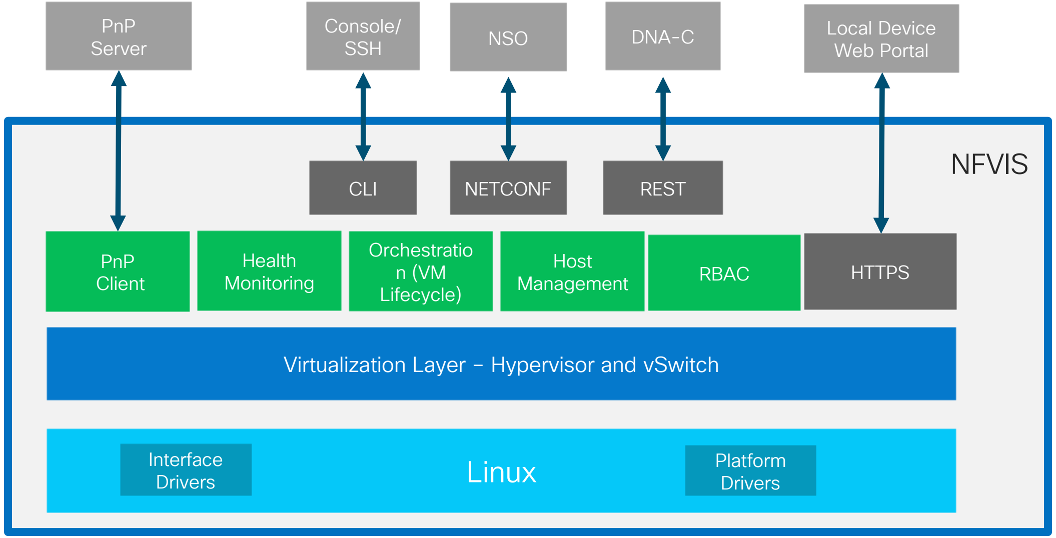
- Interface to configure onboard switch
- Provide Cisco® CLI wrapper
- Agnostic to switch vendor selected

Server Monitoring Agent

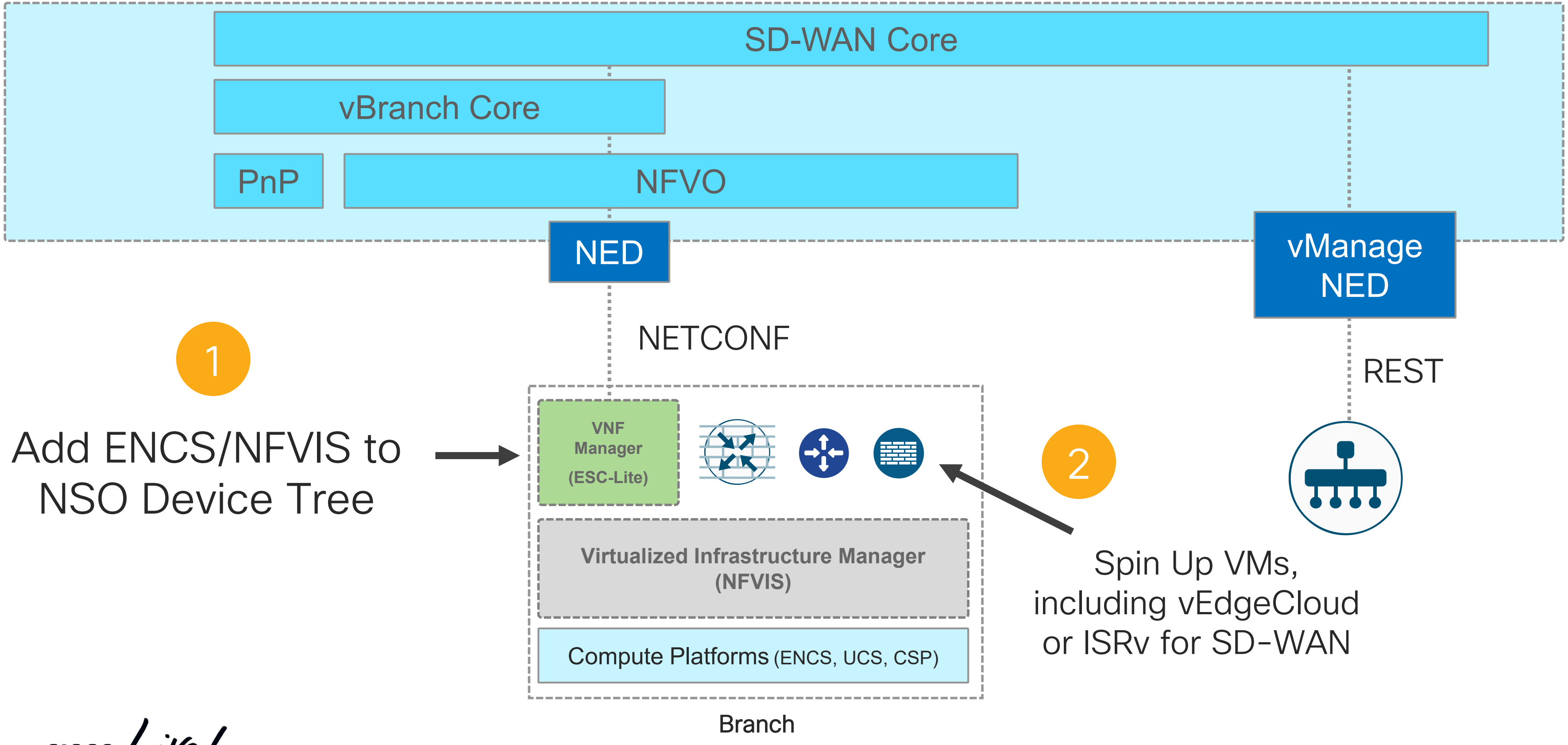
- Agent to interact with Orchestration system
- Web GUI Interface for Management and Configuration

Drivers, Firmware, and Agents

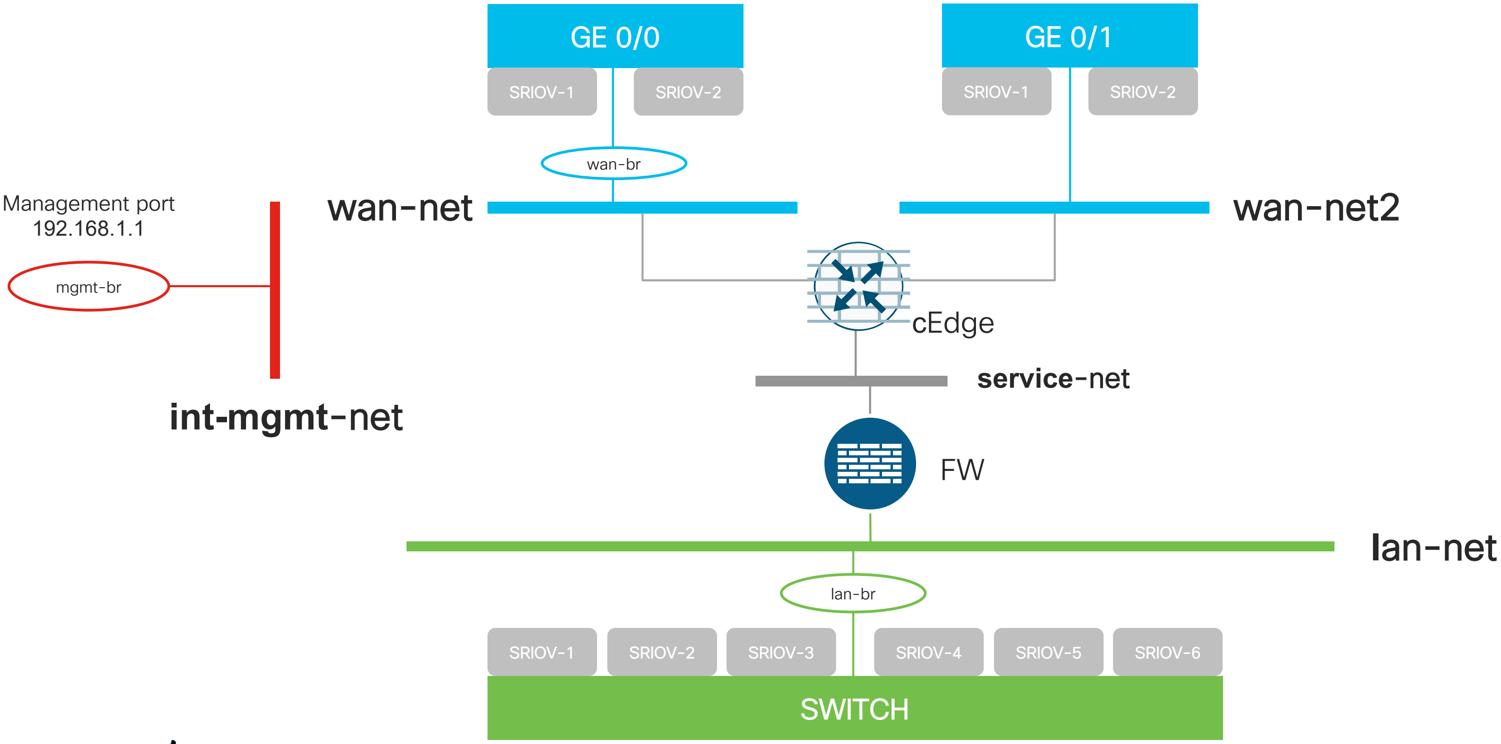
- NIC and interface drivers
- Optional Crypto support



SDWAN Core Function Pack Architecture


SD-WAN Core
vBranch Core
PnP
NFVO
NED
vManage NED
NETCONF
REST
1
Add ENCS/NFVIS to NSO Device Tree
VNF Manager (ESC-Lite)
Virtualized Infrastructure Manager (NFVIS)
Compute Platforms (ENCS, UCS, CSP)
Branch
2
Spin Up VMs, including vEdgeCloud or ISRv for SD-WAN

Networks and Service Chaining Definition



NSO - Network Deployment Unit (NDU)

Mapping vNIC / Network

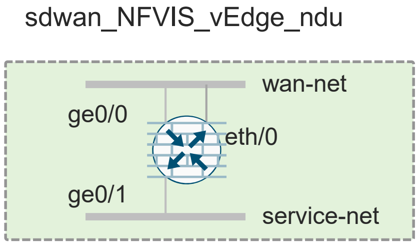
eth0 – vpn512 → nic 0

ge0/0 → nic 1

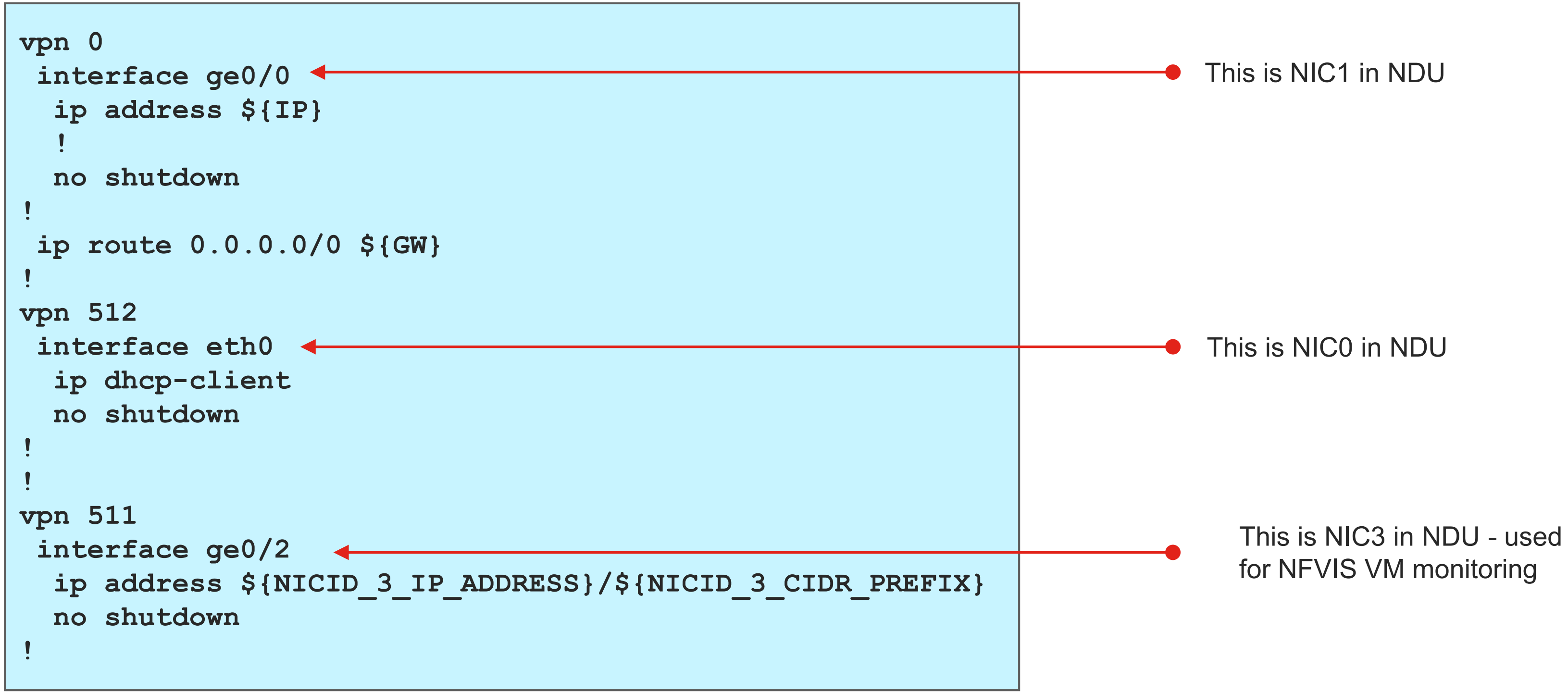
ge0/1 → nic 2

ge0/2 – vpn511 → nic 3

```
ndus sdwan_NFVIS_vEdge_ndu {
    network int-mgmt-net;
    network lan-net;
    network service-net {
        bridge service-br;
    }
    network wan-net;
    nic 0 {
        network wan-net;
    }
    nic 1 {
        network wan-net;
    }
    nic 2 {
        network service-net;
    }
    nic 3 {
        network int-mgmt-net;
    }
}
```



NSO vEdge day0 configuration – Example



```
vpn 0
 interface ge0/0
  ip address ${IP}
  !
  no shutdown
!
 ip route 0.0.0.0/0 ${GW}
!
vpn 512
 interface eth0
  ip dhcp-client
  no shutdown
!
!
vpn 511
 interface ge0/2
  ip address ${NICID_3_IP_ADDRESS}/${NICID_3_CIDR_PREFIX}
  no shutdown
!
```

This is NIC1 in NDU

This is NIC0 in NDU

This is NIC3 in NDU - used
for NFVIS VM monitoring

./cpe-day0/cfg/vedge_day0_template.cfg

NSO SD-WAN Site

1

```
sdwan-site Paris {
    provider ProviderA;
    location {
        name Paris;
    }
    infrastructure {
        type nfvis;
        nfvis {
            nfvis-serial
            shared-branch-
            branch-office
            device-on-boar
            nfvis-device-r
        }
    }
```

2

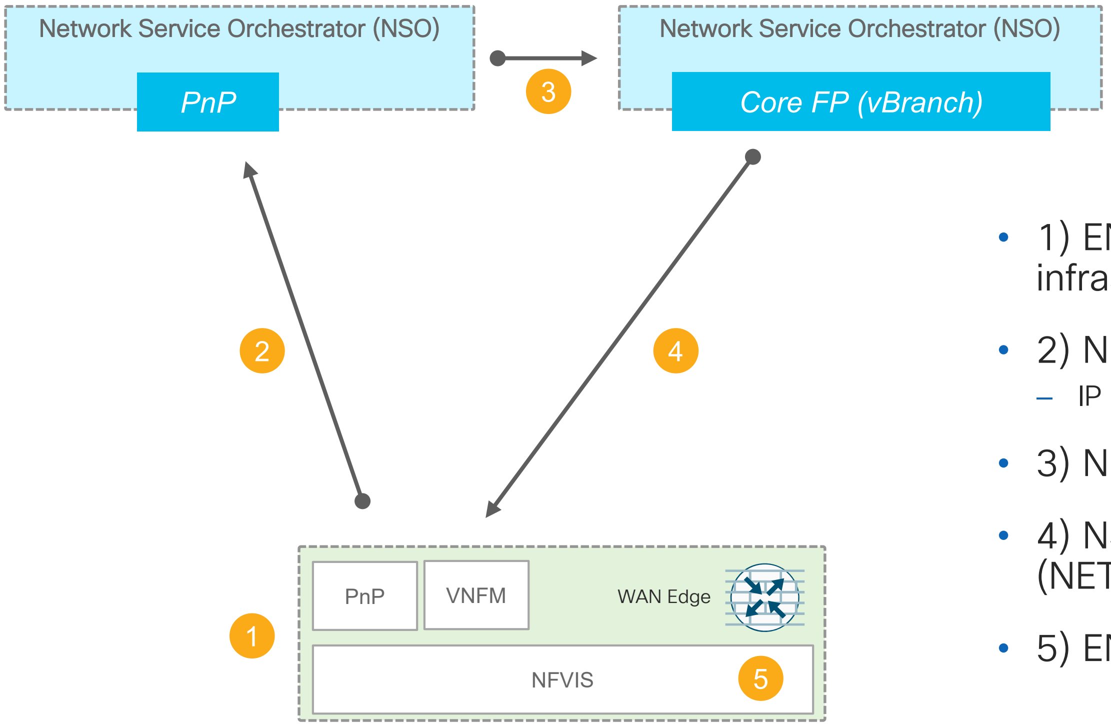
```
member-vnfs vEdgeCloudParis {
        type     vEdge-cloud;
        username admin;
        password admin;
        ip       10.60.23.14;
        mask     255.255.255.0;
        gtw      10.60.23.254;
        day-0 {
            cfg-file vedge_day0_te
        }
        vedge-cloud {
            system-ip 10.8.0.83;
            site-id   10;
        }
        ndu {
            ndu-id sdwan_NFVIS_vE
        }
    }
}
```

3

```
member-vnfs asav1 {
        type         generic;
        deployment   ASA-Unmanaged;
        vnfd         vBranch-ASA-1.0;
        vdu          ASA;
        username     admin;
        password     admin;
        sec-password admin;
        ip           192.168.1.2;
        mask         255.255.255.0;
        gtw          192.168.1.254;
        ndu {
            ndu-id sdwan_NFVIS_asa_ndu;
        }
    }
}
```

NSO - On Boarding ENCS/NFVIS

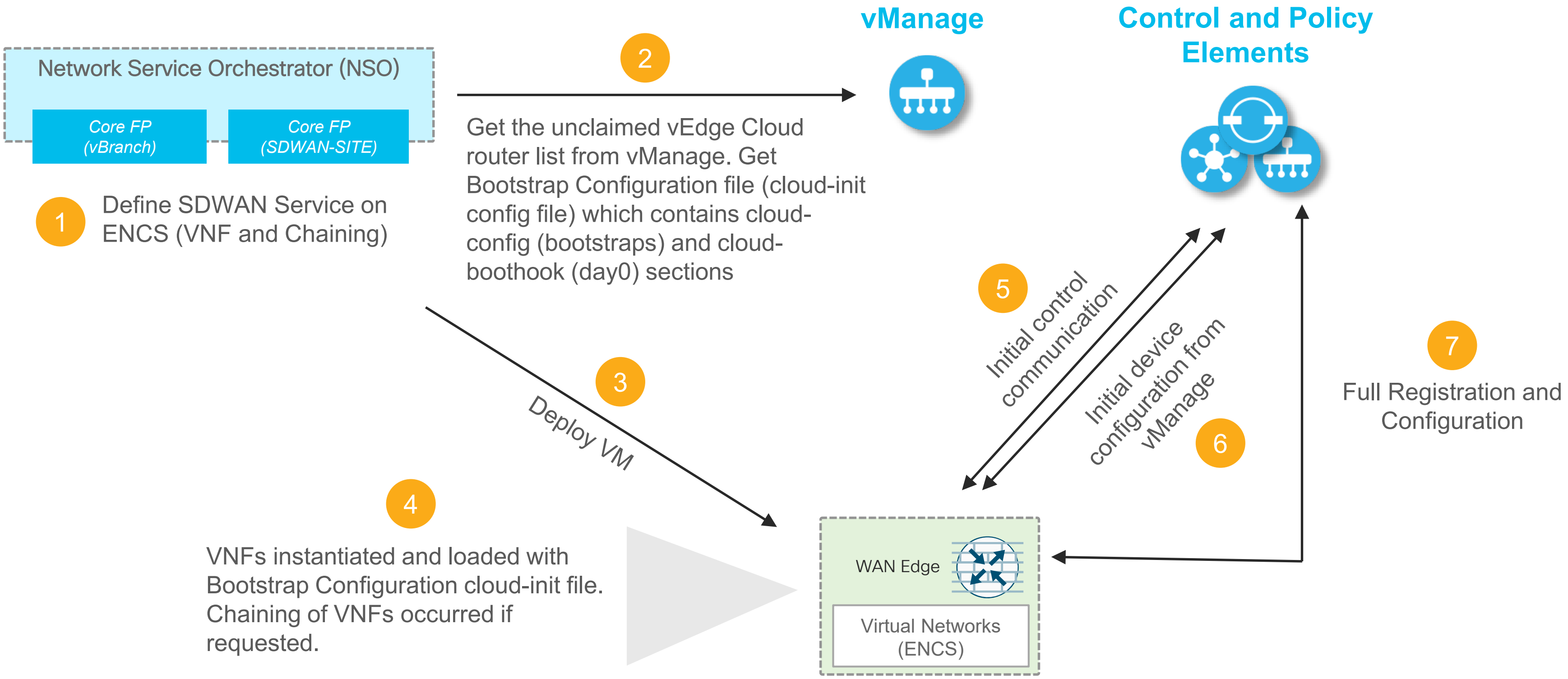
With Zero Touch Provisioning


Network Service Orchestrator (NSO)
PnP
3
Network Service Orchestrator (NSO)
Core FP (vBranch)
2
4
PnP
VNFM
WAN Edge
1
NFVIS
5

- 1) ENCS boots and creates basic n/w infrastructure
- 2) NFVIS registration to NSO using PnP
  - IP + serial + model + capabilities
- 3) NFVIS registered to NSO
- 4) NSO connects to branch NFVIS (NETCONF)
- 5) ENCS/NFVIS on-boarded in NSO

vEdge Cloud Provisioning / Activation

NSO with the SDWAN Function Pack



Network Service Orchestrator (NSO)

Core FP (vBranch)

Core FP (SDWAN-SITE)

1 Define SDWAN Service on ENCS (VNF and Chaining)

2 Get the unclaimed vEdge Cloud router list from vManage. Get Bootstrap Configuration file (cloud-init config file) which contains cloud-config (bootstraps) and cloud-boothook (day0) sections

3 Deploy VM

4 VNFs instantiated and loaded with Bootstrap Configuration cloud-init file. Chaining of VNFs occurred if requested.

5 Initial control communication

6 Initial device configuration from vManage

7 Full Registration and Configuration

vManage

Control and Policy Elements

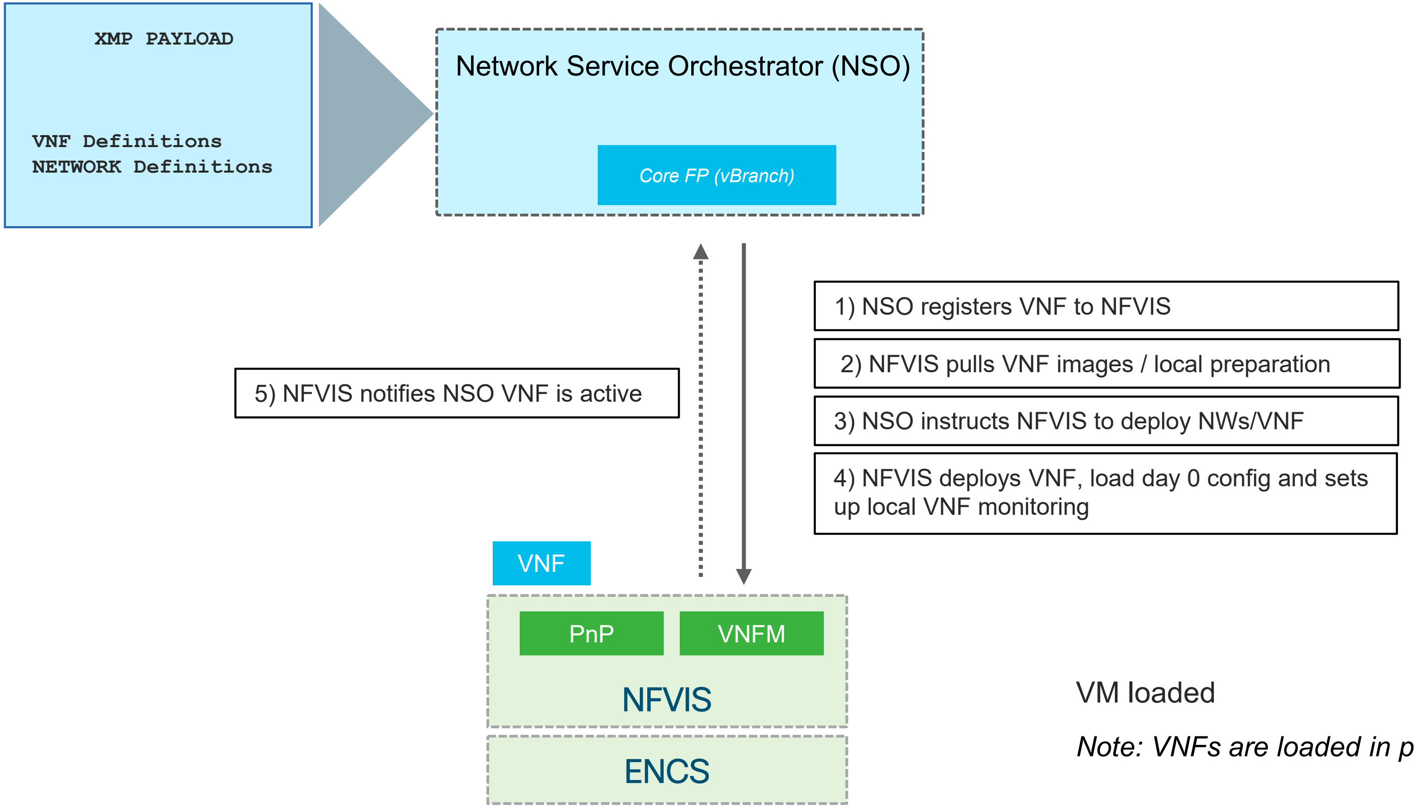
WAN Edge

Virtual Networks (ENCS)

cisco Live!

Loading 3rd VNF

NSO with the vBranch Function Pack



1) NSO registers VNF to NFVIS

2) NFVIS pulls VNF images / local preparation

3) NSO instructs NFVIS to deploy NWs/VNF

4) NFVIS deploys VNF, load day 0 config and sets up local VNF monitoring

5) NFVIS notifies NSO VNF is active

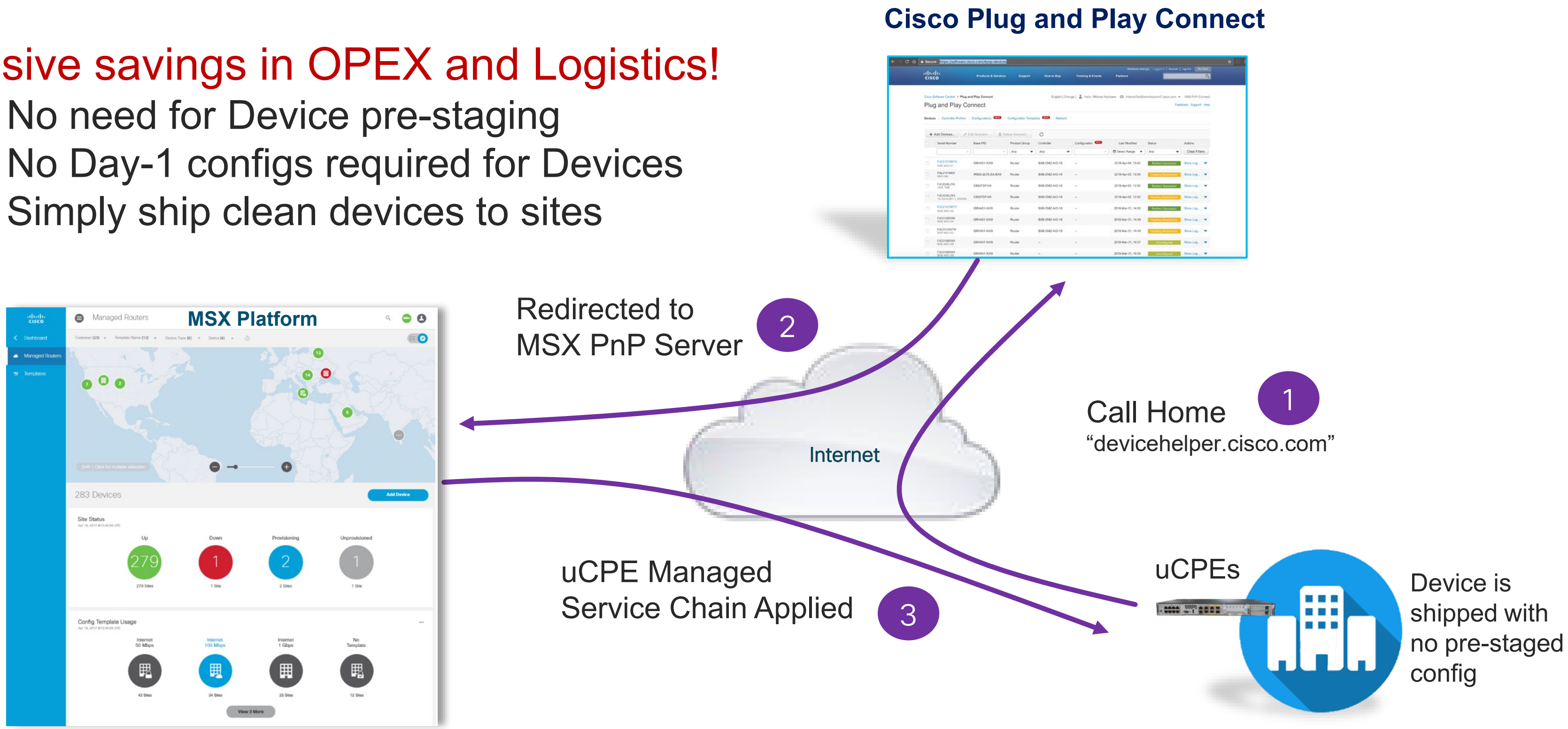
VM loaded

Note: VNFs are loaded in parallel

MSX - On Boarding ENCS/NFVIS With Zero Touch Provisioning

Massive savings in OPEX and Logistics!

No need for Device pre-staging
No Day-1 configs required for Devices
Simply ship clean devices to sites



Cisco Plug and Play Connect

Call Home 1
"devicehelper.cisco.com"

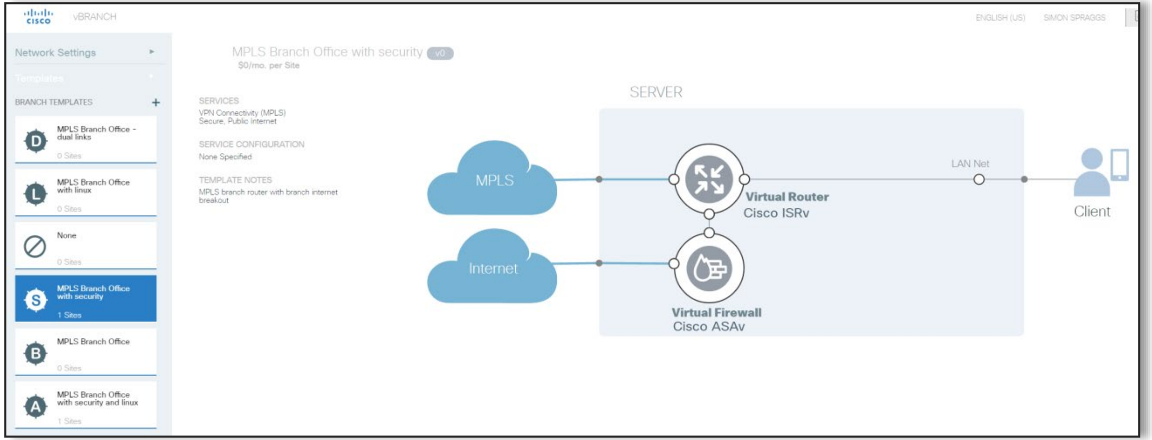
Redirected to
MSX PnP Server 2

uCPE Managed
Service Chain Applied 3

Device is
shipped with
no pre-staged
config

Examples of MSX vBranch Service Templates

- Dual WAN Links
- Protected with a Firewall



MPLS Branch Office with security v0

$0/mo. per Site

SERVICES

VPN Connectivity (MPLS)
Secure, Public Internet

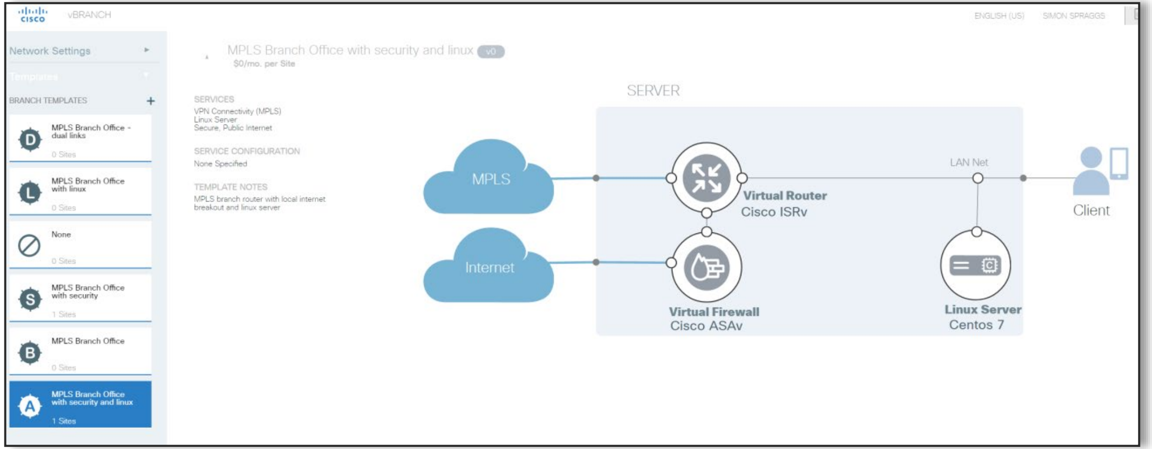
SERVICE CONFIGURATION

None Specified

TEMPLATE NOTES

MPLS branch router with branch internet breakout

- Add a Linux Server



MPLS Branch Office with security and linux v0

$0/mo. per Site

SERVICES

VPN Connectivity (MPLS)
Linux Server
Secure, Public Internet

SERVICE CONFIGURATION

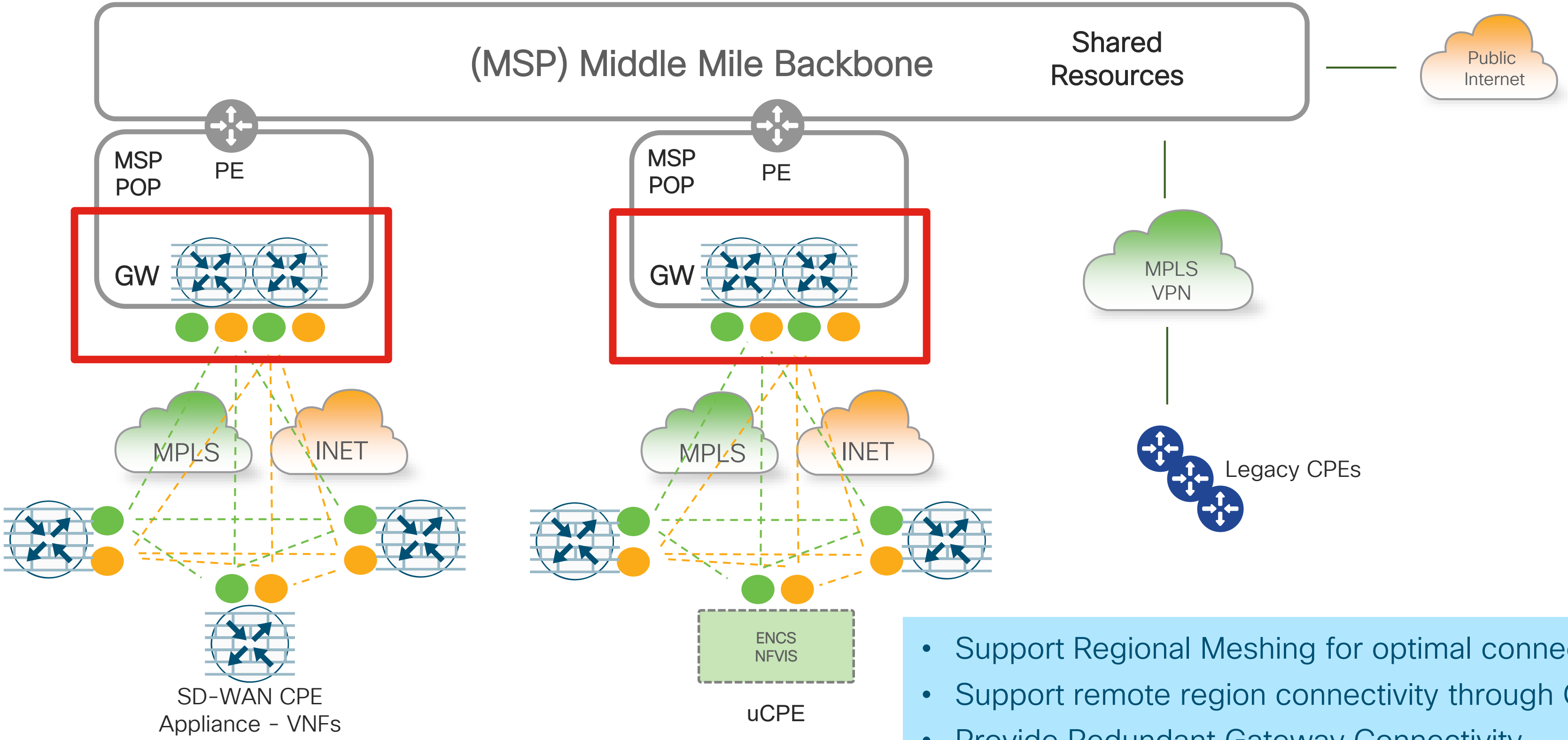
None Specified

TEMPLATE NOTES

MPLS branch router with local internet breakout and linux server

Virtualized Gateways

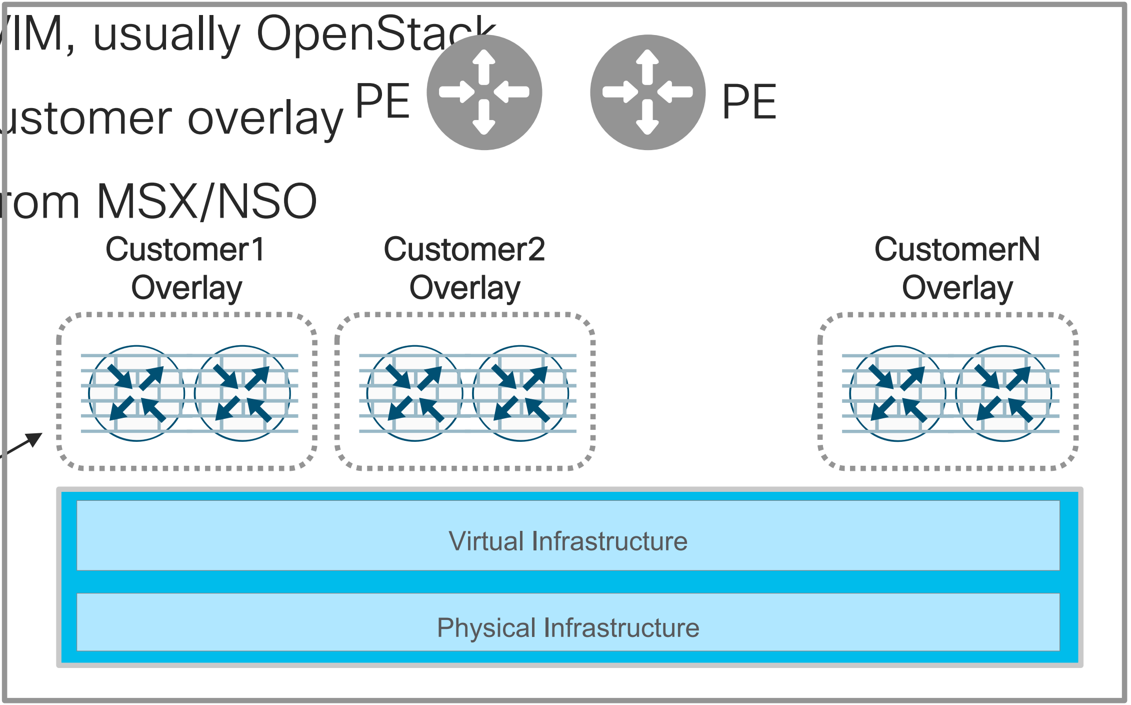
Multi-Region Overlay



- Support Regional Meshing for optimal connectivity
- Support remote region connectivity through Gateways
- Provide Redundant Gateway Connectivity

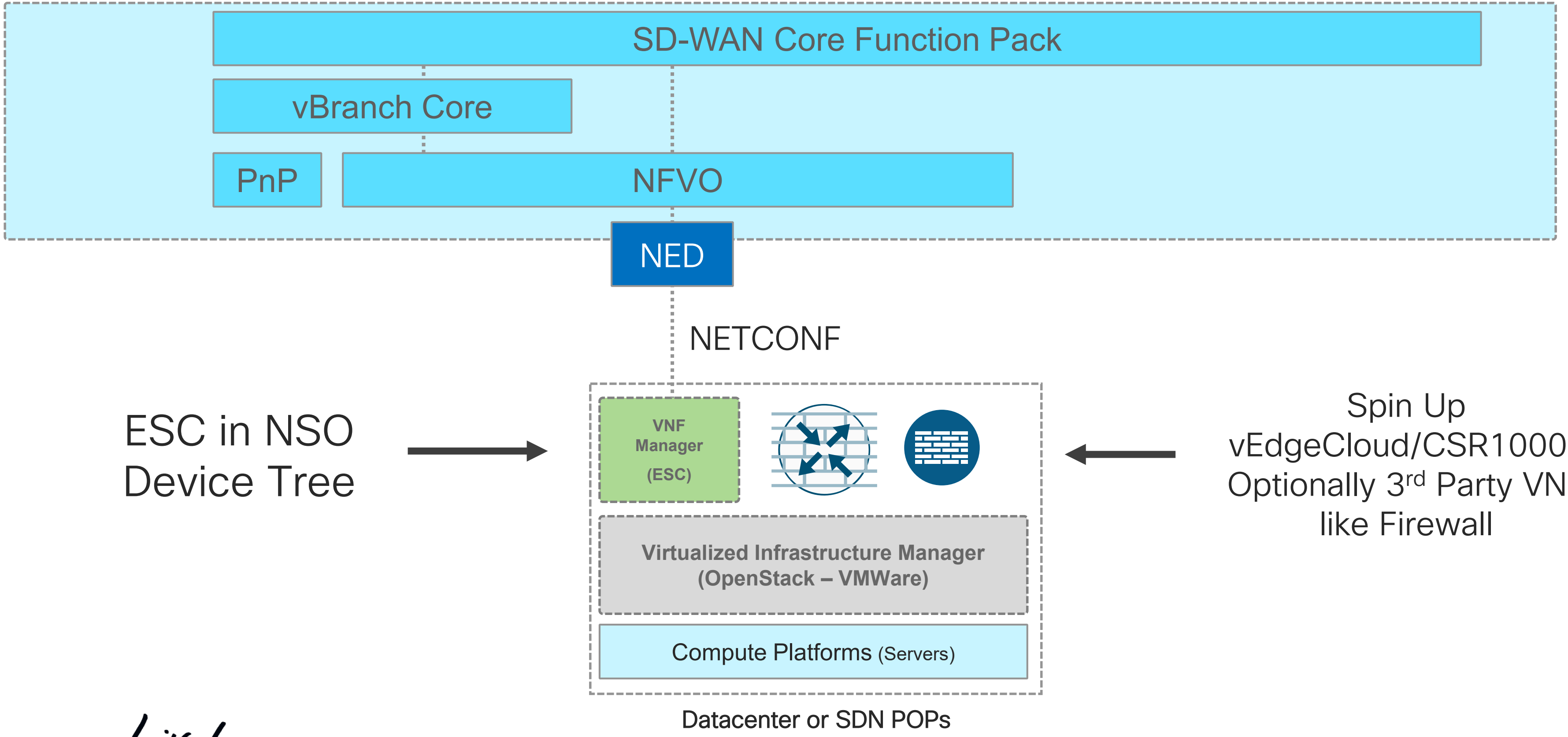
SDN-POPs – Hosting Virtualized Gateways

- Rack of servers running a VIM, usually OpenStack
- Virtualized Gateways per customer overlay
- Orchestration/automation from MSX/NSO



vEdgeCloud
CSR1000v SD-WAN

SDWAN Core Function Pack Architecture



SD-WAN Core Function Pack

vBranch Core

PnP

NFVO

NED

NETCONF

VNF Manager (ESC)

Virtualized Infrastructure Manager (OpenStack – VMWare)

Compute Platforms (Servers)

Datacenter or SDN POPs

ESC in NSO Device Tree

Spin Up vEdgeCloud/CSR1000v Optionally 3rd Party VNF like Firewall

SD-WAN Site

1

```
<config xmlns="http://tail-f.com/ns/config/1.0">
  <sdwan-site xmlns="http://com/cisco/nso/corefp/sdwan">
    <site-name>pdx-58</site-name>
    <provider>ProviderA</provider>
    <tenant>SingleTenant</tenant>
    <infrastructure>
      <type>esc</type>
      <esc>
        <name>esc1</name>
        <vim-tenant>sd-wan</vim-tenant>
      </esc>
    </infrastructure>
```

2

```
<member-vnfs>
     <vnf>esc-cedge</vnf>
     <type>vedge-CSR-1000v</type>
     <deployment>cEdgeESCDeployment</deployment>
     <vnfd>cEdge-Openstack</vnfd>
     <vdu>cEdge-Openstack</vdu>
     <username>admin</username>
     <password>admin</password>
     <ip>10.195.72.195</ip>
     <mask>255.255.255.0</mask>
     <gtw>10.195.72.1</gtw>
     <day-0>
       <cfg-file>cedgeCSR_day0_template.cfg</cfg-file>
     </day-0>
     <vedge-CSR-1000v>
       <system-ip>25.25.23.17</system-ip>
       <site-id>6599</site-id>
     </vedge-CSR-1000v>
     <ndu>
       <ndu-id>sdwan_ESC_cEdge</ndu-id>
       <management>0</management>
     </ndu>
   </member-vnfs>
```

Multi-Region Overlay

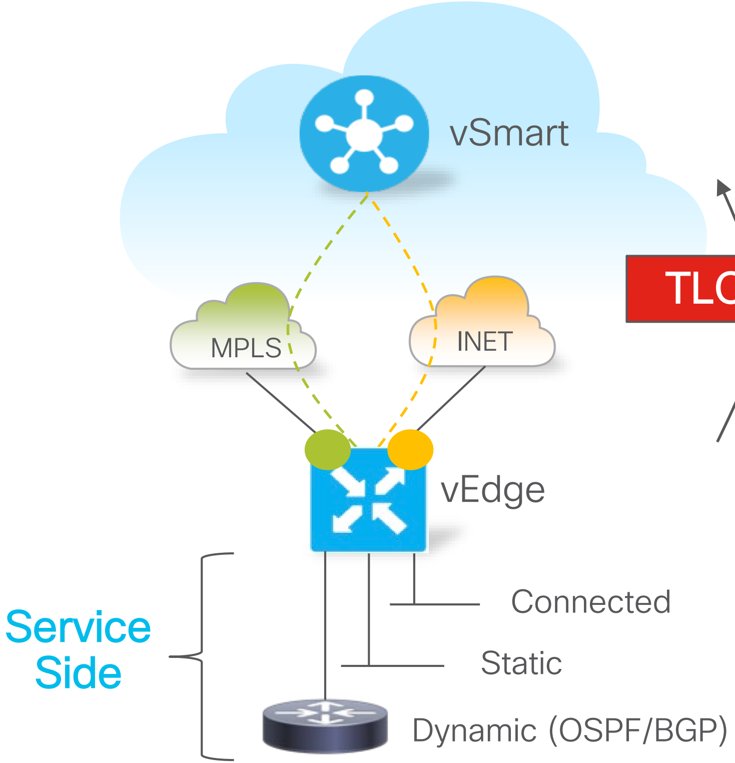
Definitions and Dependencies

- Site-ID assignment allowing for Site identification – 32 bits

	Continent	Country	Site number
	X	YYY	ZZZZ
	1-7	1-999	1-9999
Example	Europe	France	Site
	5	046	1000

- No "Region" parameter available
- Using Site-Id to introduce Region Number

OMP Route Types and Prominent Attributes



OMP Routes

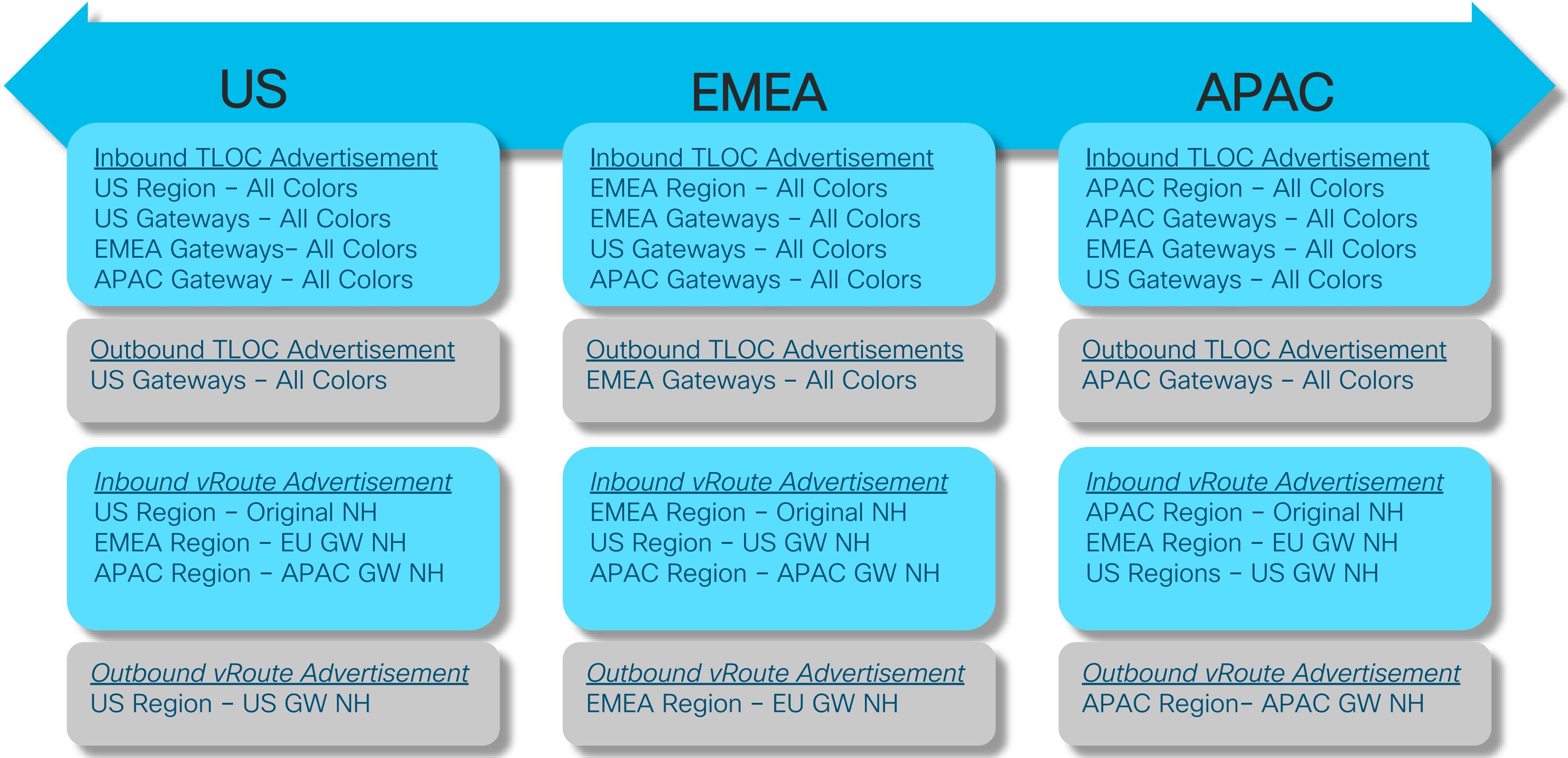
TLOC
Label
VPN-ID
Tag
Preference
Origin
Protocol
Origin Metric

TLOC Routes

Site-ID
System-IP
Encap-Auth
Public IP/Port
Private IP/Port
Tag
Preference
Weight

Control Policy Case Study

Reachability Information Distribution Requirements



US

Inbound TLOC Advertisement
US Region – All Colors
US Gateways – All Colors
EMEA Gateways– All Colors
APAC Gateway – All Colors

Outbound TLOC Advertisement
US Gateways – All Colors

Inbound vRoute Advertisement
US Region – Original NH
EMEA Region – EU GW NH
APAC Region – APAC GW NH

Outbound vRoute Advertisement
US Region – US GW NH

EMEA

Inbound TLOC Advertisement
EMEA Region – All Colors
EMEA Gateways – All Colors
US Gateways – All Colors
APAC Gateways – All Colors

Outbound TLOC Advertisements
EMEA Gateways – All Colors

Inbound vRoute Advertisement
EMEA Region – Original NH
US Region – US GW NH
APAC Region – APAC GW NH

Outbound vRoute Advertisement
EMEA Region – EU GW NH

APAC

Inbound TLOC Advertisement
APAC Region – All Colors
APAC Gateways – All Colors
EMEA Gateways – All Colors
US Gateways – All Colors

Outbound TLOC Advertisement
APAC Gateways – All Colors

Inbound vRoute Advertisement
APAC Region – Original NH
EMEA Region – EU GW NH
US Regions – US GW NH

Outbound vRoute Advertisement
APAC Region– APAC GW NH

Control Policy - Lists

For Your Reference

```
policy
 lists
  site-list US_branch_sites
   site-id 60010000-60018999
  !
  site-list US_gateway_sites
   site-id 60019000-60019999
  !
  site-list EMEA_branch_sites
   site-id 50010000-50338999
   site-id 50340000-59999999
  !
  site-list EMEA_gateway_sites
   site-id 50339000-50339999
  !

  site-list APAC_branch_sites
   site-id 30010000-30668999
   site-id 30670000-39999999
  !
  site-list APAC_gateway_sites
   site-id 30669000-30669999
  !
 !
!
```

```
policy
 lists
  tloc-list US_gateway_tlocs
   tloc 1.1.1.1 color mpls encap ipsec preference 100
   tloc 1.1.1.1 color biz-internet encap ipsec preference 100
   tloc 2.2.2.2 color mpls encap ipsec preference 50
   tloc 2.2.2.2 color biz-internet encap ipsec preference 50
  !
  tloc-list EMEA_gateway_tlocs
   tloc 3.3.3.3 color mpls encap ipsec preference 100
   tloc 3.3.3.3 color biz-internet encap ipsec preference 100
   tloc 4.4.4.4 color mpls encap ipsec preference 50
   tloc 4.4.4.4 color biz-internet encap ipsec preference 50
  !
  tloc-list APAC_gateway_tlocs
   tloc 5.5.5.5 color mpls encap ipsec preference 100
   tloc 5.5.5.5 color biz-internet encap ipsec preference 100
   tloc 6.6.6.6 color mpls encap ipsec preference 50
   tloc 6.6.6.6 color biz-internet encap ipsec preference 50
  !
 !
!
```

Control Policy – TLOC - Applied to US Sites

For Your Reference

- **Policy Logic**

Sequence 10: Advertise US Branch TLOCs

Sequence 20: Advertise US GW TLOCs

Sequence 30: Advertise EMEA GW TLOCs

Sequence 40: Advertise APAC GW TLOCs

Default: Drop

TLOC

```
policy

 control-policy US_DOMAIN
  sequence 10
   match tloc
    site-list US_branch_sites
   !
   action accept
   !
  !
  sequence 20
   match tloc
    site-list US_gateway_sites
  … (accept)
  sequence 30
   match tloc
    site-list EMEA_gateway_sites
  … (accept)
  sequence 40
   match tloc
    site-list APAC_gateway_sites
   !
  … (accept)
```

Control Policy – Routes – Applied to US Sites

For Your Reference

- **Policy Logic**

Sequence 50: Advertise US Branch routes

Sequence 60: Advertise US GW routes

Sequence 70: Advertise EMEA Branch routes w/ NH of EMEA GW

Sequence 80: Advertise EMEA GW routes

Sequence 90: Advertise APAC Branch routes w/ NH of APAC GW

Sequence 100: Advertise APAC GW Routes

```
sequence 50
  match route
   site-list US_branch_sites
  !
  action accept
  !

 sequence 60
  match route
   site-list US_gateway_sites
  … (accept)

 sequence 70
  match route
   site-list EMEA_branch_sites
  !
  action accept
   set
    tloc-list EMEA_gateway_tlocs
   !
  !
 !
 sequence 80
  match route
   site-list EMEA_gateway_sites
 … (accept)
```

```
sequence 90
  match route
   site-list APAC_branch_sites
  !
  action accept
   set
    tloc-list APAC_gateway_tlocs
   !
  !
 !

 sequence 100
  match route
   site-list APAC_gateway_sites
  !
  action accept
  !
 !

 default-action accept
```

ROUTES

Control Policy – Applying on vSmart

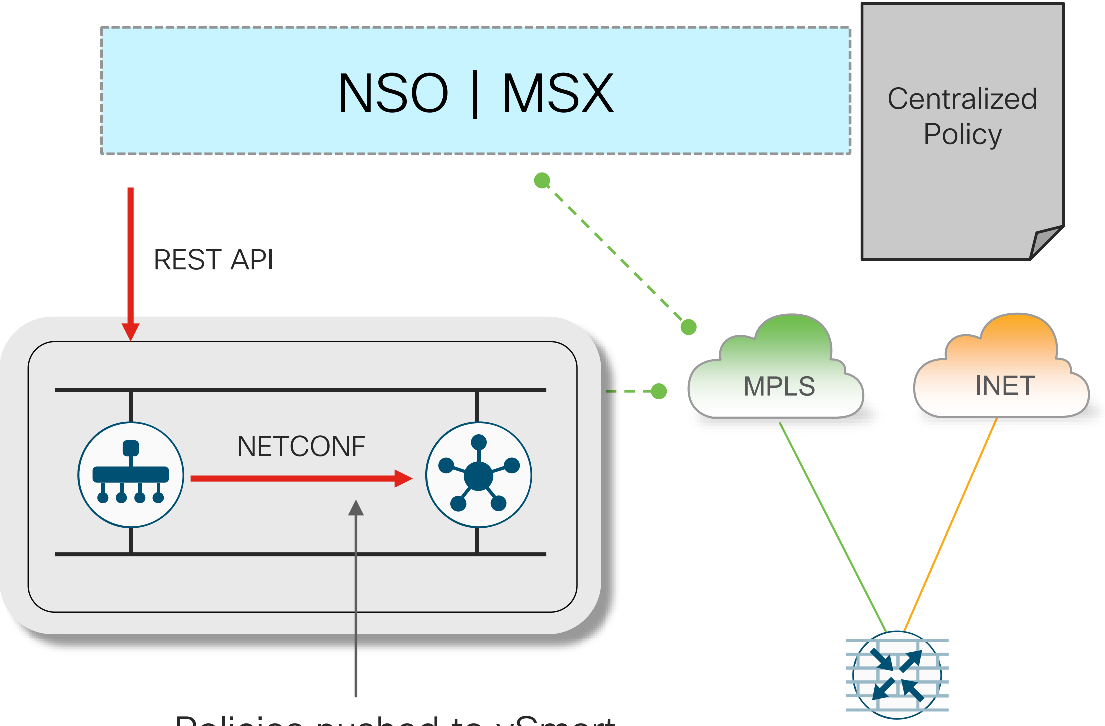
For Your Reference

Apply policy on vSmart
Advertisements OUT

```
apply-policy

 site-list US_branch_sites
  control-policy US_DOMAIN out
 !
 site-list US_gateway_sites
  control-policy US_DOMAIN out
 !
!
```

Centralized Policies

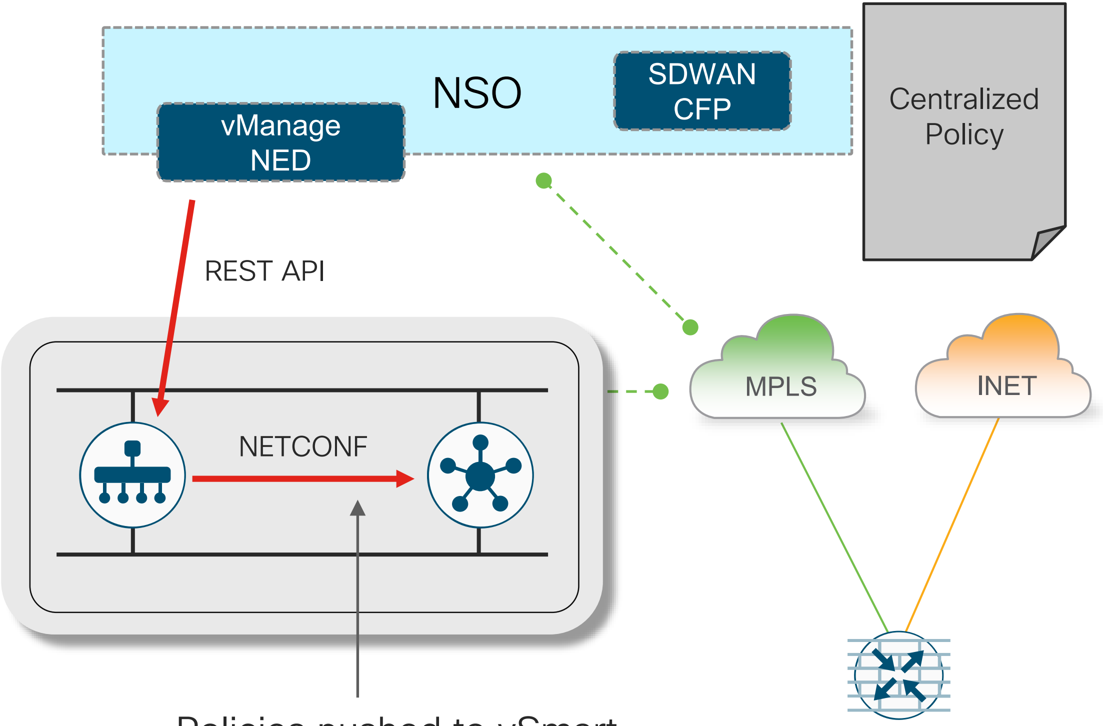
Centralized Policies Support



Policies pushed to vSmart using NETCONF

- vManage NED (REST API)
- Centralized Configuration – Pushed to vManage
- Instructs vManage to deploy policy to vSmarts

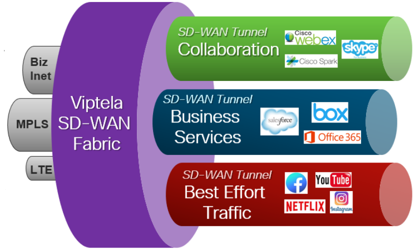
Deploying Policies using NSO SDWAN Core FP



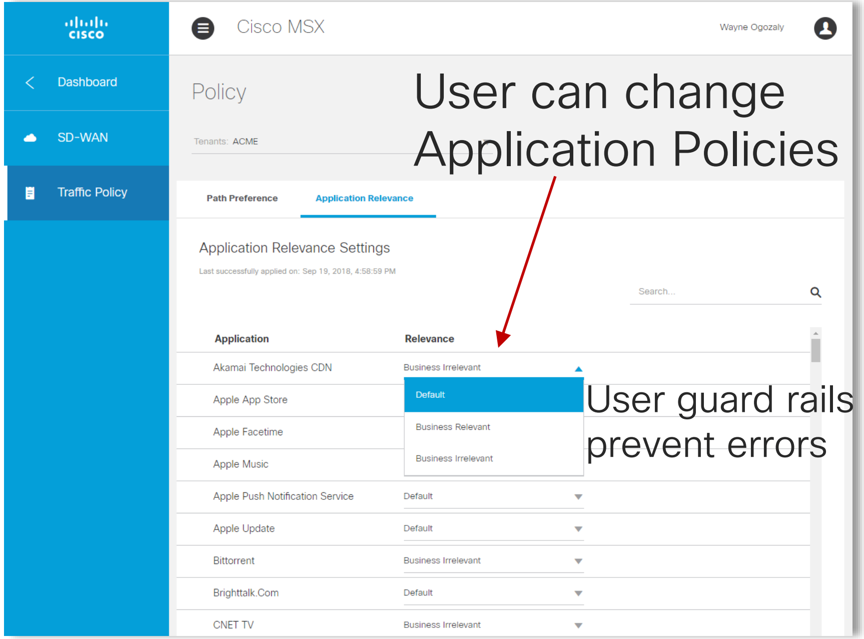
Policies pushed to vSmart using NETCONF

- vManage NED (REST API)
- Centralized Configuration – Pushed to vManage
- Instructs vManage to deploy policy to vSmarts

Using MSX



Simply with two clicks from MSX Cloud



Policy

Tenants: ACME

Path Preference | Application Relevance

Application Relevance Settings

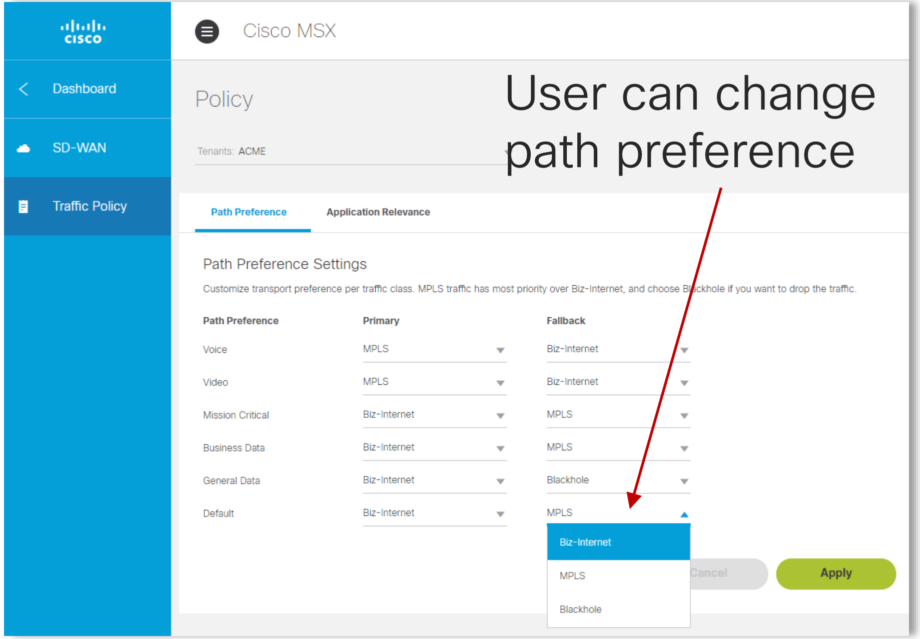
Last successfully applied on: Sep 19, 2018, 4:58:59 PM

Search...

Application	Relevance
Akamai Technologies CDN	Business Irrelevant
Apple App Store	
Apple Facetime	
Apple Music	
Apple Push Notification Service	Default
Apple Update	Default
Bittorrent	Business Irrelevant
Brighttalk.Com	Default
CNET TV	Business Irrelevant

User can change Application Policies

User guard rails prevent errors



Policy

Tenants: ACME

Path Preference | Application Relevance

Path Preference Settings

Customize transport preference per traffic class. MPLS traffic has most priority over Biz-Internet, and choose Blackhole if you want to drop the traffic.

Path Preference	Primary	Fallback
Voice	MPLS	Biz-Internet
Video	MPLS	Biz-Internet
Mission Critical	Biz-Internet	MPLS
Business Data	Biz-Internet	MPLS
General Data	Biz-Internet	Blackhole
Default	Biz-Internet	MPLS

User can change path preference

Key Takeaways

Complete your online session survey

- Please complete your session survey after each session. Your feedback is very important.
- Complete a minimum of 4 session surveys and the Overall Conference survey (starting on Thursday) to receive your Cisco Live t-shirt.
- All surveys can be taken in the Cisco Events Mobile App or by logging in to the Content Catalog on ciscolive.com/emea.

Cisco Live sessions will be available for viewing on demand after the event at ciscolive.com.

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Meet the Engineer 1:1 meetings

Related sessions

Thank you

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