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Enterprise Network Functions Virtualization (ENFV) Architecture, Configuration and Troubleshooting

Muhilan Natarajan, Technical Leader

BRKARC-2012

CISCO *Live!*

Barcelona | January 27-31, 2020



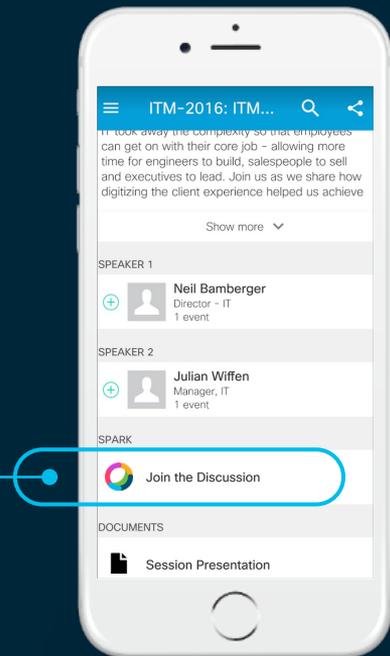
Cisco Webex Teams

Questions?

Use Cisco Webex Teams to chat with the speaker after the session

How

- 1 Find this session in the Cisco Events Mobile App
- 2 Click “Join the Discussion”
- 3 Install Webex Teams or go directly to the team space
- 4 Enter messages/questions in the team space



cs.co/ciscolivebot#BRKARC-2012

Agenda

- Enterprise NFV
- NFVIS Architecture
- VM Life Cycle
- Designing and Provisioning using Cisco DNA Center
- Troubleshooting

Enterprise NFV

Benefits of Software Defined Branch

Simplified Management



Simplify day to day operations



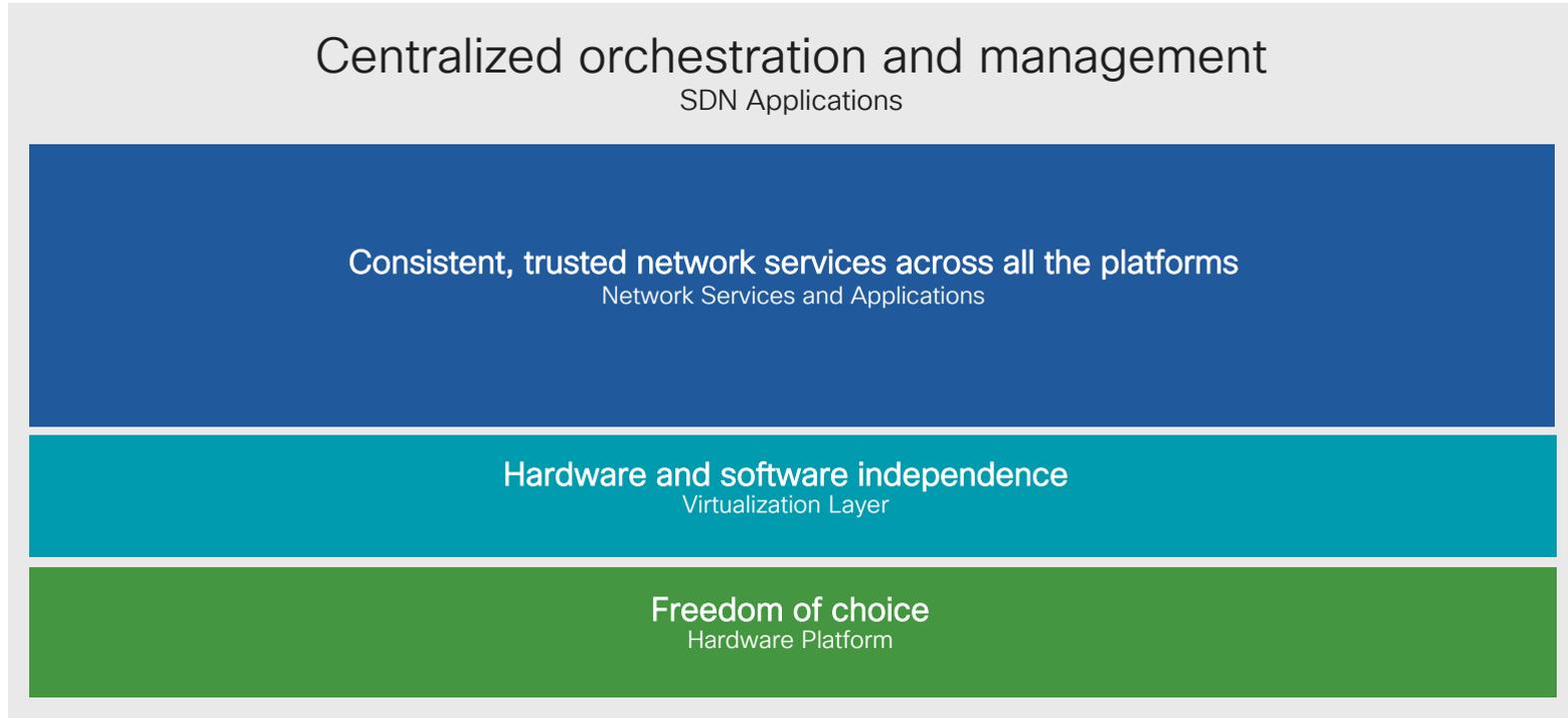
Quickly roll out new services and locations



Consistent network policies through the entire enterprise network to the cloud

Use Cisco DNA Center, MSX/NSO to manage your Branch

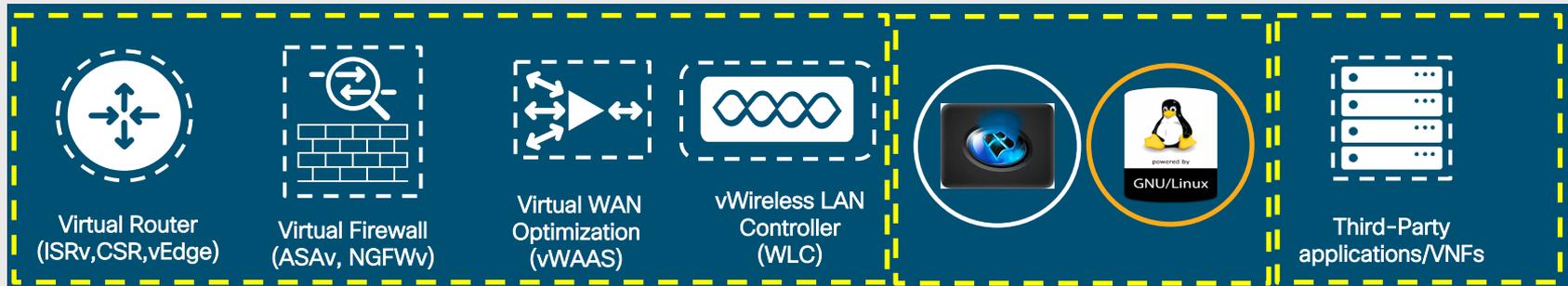
What is Software Defined Branch Architecture?



Cisco Enterprise NFV for Branch

Deploy Services on Any Platform

Cisco DNA Center / Network Service Orchestrator/ MSX



Network Functions Virtualization Infrastructure Software (NFVIS)

Cisco 4000 Series ISR +
UCS® E-Series

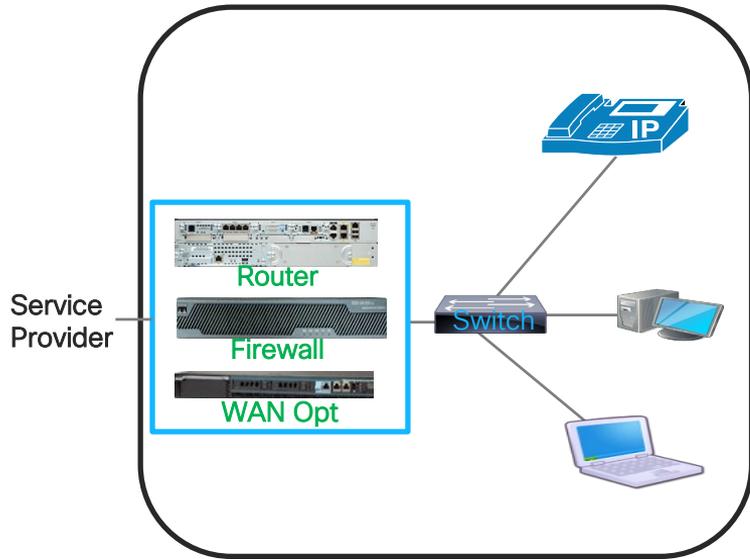
Enterprise Network
Compute System
(ENCS)

CSP-5000
UCS-M5 C-Series

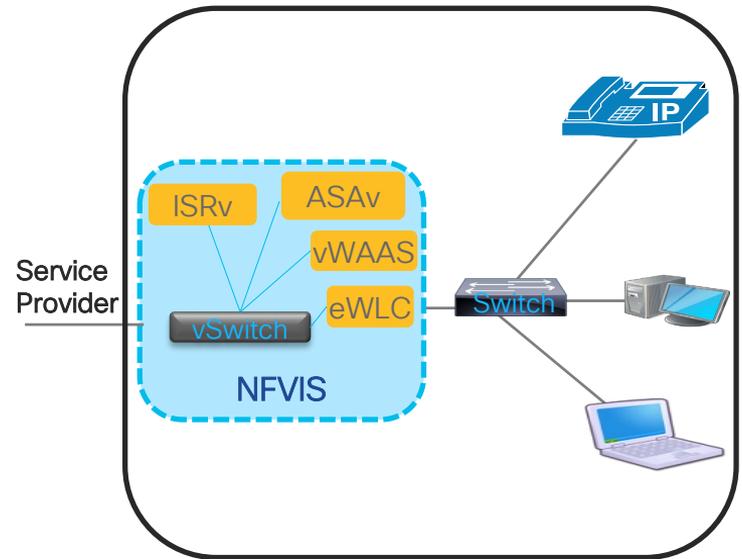
Select
3rd Party Hardware

In Other words

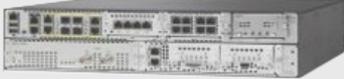
Traditional Branch



Virtualized Branch



Hardware Options

Enterprise NFV		
<p>Physical Router Virtual Services</p>  <p>4000 Series ISR + UCS® E-Series</p>  <p>Upgradable hardware Deterministic routing performance</p>	<p>Virtual Router Virtual Services</p>  <p>Enterprise Network Compute System (ENCS)</p>  <p>Elastic routing and services Router / Server Hybrid</p>	<p>Virtual Router Virtual Services</p>  <p>UCS C-Series & CSP</p>  <p>Elastic routing and services Performance Early adopter</p>

Platform Built for Enterprise NFV

ENCS 5000 Series for the Branch

Best of Routing
& Compute

Complete
Virtualized Services

Open for Third Party
Services and Apps

Enterprise Network Compute System

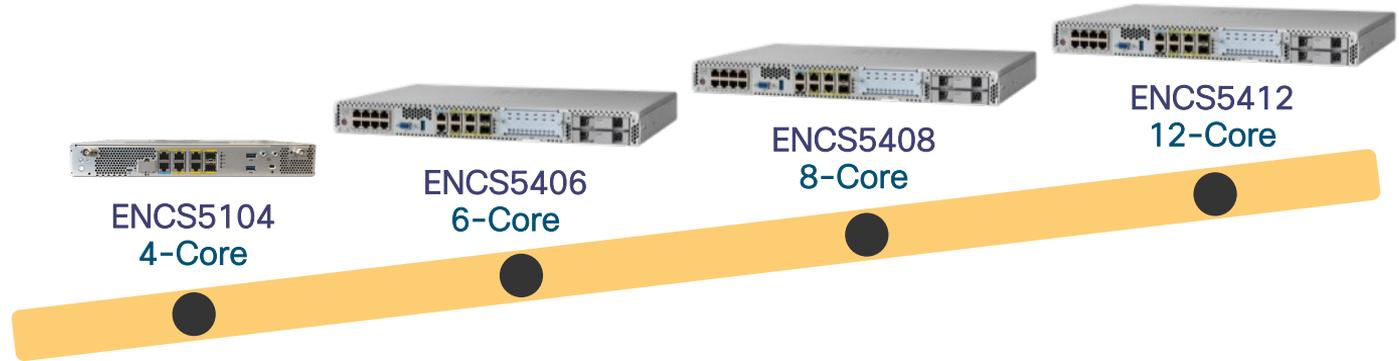
ENCS 5100 Series



ENCS 5400 Series

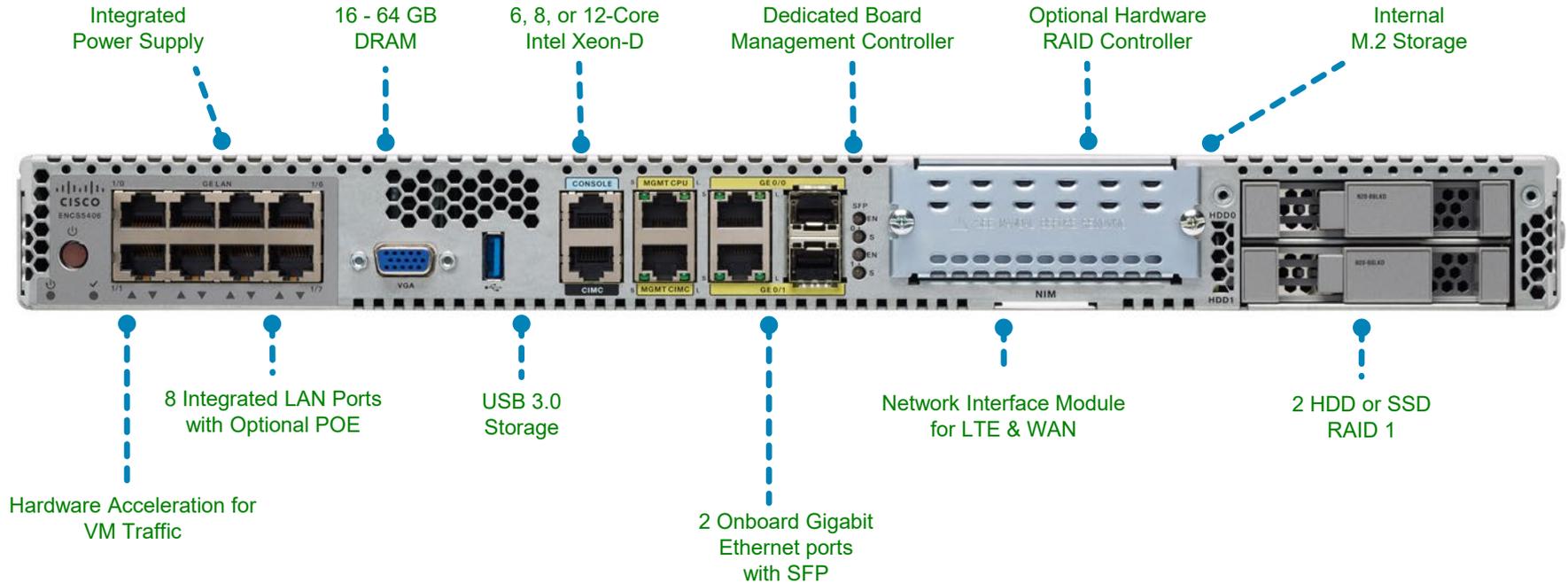
cisco Live!

ENCS 5000 Series - Chassis Options

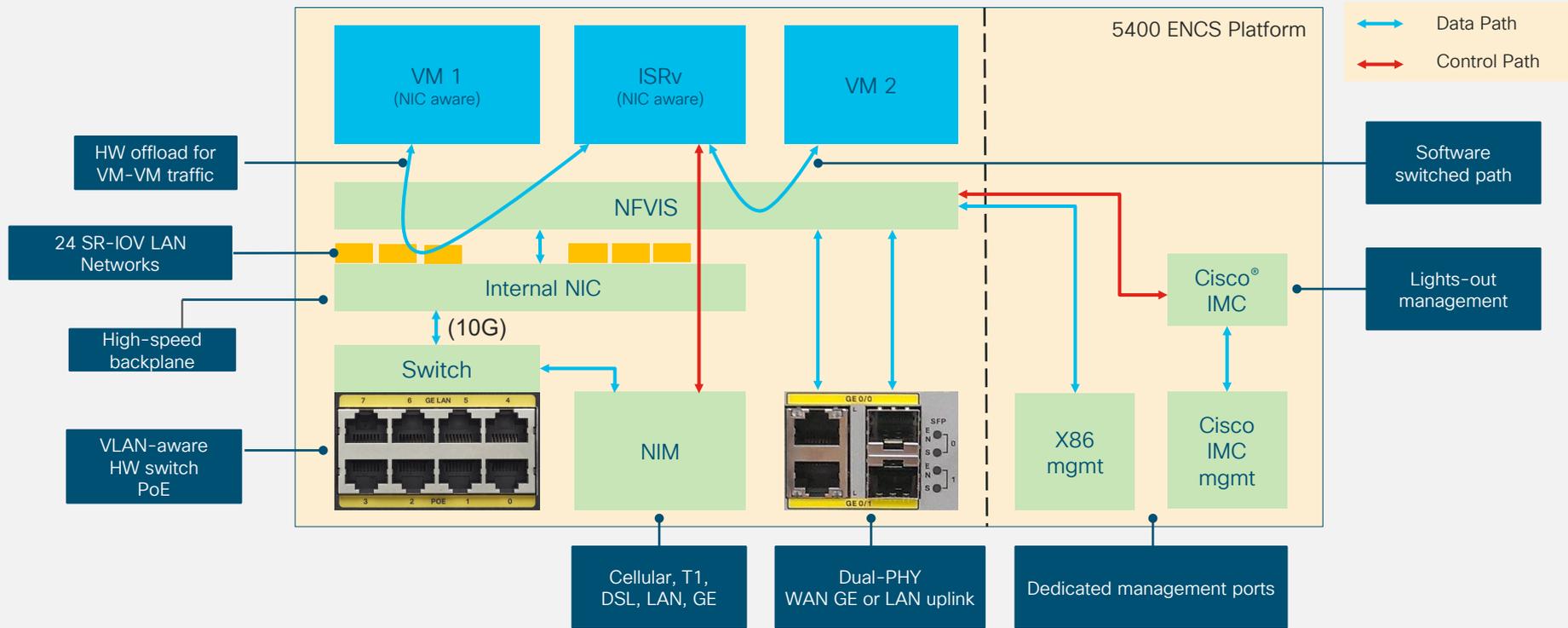


	ENCS 5104	ENCS 5406	ENCS 5408	ENCS 5412
CPU	4-core	6-core	8-core	12-core
PoE	No	No	200W	200W
Capacity Guidance	ISRV + 1 VM	ISRV + 2 VMs	ISRV + 3 VMs	ISRV + 5 VMs

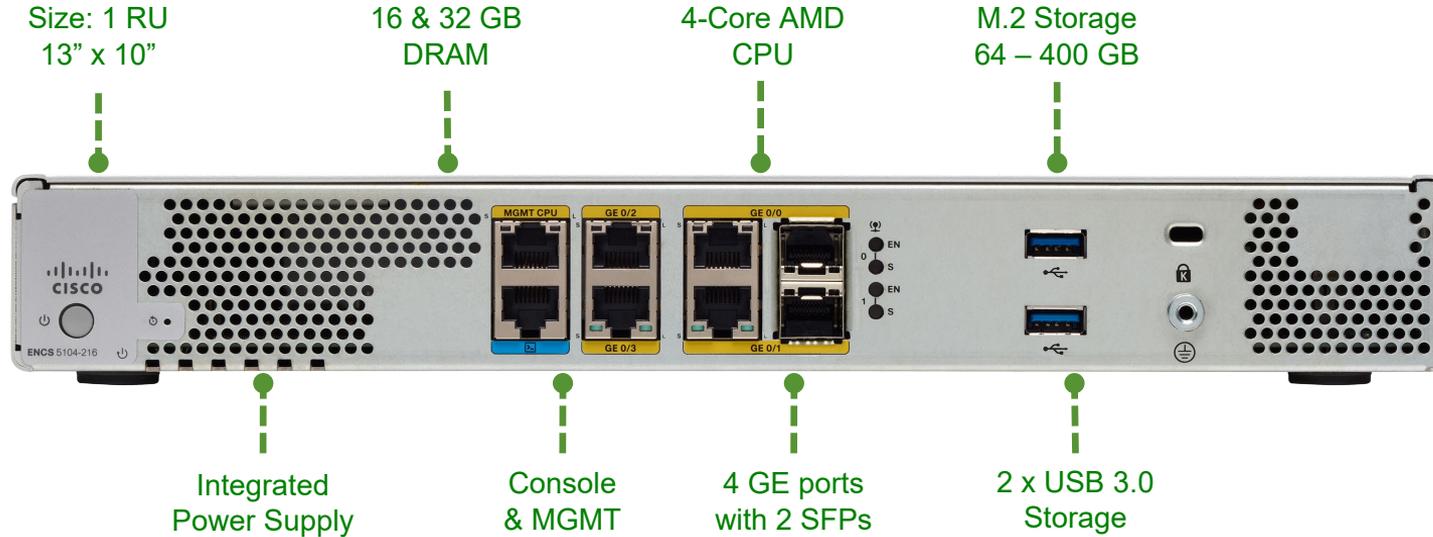
ENCS 5400 Series



5400 ENCS Internal Networking

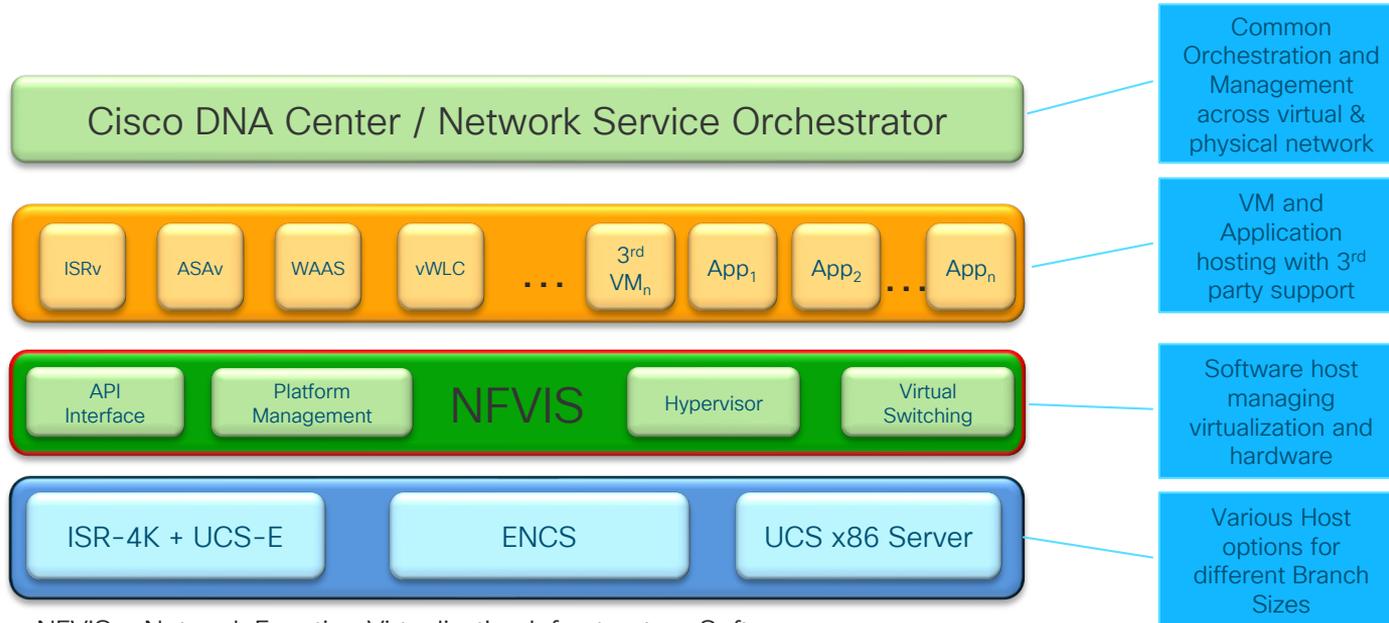


ENCS 5100 Series - I/O Side



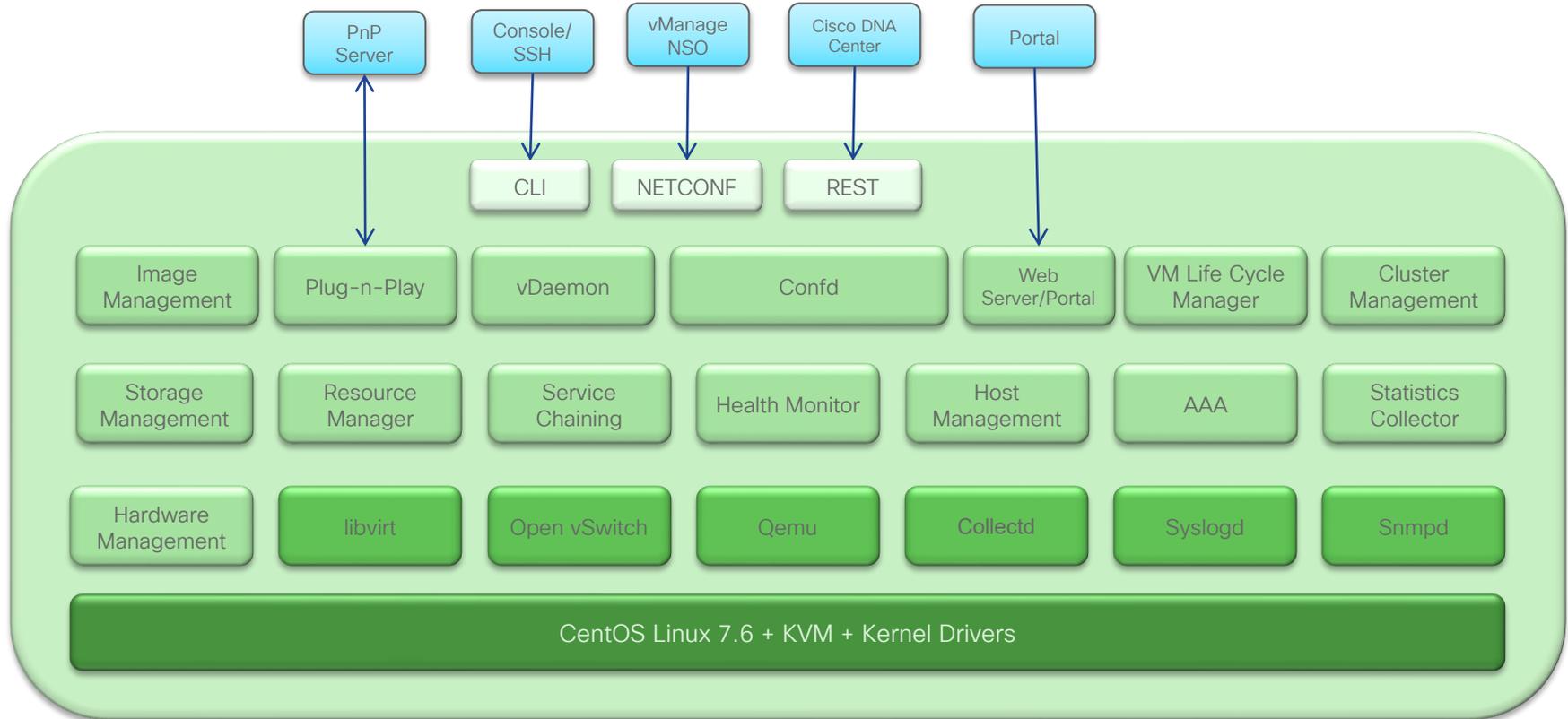
NFVIS Architecture

Enterprise NFV Solution Architecture



NFVIS = Network Function Virtualization Infrastructure Software

NFVIS Architecture



Purpose built Network Hypervisor Enterprise NFV Infrastructure Software (NFVIS)



Network Hypervisor

- Supports segmentation of virtual networks
- **Abstract CPU, memory, and storage resources**



Zero-Touch Deployment

- **Automatic connection to PnP server**
- Highly secure connection to the orchestration system
- Easy day-0 provisioning



Security

- **Secure Chain of Trust**
- Secure overlay for management and monitoring
- VNF secure boot
- Role Based Access Control



Lifecycle Management

- **Provisioning and launch of VNFs**
- Stop and restart services
- Dynamically add and remove services
- Failure monitoring and recovery
- VNF Backup Restore



Service Chaining

- **Elastic service insertion**
- PNIC tracking and VNIC update
- Multiple independent service paths based on applications or user profiles
- Host and VM Statistics, Packet Capture



Open API

- **Programmable API for service orchestration**
- Rest and NETCONF API
- Netconf Notification

Features

- Manage via GUI, CLI (IOX XR syntax), REST API, Netconf/Yang
 - GUI & REST connections are over HTTPS – used by Cisco DNA Center
 - YANG models – used by NSO or other MANO
- Service Image Types: ISO, OVA, QCOW/QCOW2, VMDK, RAW
- DPDK VM Migration supports upgrade from non-DPDK to DPDK mode
- Dynamic SR-IOV support on UCSC-M5, UCSE-M3, and CSP platforms
- ENCS 5400 supports 24 LAN SRIOV networks

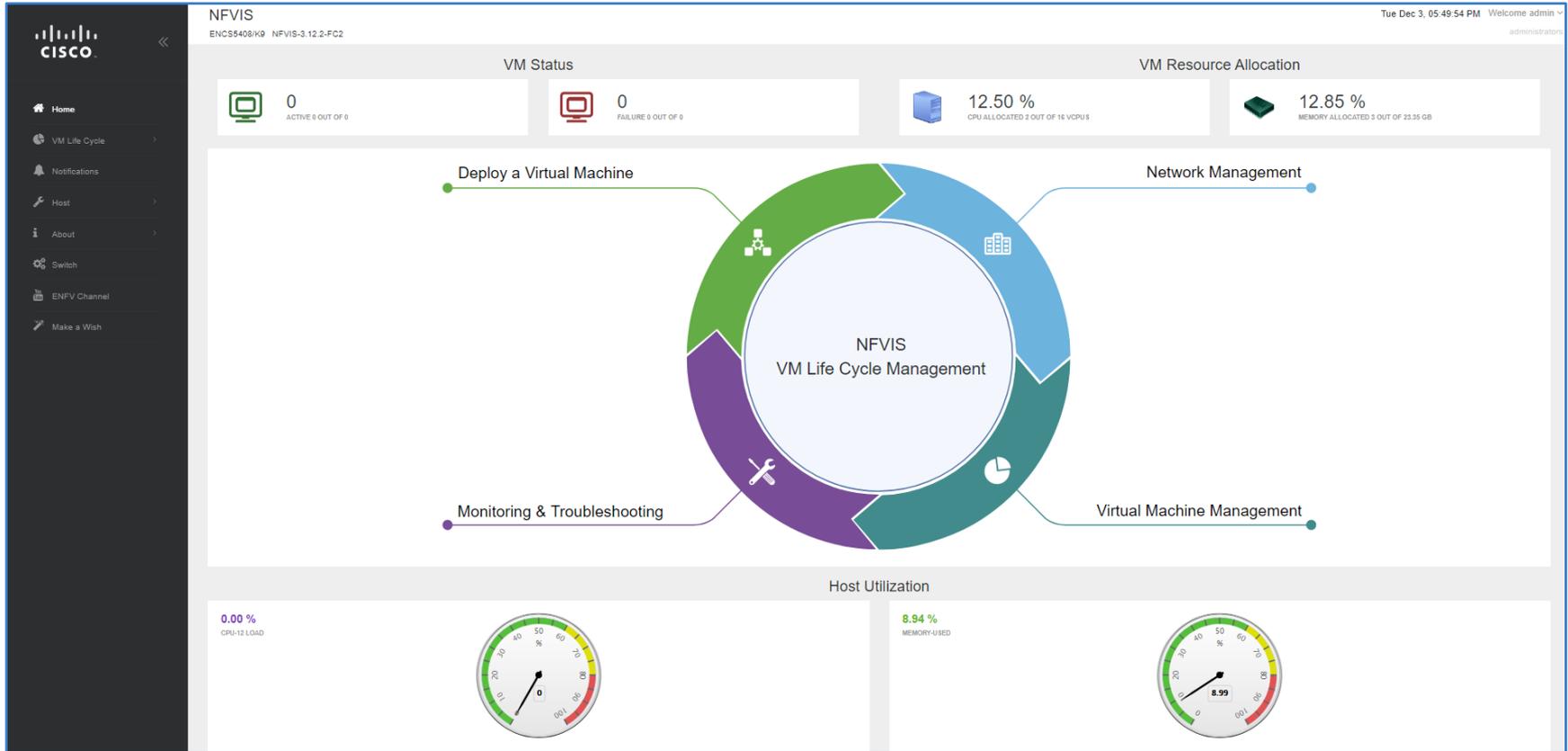
Default System Settings

NFVIS has following default settings when it is installed

- DHCP is enabled on WAN facing network / port (wan1)
 - DHCP can only be enabled on one network / port
- Static IP (192.168.1.1) assigned on LAN facing network / port
- PnP for zero-touch deployment enabled
- Following networks /bridges created by default:
 - wan-net / wan-br
 - wan2-net / wan2-br
 - lan-net / lan-br

GUI Access

https://<IP_Address>



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Upgrading NFVIS - GUI

NFVIS 14:22:50 Welcome admin
ENC5408/K9 NFVIS-3.7.1-FC2 administrator

Drop Files or Click

Name	Upload Progress	Size	Status
Cisco_NFVIS_BRANCH_Upgrade-3.8.1-FC3.nfvispkg	<div style="width: 100%;"></div>	511 MB	Uploaded

System Upgrade

Upgrade Name	Status	Upload Date	Version	Delete
Cisco_NFVIS_BRANCH_Upgrade-3.8.1-FC3.nfvispkg	Valid	2018-04-30T19:20:50.917563-00:00	3.8.1-FC3	

Showing 1 to 1 of 1 entries Previous 1 Next

Select Upgrade: Cisco_NFVIS_BRANCH_Upgrade-3.8.1-FC3.nfvispkg Upgrade Now Upgrade Later Start Upgrade

Upgrade Applied:	Status	Delete
No data available in table		

Showing 0 to 0 of 0 entries Previous Next

Upgrading NFVIS - CLI

- Upload upgrade file
 - *scp root@<Server_IP>/Cisco_NFVIS_BRANCH_Upgrade-3.12.2-FC2.nfvispkg intdatastore:Cisco_NFVIS_BRANCH_Upgrade-3.12.2-FC2.nfvispkg*
- Register the upgrade image
 - *system upgrade image_name Cisco_NFVIS_BRANCH_Upgrade-3.12.2-FC2.nfvispkg location /data/intdatastore/uploads*
- Verify registered image
 - *show system upgrde reg-info*
- Upgrade registered image
 - *system upgrade apply-image Cisco_NFVIS_BRANCH_Upgrade-3.12.2-FC2.nfvispkg scheduled-time <hours>*

Plug-n-Play (PnP)

Cisco PnP Overview

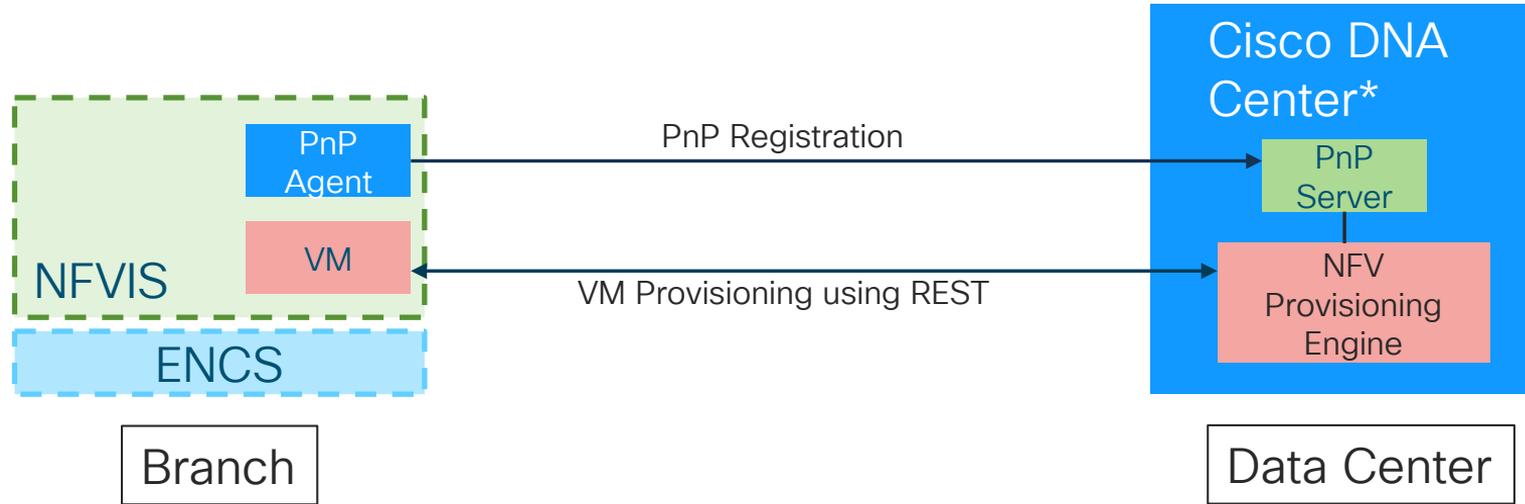
Cisco Network Plug-and-Play solution provides:

- Zero touch deployment for Routers, Switches, Access Points & NFVIS
- Automated and centrally managed remote device deployment
- Simplified and consistent deployment of Network devices

PnP Agent in NFVIS

- Running as a service
- Auto-discover PnP server
- Provide device UDI (Serial Number, PID) to server

Zero-touch deployment using PnP



* - Network Services Orchestrator (NSO) can also be used

PnP priorities with NFVIS

- Manual Configuration
 - PnP Server IP is configured in NFVIS using CLI or GUI or API
- Automatic Discovery with DHCP option 43
- DNS Lookup
- Cisco Cloud Redirection

PnP DHCP options 43



```
ip dhcp pool pnp
 network 10.89.23.0 255.255.255.0
 default-router 10.89.23.1
 option 43 ascii "5A1D;B2;K4;I10.27.87.146;J80"
```



5A = PnP DHCP ID
1D = PnP DHCP debug on
1N = PnP DHCP debug off
Token K = <protocol>
1: XMPP-starttls
2: XMPP-socket
3: XMPP-tls
4: HTTP
5: HTTPS

Token B = <address type> 1:host; 2:ipv4; 3:ipv6
Token I = <remote server IP / hostname>
Token J = <remote server port>

option 43 ascii "5A1D;B2;K4;I10.27.87.146;J80"

5A1D: PnP DHCP ID and debug on

B2: Address type IPv4

K4: Protocol HTTP

I: Remote Server IP 10.27.87.146 (PnP server IP)

J80: Remote Server Port 80

PnP DNS Lookup

Construct a fully qualified domain name (FQDN), using the preset hostname "pnpserver", based on the network domain name configured on the DHCP server.

Example of DNS lookup configurations on DHCP server:

```
ip dhcp pool P_ENCS_18375
  host 172.19.183.75 255.255.255.0
  hardware-address 00f2.8bc3.4a54
  default-router 172.19.183.1
  domain-name cisco.com
  dns-server 172.19.183.147
ip host pnpserver.cisco.com 172.19.152.41
ip dns server
```

PnP Cloud Redirect

- This method uses the Cisco Cloud Device Redirect tool available in the Cisco Software Central.
 - User needs to have a Cisco CCO account in advance.

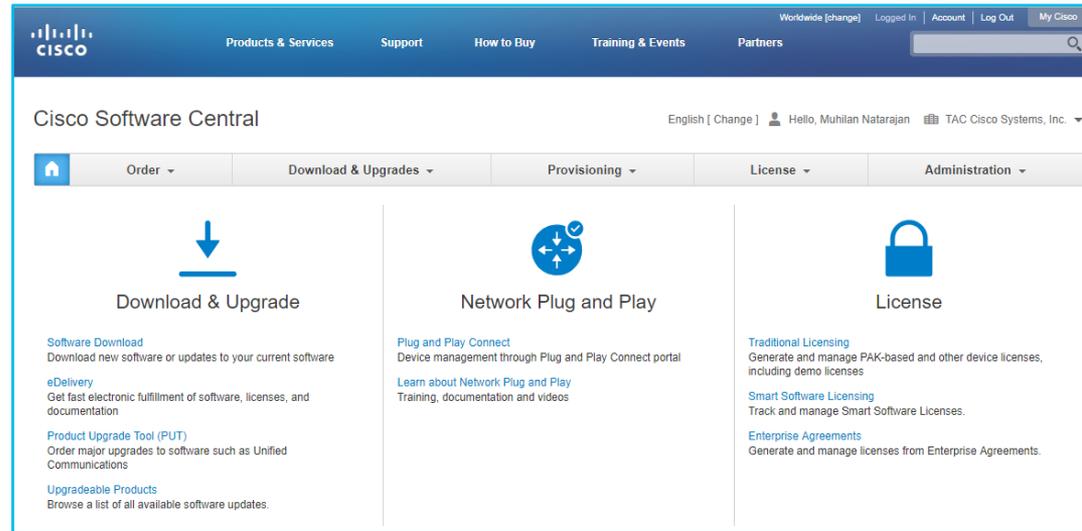
Example of Cloud Redirect configurations on DHCP server:

```
ip dhcp pool P_ENCS_18375
  host 172.19.183.75 255.255.255.0
  hardware-address 00f2.8bc3.4a54
  default-router 172.19.183.1
  domain-name cisco.com
  dns-server 172.19.183.147
  ip dns server
```

PnP Cloud Redirect – Cisco Account

In order to use Cisco Cloud Device Redirect tool, user needs to have a Cisco Account in advance.

- Launch Cisco Software Central at <https://software.cisco.com> in browser
- Click “Login In”



PnP Cloud Redirect (cont'd)

- When Successful, pull down Provisioning Tab and Click “Plug and Play Connect”

The screenshot shows the Cisco Software Central interface for the 'Plug and Play Connect' section. The top navigation bar includes the Cisco logo, 'Products & Services', 'Support', 'How to Buy', 'Training & Events', and 'Partners'. The user is logged in as 'Hello, Muhilan Natarajan' from 'TAC Cisco Systems, Inc.'. The main content area has a breadcrumb 'Cisco Software Central > Plug and Play Connect' and a title 'Plug and Play Connect'. Below the title are tabs for 'Devices', 'Controller Profiles', 'Network', and 'Certificates'. A toolbar contains buttons for '+ Add Devices...', '+ Add Software Devices...', 'Edit Selected...', and 'Delete Selected...'. A table with columns for 'Serial Number', 'Base PID', 'Product Group', 'Controller', 'Last Modified', 'Status', and 'Actions' is shown. The table is currently empty, displaying 'No Devices to display.' and 'No Records to Display'.

Worldwide [change] | Logged In | Account | Log Out | My Cisco

Products & Services | Support | How to Buy | Training & Events | Partners

Cisco Software Central > Plug and Play Connect

English [Change] | Hello, Muhilan Natarajan | TAC Cisco Systems, Inc. | DNA

Plug and Play Connect

Feedback | Support | Help

Devices | Controller Profiles | Network | Certificates

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

Serial Number	Base PID	Product Group	Controller	Last Modified	Status	Actions
<input type="text"/>	<input type="text"/>	Any	Any	Select Range	Any	Clear Filters

No Devices to display.

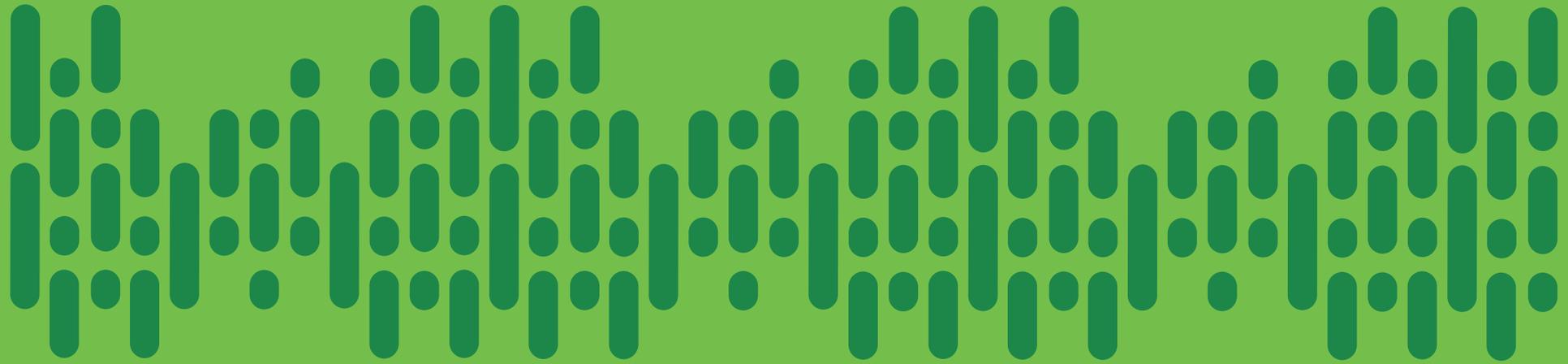
No Records to Display

PnP Configuration

The screenshot displays the 'Plug-n-Play' configuration page in a web interface. On the left is a dark sidebar with navigation items: Home, VM Life Cycle, Notifications, Host (selected), Certificate Management, Diagnostics, Interfaces, Monitoring, Plug-n-Play, Settings, SNMP, Upgrade, and Users & Roles. The main content area is titled 'Plug-n-Play' and contains the following configuration fields:

- PNP Agent Status:** Running (with a refresh and power icon)
- Server Connection Status:** Success
- Created By:** user
- Method:** Static Automatic
- Options:** DHCP Option 43 DHCP Option 17 DNS Discovery
 DNS IPv6 Discovery CCO Discovery CCO IPv6 Discovery
- Retry Timeout:** 0s (with a slider)
- Transport:** HTTP HTTPS
- PNP Server IPv4 or IPv6 Address:** PNP Server IPv4 or IPv6 Address
- PNP Server Port:** PNP Server Port

At the bottom right of the configuration area are two buttons: 'Save' and 'Cancel'. A red oval is drawn around the 'Method' and 'Options' sections.



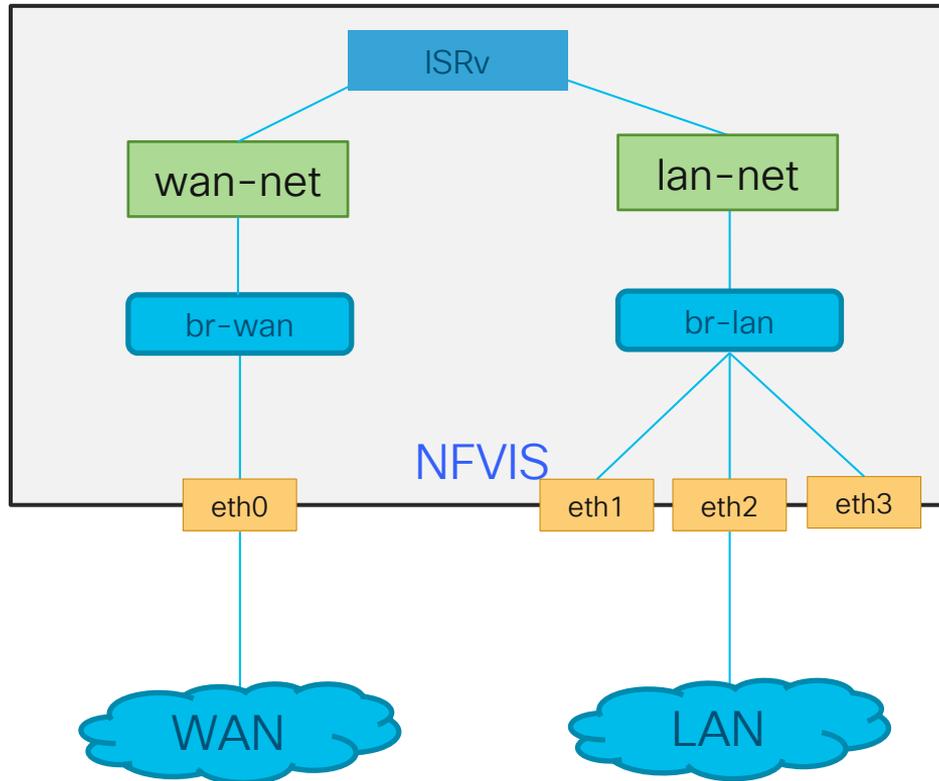
Demo – Portal and PnP

NFVIS Networking

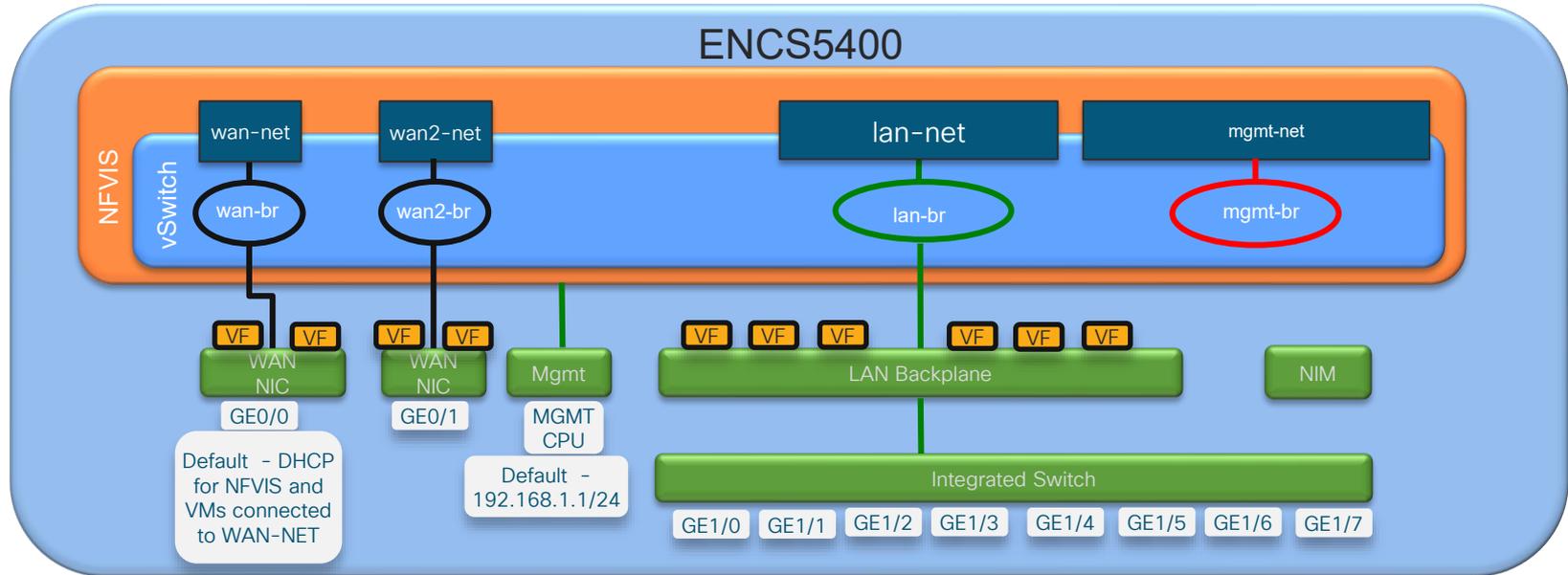
Networking

- Flexible network virtualization model
- OVS bridges and virtual networks for service chaining between VMs
- VLAN on virtual networks
- High performance SR-IOV networks
- Port forwarding to manage multiple VMs through single IP

Simplified Networking within NFVIS



Default System Configuration on ENCS

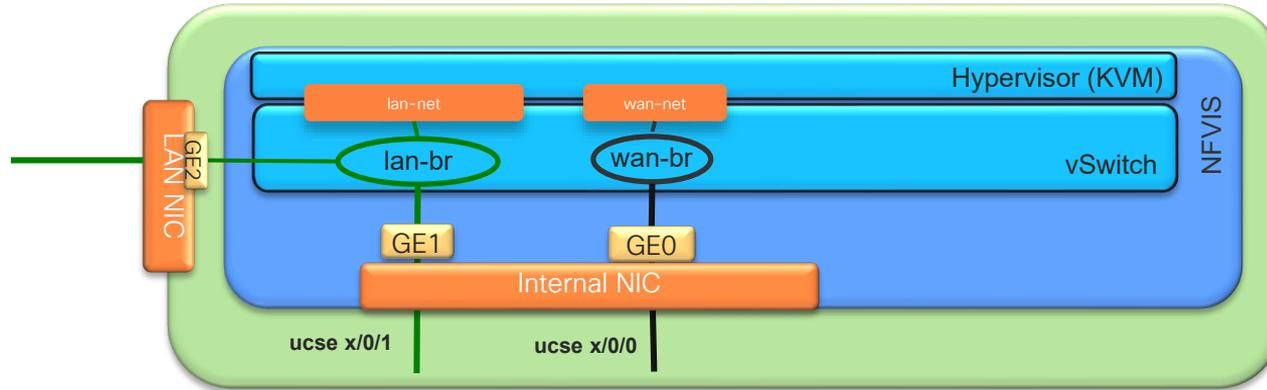


Default System Configuration on ENCS (Contd.)

- NFVIS can be accessed by default via the GE WAN ports or via the dedicated Management port
- WAN network (wan-net) and a WAN bridge (wan-br) is set by **default to enable DHCP**. GE0-0 is by default associated to WAN bridge (wan-br)
- The Management port on ENCS is set to to 192.168.1.1 to access NFVIS
- All Switch ports – GE 1/0 to GE1/7 is associated to LAN bridge
- An internal management network (int-mgmt-net) and a bridge (int-mgmt-br) is created and is internally used for system monitoring.

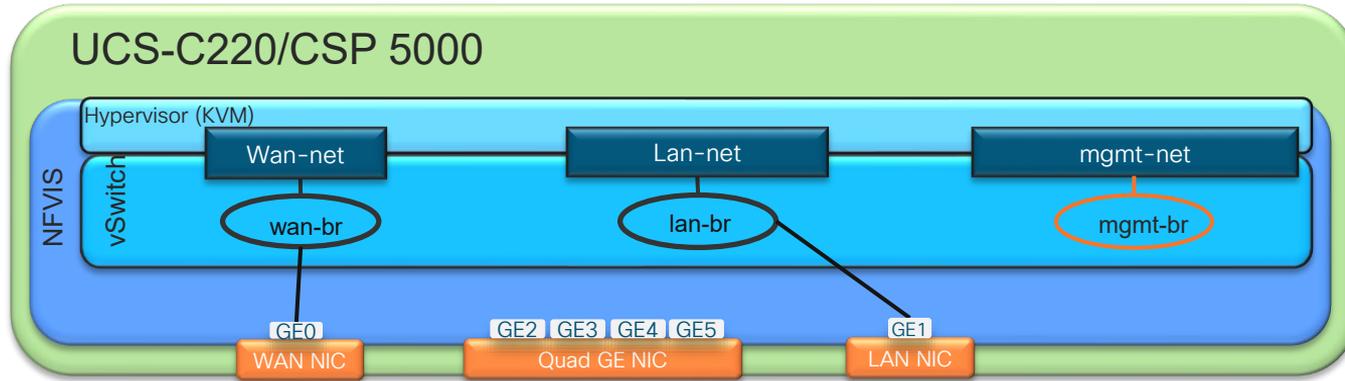
Default System Settings on UCS E-Series

UCS E-Series



- NFVIS can be accessed by default by either WAN or LAN networks
- WAN network (wan-net) and a WAN bridge (wan-br) is set by default to enable DHCP.
- GE 0 (Internal GigE port to ISR4K) is by default associated to WAN bridge
- LAN network (lan-net) and a LAN bridge (lan-br) set by default to 192.168.1.1 to access NFVIS
- All remaining ports - GE1 (internal interface to ISR4K) and external GigE ports on UCS-E - GE2 and/or GE3 is associated to LAN bridge
- An internal management network (int-mgmt-net) and a bridge (int-mgmt-br) is created and is internally used for system monitoring.

Default System Configuration on CSP 5000



- NFVIS can be accessed by default by either WAN or LAN networks
- WAN network (wan-net) and a WAN bridge (wan-br) is set by default to enable DHCP.
- Ethernet port 0 is by default associated to WAN bridge
- LAN network (lan-net) and a LAN bridge (lan-br) set by default to 192.168.1.1 to access NFVIS
- All remaining ports – Ethernet 1 through N is associated to LAN bridge
- An internal management network (int-mgmt-net) and a bridge (int-mgmt-br) is created and is internally used for system monitoring.

Network Administration

Networks & Bridges

Mon Dec 16, 10:25:28 PM Welcome admin administrators

DPDK **?** **DISABLED**

Network	Mode	Vlans	Native Vlan	Bridge	Interfaces	Actions
lan-net	trunk			lan-br	int-LAN	
wan-net	trunk			wan-br	GE0-0	
wan2-net	trunk			wan2-br	GE0-1	

Showing 1 to 3 of 3 entries

Previous 1 Next

Interface Status

Interface	Speed (Mbps)	Media	MAC	SRIOV
GE0-0	1000	Twisted Pair	00:81:c4:37:98:fa	enabled
GE0-1	0	Fibre	00:81:c4:37:98:fb	enabled
MGMT	1000	Twisted Pair	00:81:c4:37:99:6e	enabled

Showing 1 to 3 of 3 entries

Previous 1 Next

SRIOV Networks

Show 5 entries Search:

SRIOV Network	Interface	Mode	VLAN	Actions
GE0-0-SRIOV-1	GE0-0	trunk		
GE0-0-SRIOV-2	GE0-0	trunk		
GE0-1-SRIOV-1	GE0-1	trunk		
GE0-1-SRIOV-2	GE0-1	trunk		
LAN-SRIOV-1	LAN Switch	trunk		

Showing 1 to 5 of 28 entries

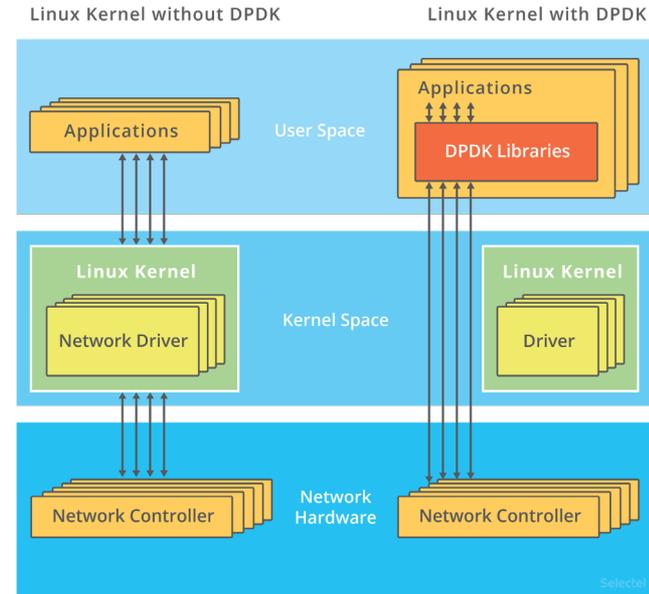
Previous 1 2 3 4 5 6 Next

Add New Network

Edit a Network

Data Plane Development Kit (DPDK)

- DPDK skips the Linux kernel by processing packets directly in the userspace.
- DPDK reserves a CPU that is constantly polling for new packets.



NFVIS resource requirements for DPDK

Total Cores	Cores Reserved for DPDK
<= 16	1
> 16	2

Total system memory	Reserved for NFVIS	Reserved for DPDK per NUMA node*
<= 16 GiB	3 GiB	1 GiB
<= 32 GiB	3 GiB	1 GiB
<= 64 GiB	4 GiB	2 GiB
<= 128 GiB	4 GiB	4 GiB

Enabling DPDK – GUI

The screenshot displays the Cisco NFVIS GUI for a device named 'NFVIS' (ENC5408/K9, NFVIS-3.12.2-FC2). The user is logged in as 'admin'. The main navigation menu on the left includes Home, VM Life Cycle, Deploy, Image Repository, Manage, Networking, Resource Allocation, VM Monitoring, Notifications, Host, About, Switch, ENFV Channel, and Make a Wish.

The 'Networks & Bridges' section is active, showing a table of network configurations. A 'DPDK' status indicator in the top right corner is circled in red and shows 'ENABLED' with a green toggle switch.

Network	Mode	Vlans	Native Vlan	Bridge	Interfaces	Actions
lan-net	trunk			lan-br	int-LAN	
wan-net	trunk			wan-br	GE0-0	
wan2-net	trunk			wan2-br	GE0-1	

Showing 1 to 3 of 3 entries

Previous 1 Next

The 'Interface Status' section shows a table of interface details:

Interface	Speed (Mbps)	Media	MAC	SRIOV
GE0-0	1000	Twisted Pair	00:81:c4:37:98:fa	enabled
GE0-1	0	Fibre	00:81:c4:37:98:fb	enabled
MGMT	1000	Twisted Pair	00:81:c4:37:99:6e	enabled

Showing 1 to 3 of 3 entries

Previous 1 Next

The 'SRIOV Networks' section shows a table of SRIOV network configurations:

SRIOV Network	Interface	Mode	VLAN	Actions
GE0-0-SRIOV-1	GE0-0	trunk		
GE0-0-SRIOV-2	GE0-0	trunk		
GE0-1-SRIOV-1	GE0-1	trunk		
GE0-1-SRIOV-2	GE0-1	trunk		
LAN-SRIOV-1	LAN Switch	trunk		

Showing 1 to 5 of 28 entries

Previous 1 2 3 4 5 6 Next

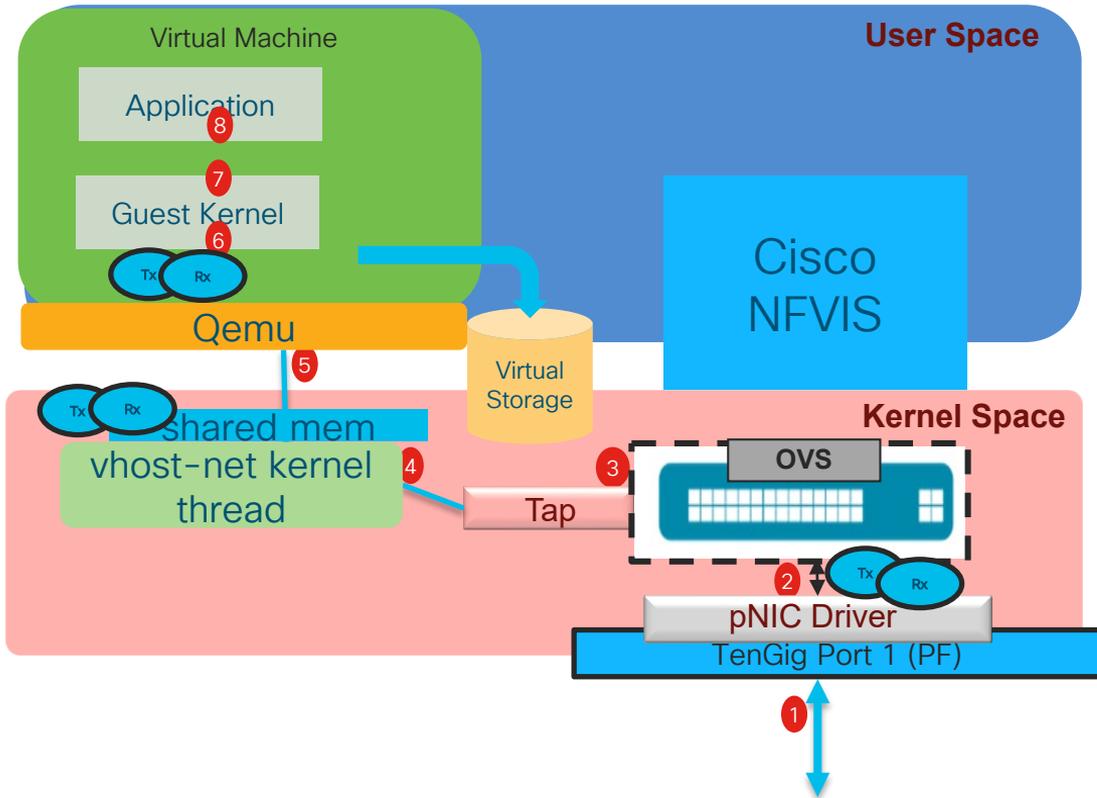
Enabling DPDK

- CLI
 - `nfvis(config)# system settings dpdk enable`
- While enabling DPDK, NFVIS goes through following stages:
 - All VMs are shutdown*
 - NFVIS reserves CPU and memory for DPDK+
 - All bridges which has PNICs with no SRIOV networks are upgraded to DPDK
 - All PNICs on the upgraded bridges are upgraded to DPDK
 - All VMs are updated to support DPDK
 - All VMs which are shutdown by NFVIS are brought back
- Complete process of enabling DPDK takes ~ 3-5 mins

* All VMs which are in Active or Error state

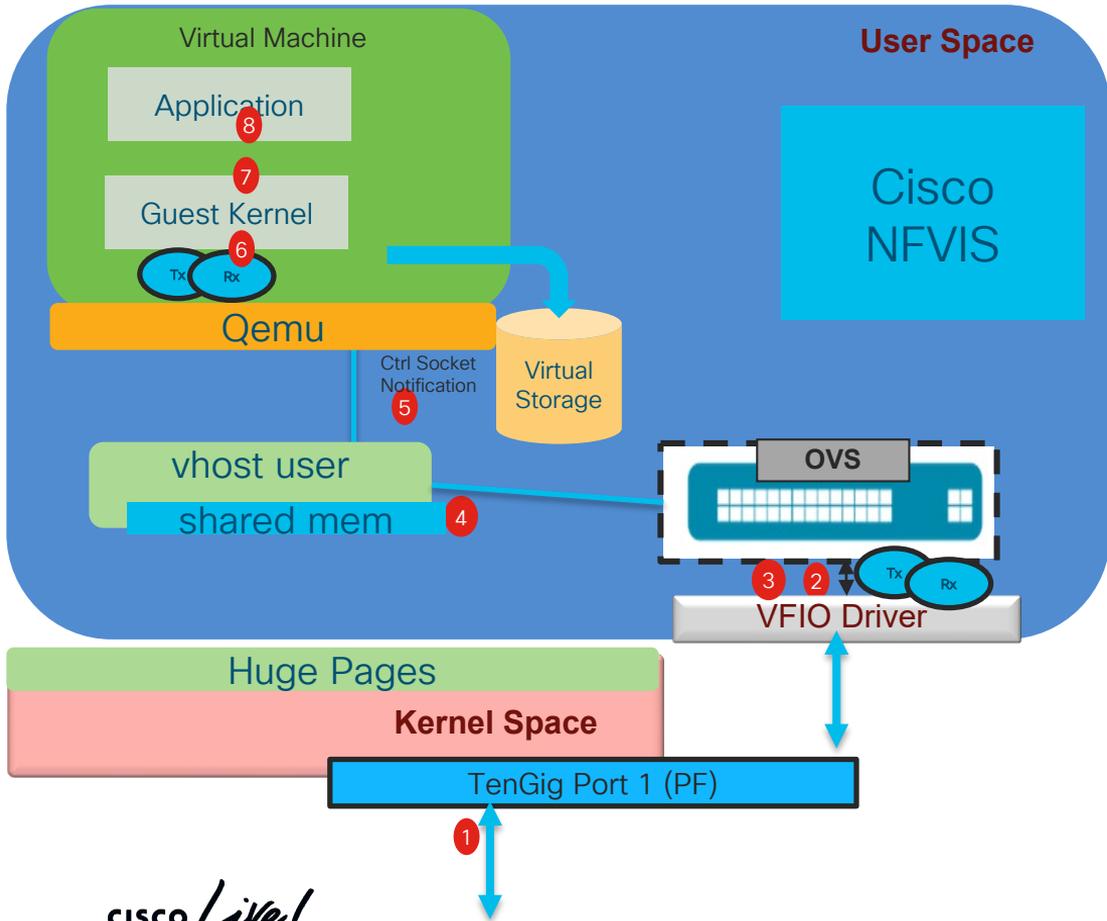
+ It is recommended to reboot NFVIS before memory allocation

Packet flow to the VM deployed with OVS



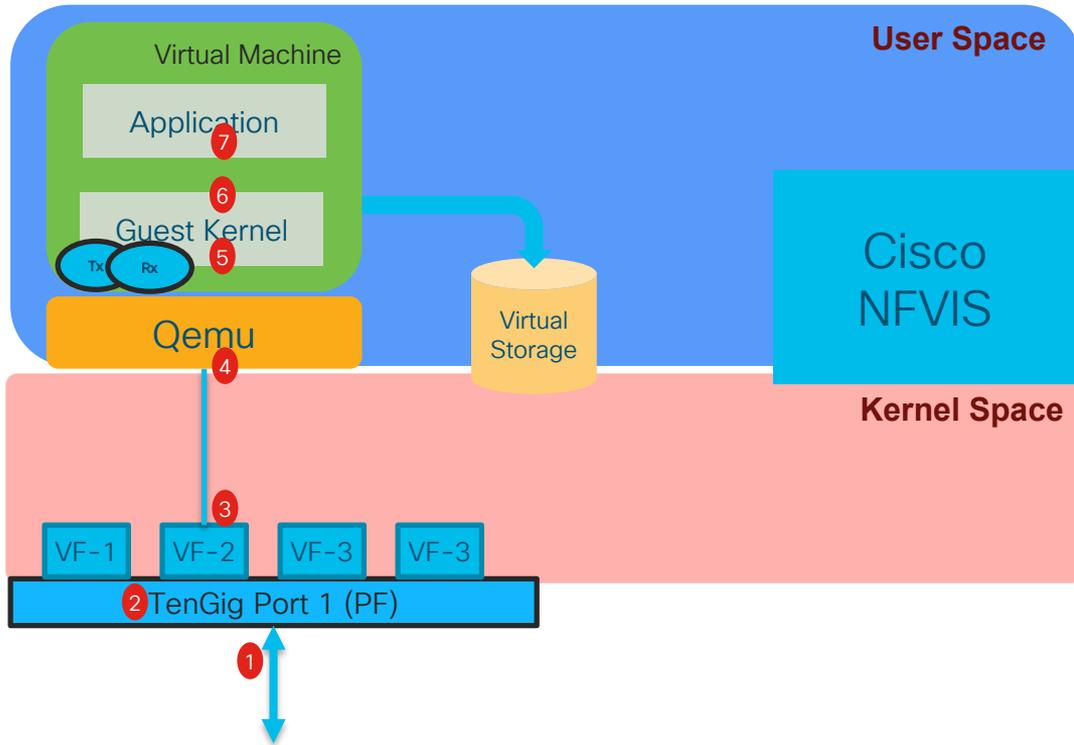
1. Packet is **received** by the physical NIC
2. Packet is placed in the interface ring buffer and an interrupt is generated.
3. OVS performs a **MAC/VLAN lookup** and identifies specific port
4. vHost kernel thread is scheduled and copies the packet to **shared memory**
5. Qemu generates the **IRQ virtual interrupt** to the guest kernel.
6. Guest kernel processes the interrupt and reads the packet from the buffer
7. Guest Linux networking stack processes the packet and delivers the packet to the user space process.
8. **Guest User space process consumes the packet**

Packet flow to the VM deployed with OVS DPDK



1. Packet is **received** by the physical NIC and placed in the ring buffer in user space
2. DPDK **Poll Mode Driver** dequeues the packet
3. OVS performs a **MAC/VLAN lookup** and identifies specific port
4. Packet is copied to vhost-user **shared memory**
5. OVS generates the control **socket notification** to Qemu.
6. Guest kernel processes the notification and reads the packet from the buffer
7. Guest Linux networking stack processes the packet and delivers the packet to the user space process.
8. **Guest User space process consumes the packet**

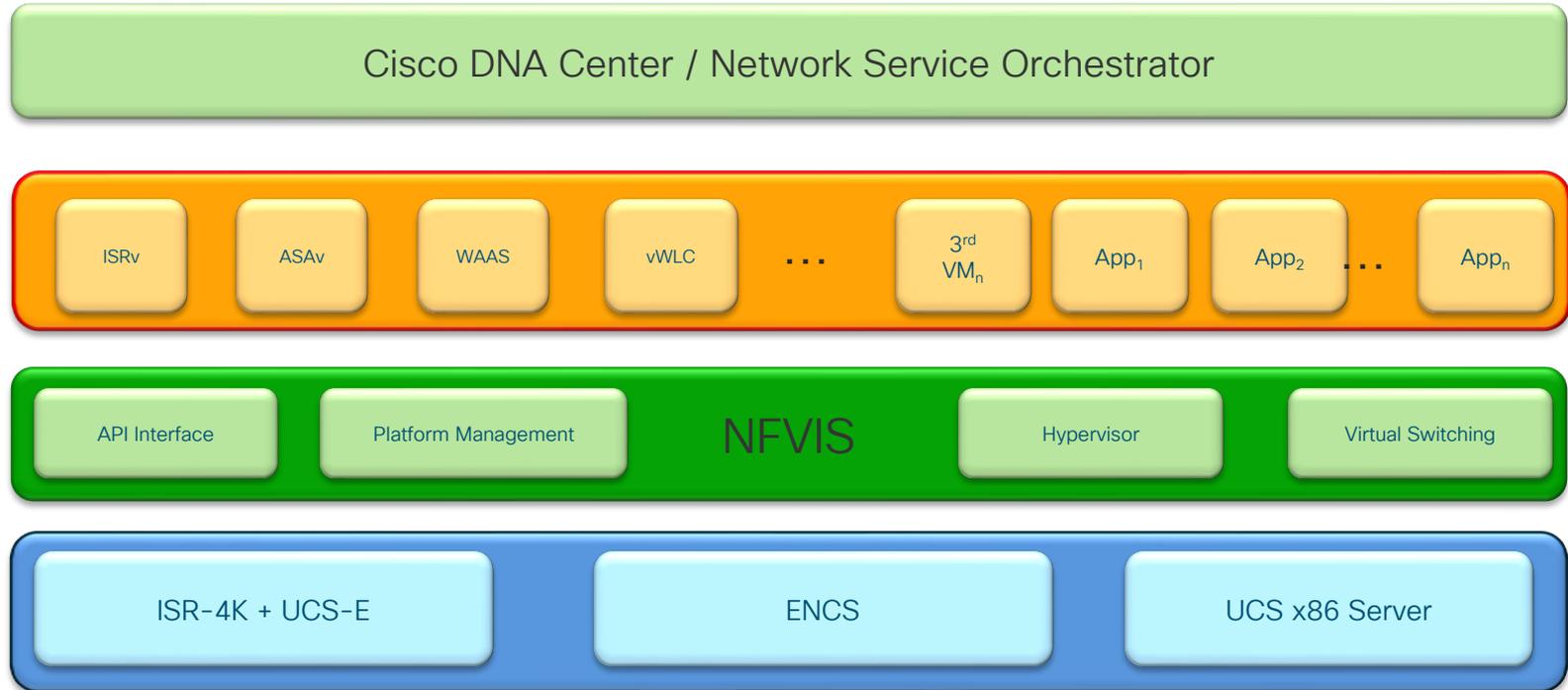
Packet flow to the VM deployed with SRIOV



1. **Packet is received** by the physical NIC
2. NIC performs a **MAC/VLAN lookup** and selects a VF.
3. Packet is placed in the VF queue and an **interrupt is generated**.
4. Qemu thread for the VM vCPU receives the interrupt and sends an virtual interrupt to the guest kernel.
5. Guest kernel processes the interrupt and reads the packet from the buffer
6. Guest Linux networking stack processes the packet and delivers the packet to the user space process.
7. **Guest User space process consumes the packet**

VM Life Cycle Management

Enterprise NFV Solution Architecture



NFVIS = Network Function Virtualization Infrastructure Software

NFVIS VM



- Supported VMs in NFVIS 3.12.x
 - ISRv
 - ASA v
 - vWAAS
 - NGFWv
 - vEdge
 - cEdge
 - eWLC
 - Windows/Linux
 - 3rd Party VMs (PaloAlto, Fortinet, ThousandEyes, InfoVista, CTERA, etc)

VM Packaging, Deployment and Management

VM Image Packaging

- Converting qcow2 and img images into tar.gz
- Not Mandatory
 - Simplify deployment for complex VM
 - Support for Day 0 configuration for 3rd Part VM
 - Easy to scale out deployments
- A tar.gz file containing
 - qcow2 disk image (*.qcow)
 - Image properties file (Image_properties.xml)
 - Package Manifest (package.mf)
 - Optional Bootstrap configuration file (ovf-env.xml)
 - Other files (Ex: license)

VM Image Package Files

- Image properties file (Image_properties.xml)
 - VM Type
 - Resource requirement (vCPU, Memory etc.,)
 - Profile
- Bootstrap Configuration file (ovf-conf.xml)
 - Login username and password
 - Mgmt interface
- Package Manifest (package.mf)
 - Checksum
 - File type, name

VM Packaging Utility

 <<

NFVIS
ENCS5408/K9 NFVIS-3.12.2-FC2

Fri Dec 20, 10:24:26 PM Welcome admin administrators

Image Registration Browse Datastore USB Upload **Image Packaging**

Package Name:

VM Version:

VM Type:

Dedicate Cores(Optimize):

Serial Console:

Sniov Driver(s):

Local Upload Raw Images (.qcow2/.img)

Raw Disk File Bus:

Thick Disk Provisioning:

Local Upload Bootstrap Files

Monitored:

Bootstrap Cloud Init Drive:

Bootstrap Cloud Init Bus:

▶Advanced Configuration

VM Packaging Utility



Home

VM Life Cycle

Deploy

Image Repository

Manage

Networking

Resource Allocation

VM Monitoring

Notifications

Host

About

Switch

ENFV Channel

Make a Wish

Local Upload Raw Images (.qcow2/img)

Raw Disk File Bus:

Thick Disk Provisioning:

Local Upload Bootstrap Files

Monitored:

Bootstrap Cloud Init Drive:

Bootstrap Cloud Init Bus:

Advanced Configuration

Virtual Interface Model:

Tablet:

No Cloud

Custom Properties

Resource Requirements

Add Profile(s)

Profile:	<input type="text" value="Small"/>	CPU:	<input type="range" value="1"/>	Memory (MB):	<input type="text" value="256"/>	Disk (GB):	<input type="text" value="1"/>	<input checked="" type="checkbox"/> Default
Profile:	<input type="text" value="Meditum"/>	CPU:	<input type="range" value="2"/>	Memory (MB):	<input type="text" value="512"/>	Disk (GB):	<input type="text" value="1"/>	<input type="checkbox"/> Default <input type="button" value="+"/>

VM Image Packaging Utility

- This is an enhanced packaging process that allows the VM owner to run the `nfvpt.py` utility as a command with a combination of parameters to package the VM.
- The VM packaging utility contains the following
 - `nfvpt.py` – It is a python based packaging tool that bundles the VM raw disk image/s along with VM specific properties.
 - `image_properties_template.xml` – This is the template file for the VM image properties file, and has the parameters with default values. If the user provides new values to these parameters while creating the VM package, the default values get replaced with the user-defined values.
 - `nfvpt_vm_packaging_utility_examples.txt` – This file contains examples on how to use the image packaging utility to package a VM image.
- *`nfvpt.py -o asav961-201 -i asav961-201.qcow2 -n ASAv -t firewall -r 961-201 --monitored true --bootstrap day0-config:filename1 --min_vcpu 1 --max_vcpu 4 --min_mem 1024 --max_mem 8192 --min_disk 8 --max_disk 16 --vnic_max 8 --optimize true --profile ASAv5, "ASAv5 profile", 1, 1024, 8192 --profile ASAv10, "ASAv10 profile", 1, 4096, 8192 --profile ASAv30, "ASAv30 profile", 4, 8192, 16384 --default_profile ASAv5`*

View of a registered Package

CISCO

NFVIS
ENCS5408/K9 NFVIS-3.12.2-FC2

Wed Dec 4, 09:35:25 PM Welcome admin administrators

Image Registration

Browse Datastore USB Upload Image Packaging

Drop Files or Click

#	Name	Size	VM Type	Dedicated Cores	File Storage	Progress	Status
	isrv-universalk9.16.12.01a.tar.gz	1075 MB	NA	NA	datastore1(internal)	<div style="width: 100%;"></div>	Uploaded

Images

Image Name	State	Type	Version	Storage Location	Secure Boot	Action
isrv-universalk9.16.12.01a.tar.gz	ACTIVE	ROUTER	16.12.01a	datastore1(internal)		

Showing 1 to 1 of 1 entries

Profiles

Profile	CPU	Sockets	Cores	Threads	Memory (MB)	Disk (MB)	Source Image	Action
ISRV-medium	4				4096	8192	isrv-universalk9.16.12.01a.tar.gz	
ISRV-mini	1				4096	8192	isrv-universalk9.16.12.01a.tar.gz	
ISRV-small	2				4096	8192	isrv-universalk9.16.12.01a.tar.gz	

Showing 1 to 3 of 3 entries

Managing a deployed VM

The screenshot displays the Cisco NFVIS VM Deployment interface. On the left is a navigation sidebar with options like Home, VM Life Cycle, Deploy, Image Repository, Manage, Networking, Resource Allocation, VM Monitoring, Notifications, Host, About, Switch, ENFV Channel, and Make a Wish. The main area is titled "VM Deployment" and includes a warning: "Warning: Any change in the vNIC of a deployed VM will automatically reboot the VM." Below this is a network diagram showing a central "ROUTER" icon connected to a "LAN Backplane" at the bottom. Two network interfaces, "GEO-0" and "GEO-1", are shown at the top, connected to "wan-net" and "wan2-net" respectively. A "lan-net" is also connected to the LAN Backplane. A legend at the top identifies icons for ROUTER, FIREWALL, WAAAS, VWLC, and OTHER. On the right, the "VM Details" panel shows configuration for a VM named "ROUTER". The "Port Number" field is circled in red and set to "22". Other fields include VM Name, Image, Profile, VNC Password, TECH PACKAGE, NIM, SSH USERNAME, SSH PASSWORD, External Port Range, Source Bridge, Deployment Disk, and Management IP.

NFVIS
ENC55408/K9 NFVIS-3.12.2-FC2

Wed Dec 4, 09:47:54 PM Welcome admin administrator

VM Deployment

Warning: Any change in the vNIC of a deployed VM will automatically reboot the VM.

ROUTER FIREWALL WAAAS VWLC OTHER NETWORK

GEO-0 GEO-1

wan-net wan2-net

lan-net

LAN Backplane

ROUTER

Deploy

VM Details

VM Name *	ROUTER
Image	isrv-universalk9.16.12.01a.ta
Profile	ISRV-small
VNC Password	
TECH PACKAGE	ax
NIM	DISABLE
SSH USERNAME	cisco
SSH PASSWORD
Port Number	22
External Port Range	2222
Source Bridge	wan-br
Deployment Disk	datastore1(internal)
Management IP	
Single IP	<input type="checkbox"/>

► Add Bootstrap Config

Console Access to VM

The screenshot displays the Cisco NFVIS interface. At the top, it shows 'NFVIS' and 'ENCS5408/K9 NFVIS-3.12.2-FC2'. The right side shows the date and time 'Mon Dec 16, 10:49:56 PM' and 'Welcome admin administrators'. The main content area is titled 'VM Status' and contains a table with the following data:

Name	Status	Profile	Port Forwarding	0	1	2	3	4	5	6	7	Management IP	Actions
ROUTER	Active	SRV-small	2222 => 22	internal	wan2-net	LAN-SRIOV-24						10.20.0.2	[Edit] [Refresh] [Stop] [Settings]

Below the table, it says 'Showing 1 to 1 of 1 entries'. A blue box labeled 'Console Access' points to a console icon in the 'Status' column. Another blue box labeled 'Port Forwarding for access' points to the '2222 => 22' entry in the 'Port Forwarding' column. Below the table is a network diagram titled 'VM Status Overview' showing a 'ROUTER' connected to 'GEO-0' and 'GEO-1' ports, which are connected to 'wan-net' and 'wan2-net' respectively. The 'ROUTER' is also connected to a 'LAN Backplane' which is connected to 'lan-net'. A 'Switch' icon is also present in the diagram.

On the right side, there is a 'VM Deployment Status' section with a table:

Name	Status
ROUTER	Active

Console Access to ISRv – CLI



- Provision with serial port (image_properties.xml)
 - `<console_type_serial>true</console_type_serial>`
- Enable serial port for console – accessing from UI console
 - *platform console serial*
 - Save and reload ISRv

Console Access to ISRv – CLI (Contd.)



- Logon to NFVIS

```
rcdn5408B#  
rcdn5408B# show system deployments  
NAME                               ID STATE  
-----  
rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv 3 running  
  
rcdn5408B#  
rcdn5408B# vmConsole rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv  
Connected to domain rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv  
Escape character is ^]  
  
rcdn5-4-rcdn5408-isrv#
```

PNIC Track State

- Notification to VNIC/VM when it's PNIC state changes

NFVIS
ENC5408/K9 NFVIS-3.12.2-FC2

Sun Dec 22, 04:34:41 PM Welcome admin administrators

VM Status

Name	Status	Profile	Port Forwarding	vnic								Management IP	Actions
				0	1	2	3	4	5	6	7		
ROUTER	Shutdown	ISRv-small	2222 => 22	internal	wan2-net	LAN-SRIOV-24						10.20.0.2	

Showing 1 to 1 of 1 entries

PNIC Tracking

*Click on icon to show details

Select port: GE0-1
VM Name: ROUTER
Select Vnic: VNIC1.wan2-net
Start Tracking

GE0-1 Tracking Status

VM	Vnic	Action
No data available in table		

Showing 0 to 0 of 0 entries

Secure Boot – NFVIS

- Software applications that boot up on the device are certified by Cisco
- Enable in ENCS CIMC
 - Server# scope bios
 - Server /bios # set secure-boot enable
 - Setting Value : enable
 - Commit Pending.
 - Server /bios *# commit
- Set boot order to loose
 - encs# scope bios
 - encs /bios # scope advanced
 - encs /bios/advanced # set BootOpRom UEFI
 - encs /bios/advanced # set BootOrderRules Loose
 - encs /bios/advanced *# commit

VM Secure Boot

- UEFI Secure Boot
- Prevents loading software which is not signed with an acceptable digital signature
- VM shim can be signed by either Microsoft or Cisco
- VM Image properties file (image_properties.xml)
 - `<boot_mode>efi-secure-boot</boot_mode>`
 - `<shim_signature>microsoft</shim_signature>`

VM Secure Boot – Verification

- ISRv – show platform software system boot
 - Boot mode: EFI-Secure

NFVIS Fri Mar 1, 07:02:19 PM Welcome admin ▼
ENCS5412/K9 NFVIS-3.11.0-10 administrators

Image Registration Browse Datastore USB Upload Image Packaging

Images

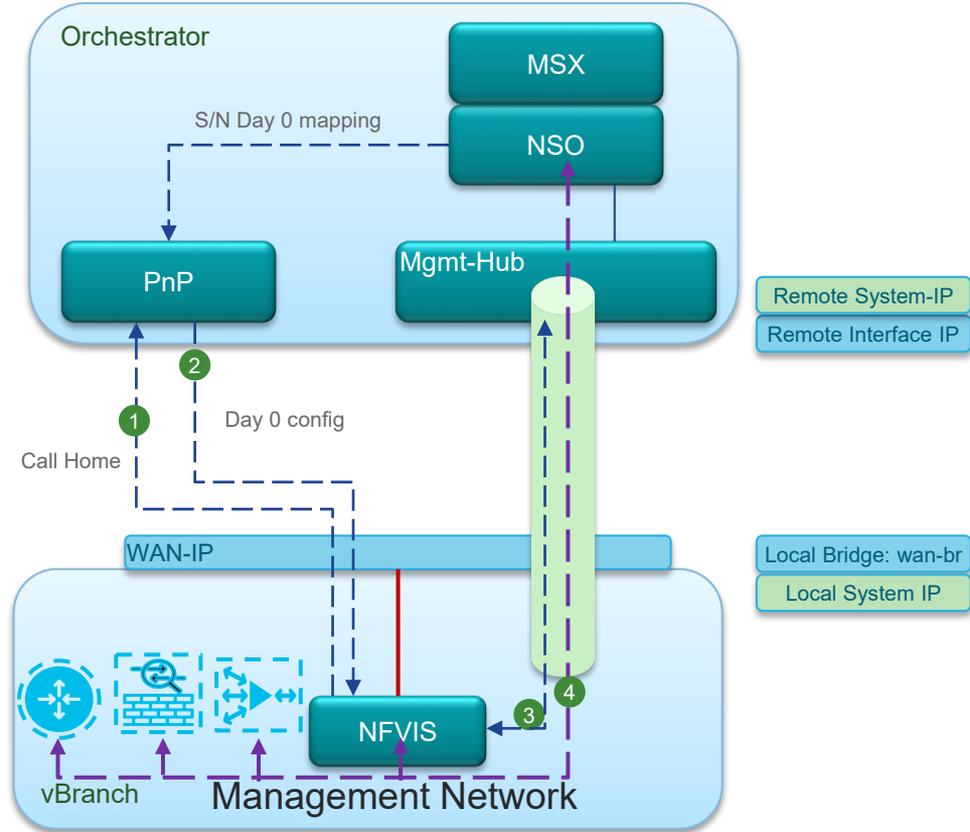
Image Name	State	Type	Version	Storage Location	Secure Boot	Action
ASAv_IMAGE_B	ACTIVE 	FIREWALL	951-201	datastore1(internal)		 
sb_20190101-nfvis.tar.gz	ACTIVE 	ROUTER	RELVER	datastore1(internal)	✓	 
ubuntu_raw.tar.gz	ACTIVE 	OTHER	1	datastore1(internal)		 

Showing 1 to 3 of 3 entries Previous 1 Next

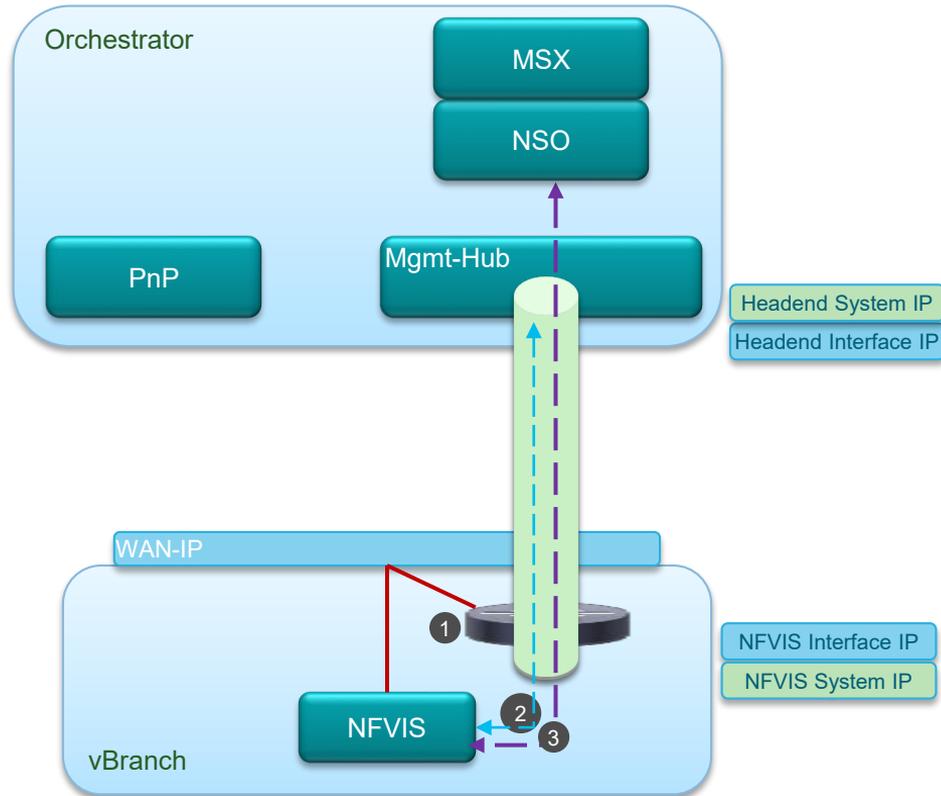
Secure overlay and Single IP

- Allow IPSec overlay established between NFVIS and headend orchestrator (VPN Router)
- Orchestrator can connect to NFVIS via its system IP and manage NFVIS over the secured tunnel
- Support following use cases
 - Static WAN IP
 - DHCP WAN IP
 - NAT CPE in front of NFVIS

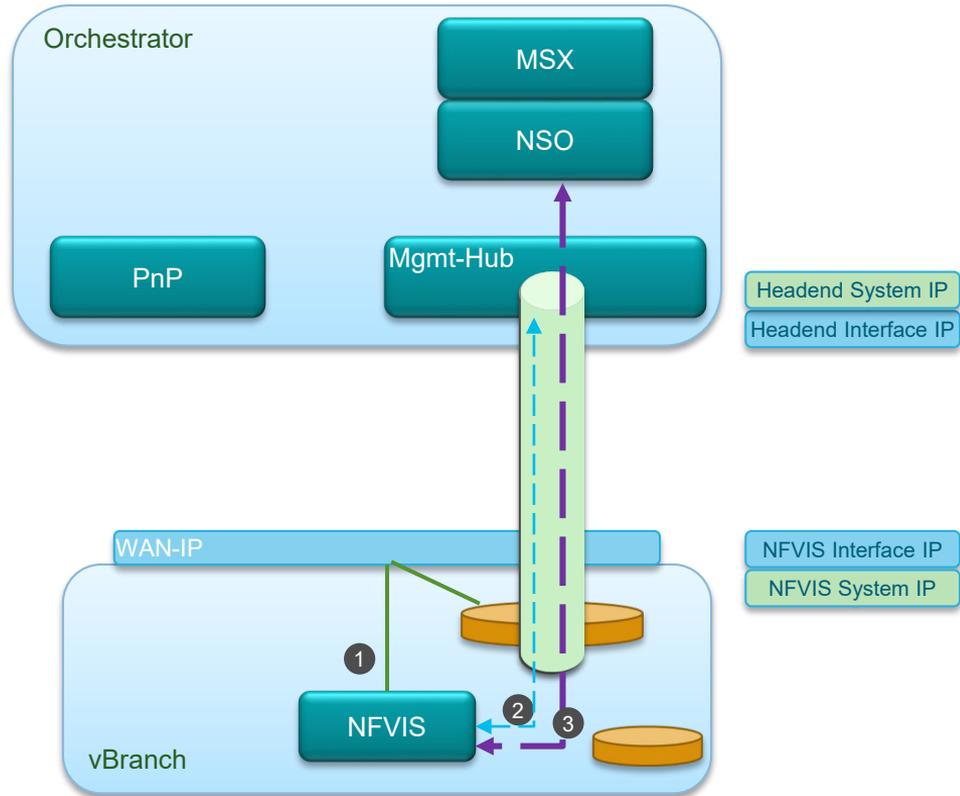
Secure Overlay over WAN



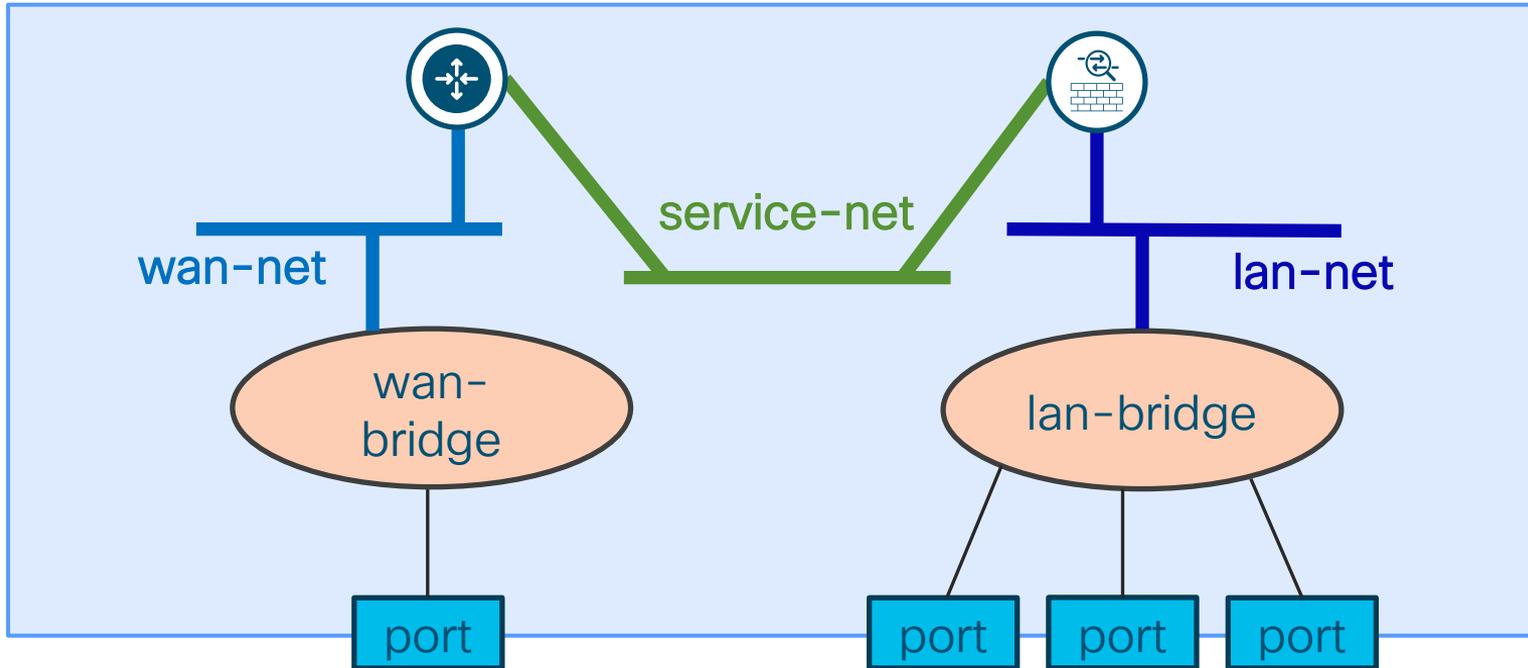
Solution – Overlay and Single Public IP



Solution – Single Public IP Failover

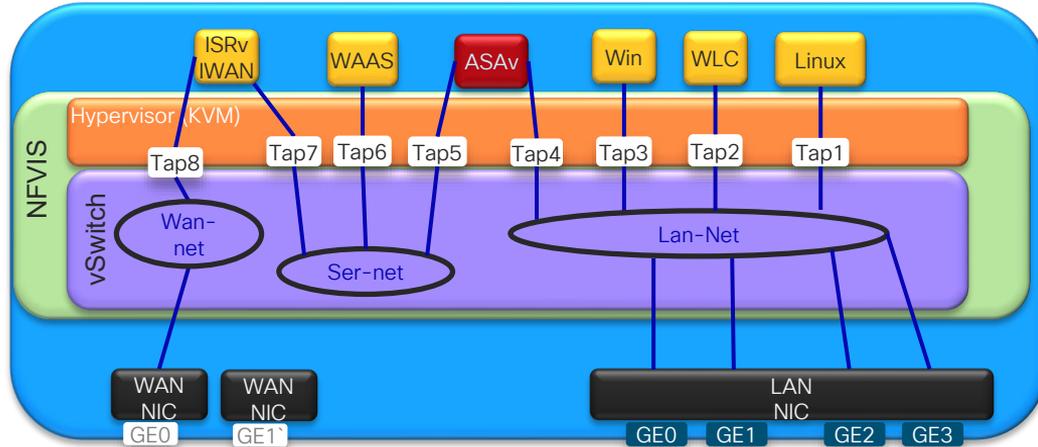


VM Service Chaining - Overview



Example Packet Flows

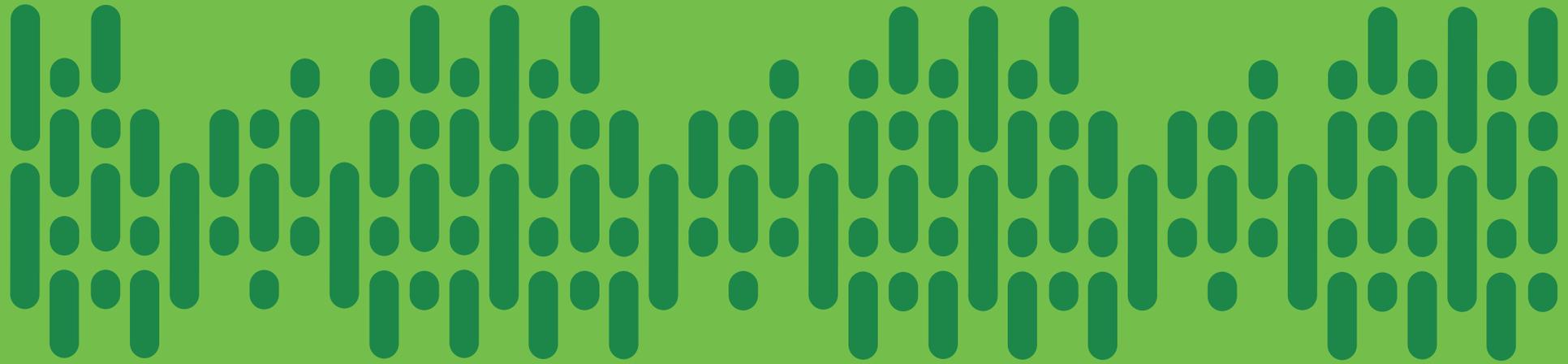
LAN -> WAN



DST



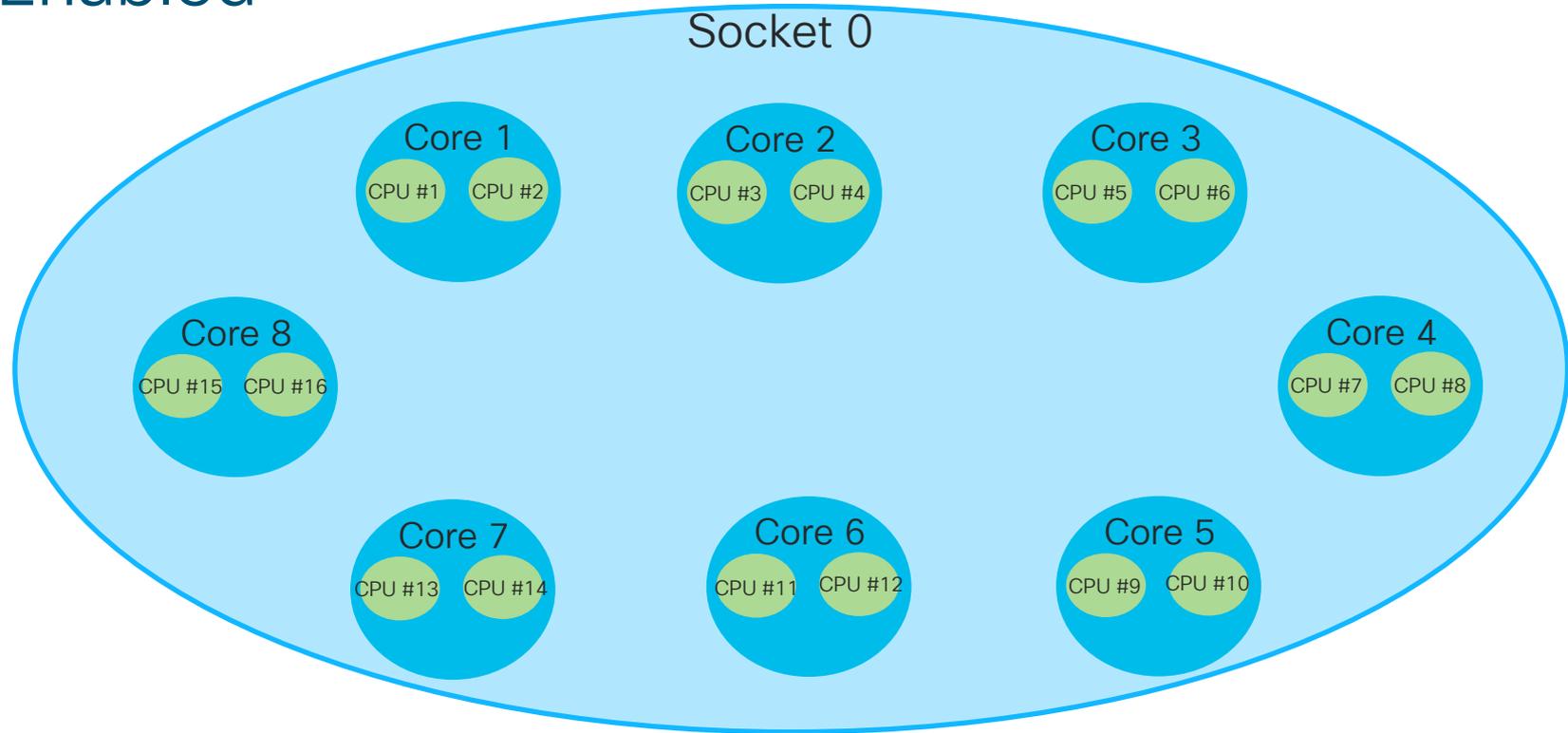
- Frame arrives LAN GEx with ISRV MAC Address
- GE bridged to NFVIS-vSwitch
- Lan-net of vSwitch connects to ASA
- ASA processes frame and Sends to vSwitch Ser-net
- vSwitch Ser-net connects to ISRV
- ISRV sends back to Ser-net with destination vWAAS
- vWAAS processes (compresses) Packet and sends back to ISRV via Ser-net
- ISRV routes the frame to WAN GE



Demo – VM Deployment

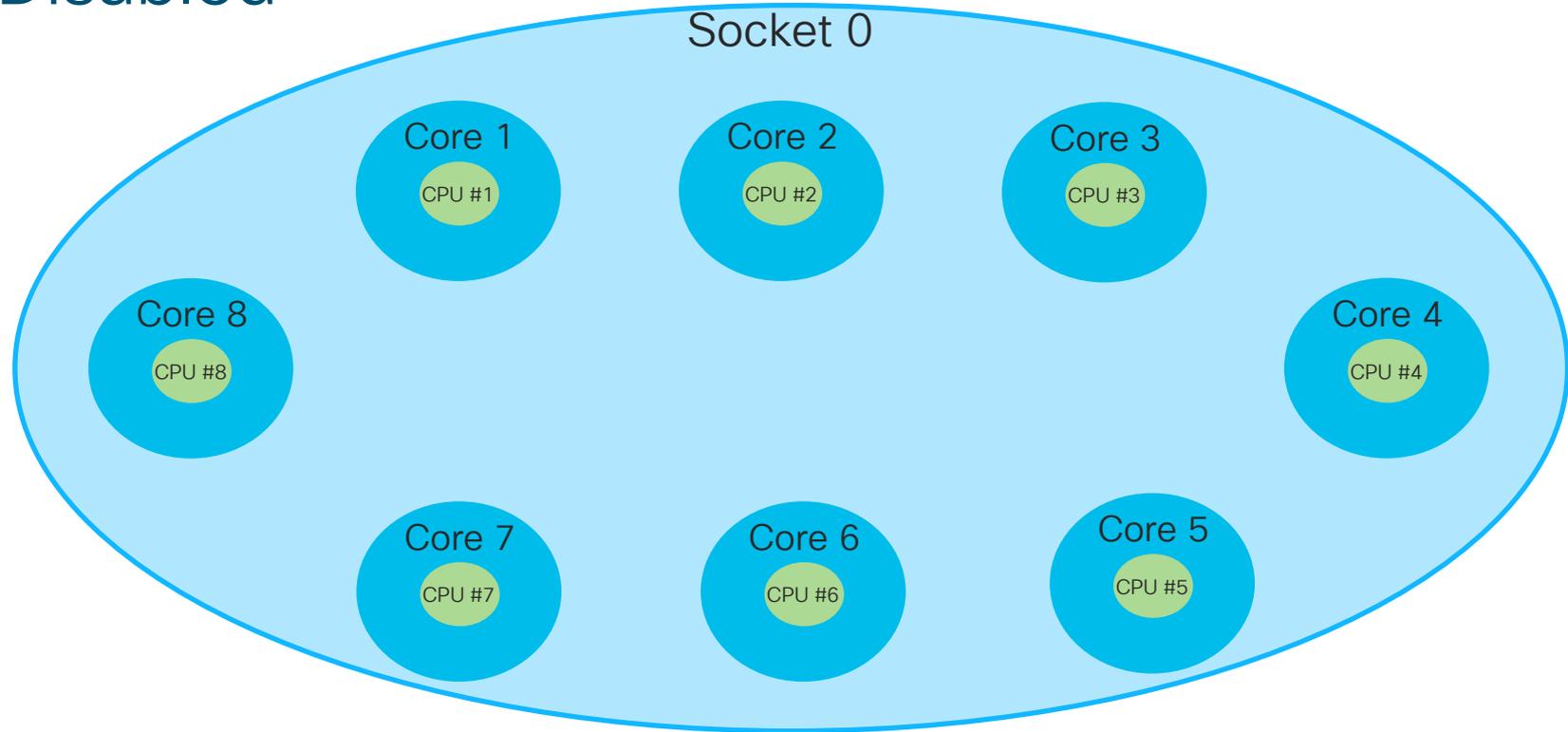
Resource (CPU) Management

Understanding CPU Resources – Hyper threading Enabled



- Logical CPU (vCPU): (socket, Core, CPU-id)
- Ex: Logical CPU 5 – (0, 3, 1)

Understanding CPU Resources – Hyper threading Disabled



VM Types

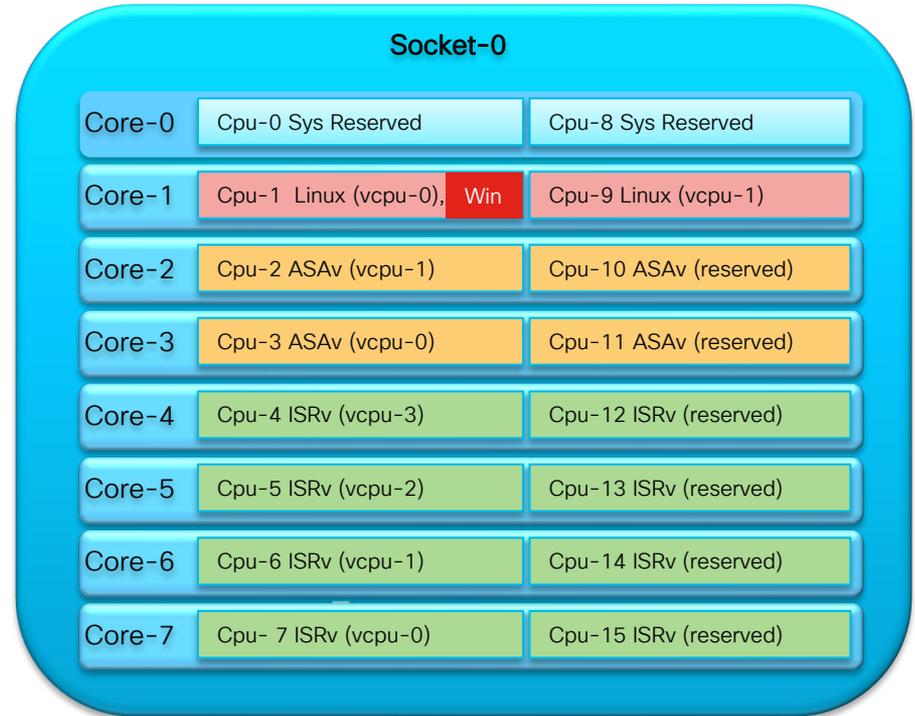
- Low-latency VM & non low-latency VM
 - It is a flag (true or false) in image properties
- Low-latency VM
 - Intend to provide predictable and guaranteed services
 - Requires one **dedicated** physical Core for each VCPU
 - Router (ISRv), Firewall (ASAv), vWAAS
- Non low-latency VM
 - Don't require dedicated physical core for each of VCPU
 - Oversubscription allowed for non low-latency VMs
 - 1 logical CPU can be shared by multiple VCPUs of non low-latency VM
 - Tiny Linux, win2k

How CPUs are assigned

- Physical cores (/ logical CPUs) are assigned to VM based on the number of VCPUs requested when VM is deployed or updated
 - **System Usage**
 - 1 CPU Core is reserved
 - **low-latency VM**
 - Dedicate 1 **physical Core** to 1 VCPU. The logical CPUs on this physical core can not be assigned to any other VCPU anymore
 - **non low-latency VM**
 - Assign 1 **logical CPU** to 1 VCPU. This logical CPU can be shared by other VCPU of non low-latency VM

vCPU Allocations

- ISRV - 4 vCPUs (low-latency)
- ASAv - 2 vCPUs (low-latency)
- Linux - 2 vCPUs (non low-latency)
- Windows - 1 vCPU (non low-latency)



Plan VM deployment

- Deploy low-latency VMs first
- Use API to pre-check CPU resources before deploying a VM or updating a VM
 - Stop deploying / updating if there is not sufficient CPU resources
- Check CPU allocation and CPU assignment

View CPU Allocation

The screenshot displays the Cisco NFVIS management interface. At the top, the system name is 'NFVIS' with ID 'ENCS5406/K9' and version 'NFVIS-3.11.2-FC2'. The user is logged in as 'admin' on 'Fri May 3, 04:06:23 AM'. The interface is divided into two main sections: 'VM Status' and 'VM Resource Allocation'.

VM Status:

- Active: 1 (1 out of 1)
- Failure: 0 (0 out of 1)

VM Resource Allocation:

- CPU: 50.00% (6 out of 12 vCPUs) - This value is circled in red.
- Memory: 78.95% (6 out of 7.60 GB)

The central part of the interface features a circular diagram titled 'NFVIS VM Life Cycle Management'. The diagram is divided into four segments, each with an icon and a label:

- Deploy a Virtual Machine (Green segment, top-left)
- Network Management (Blue segment, top-right)
- Virtual Machine Management (Teal segment, bottom-right)
- Monitoring & Troubleshooting (Purple segment, bottom-left)

A dark sidebar on the left contains navigation options: Home, VM Life Cycle, Deploy, Image Repository, Manage, Networking, Resource Allocation, VM Monitoring, Notifications, Host, About, and Switch.

CPU - vCPU Assignment Example

Home

VM Life Cycle

Deploy

Image Repository

Manage

Networking

Resource Allocation

VM Monitoring

Notifications

Host

CPU Allocation Socket 0: 6 out of 12 Logical CPUs

SOCKET LOGICAL CPU FREE IN-USE RESERVED CORE

VM View Socket View

ROUTER

Socket: 0 Core: 4,5

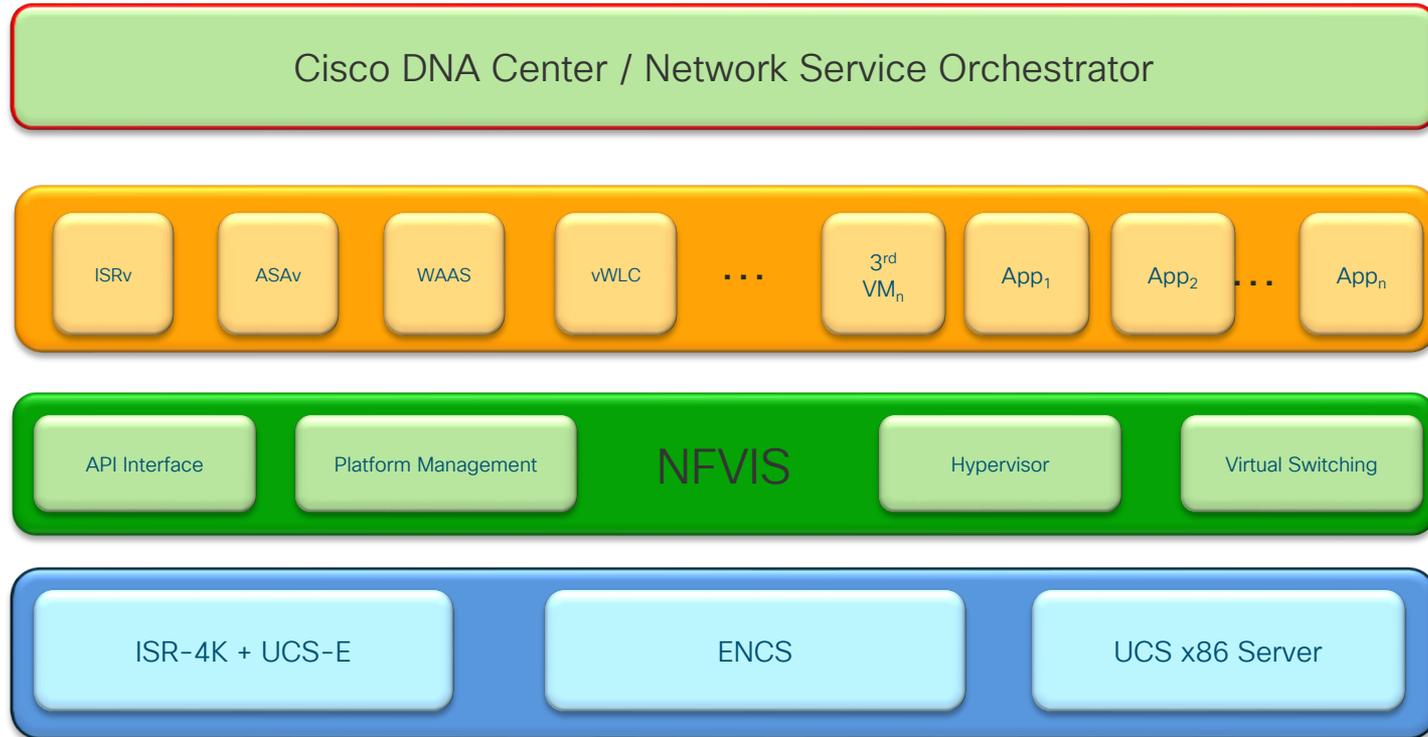
0

4 5

4 10 5 11

Designing and Provisioning using Cisco DNA Center

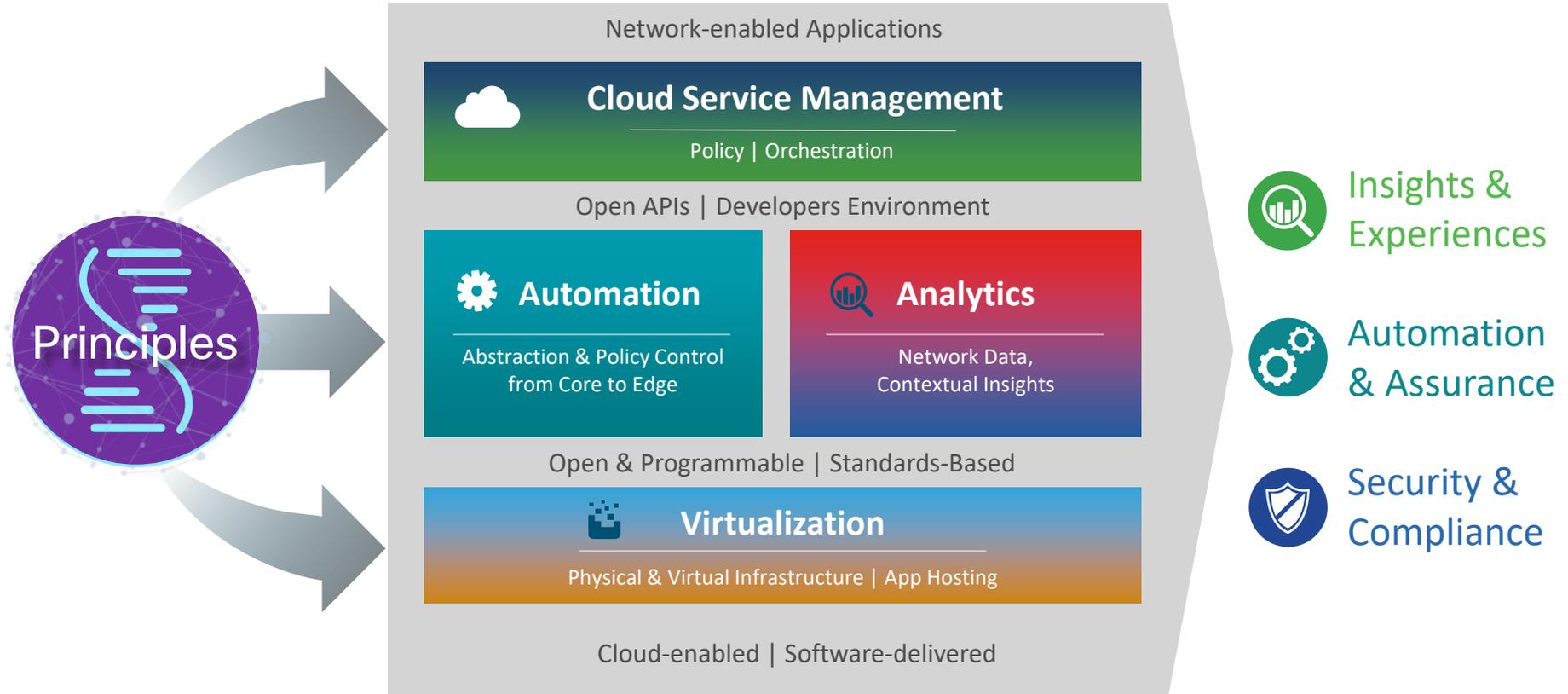
Enterprise NFV Solution Architecture



NFVIS = Network Function Virtualization Infrastructure Software

Cisco Digital Network Architecture

Cisco DNA Overview



Design

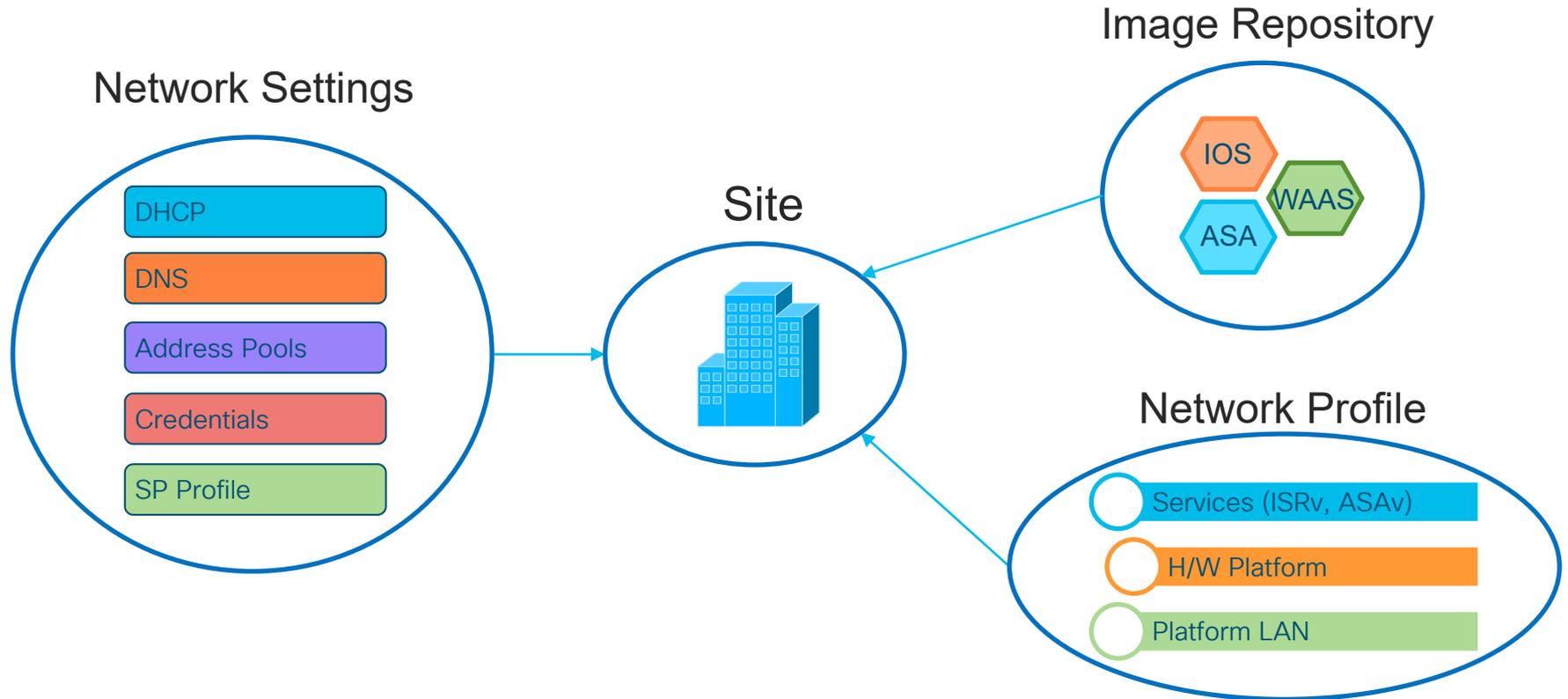
Supported Platform



Supported NFVIS Devices in Cisco DNA Center

- ENCS5100 , ENCS5400
- UCSC- 220 M4 Rack Server
- UCS-E 140S-M2, UCS E160S M3, UCS E160D M2, UCS E180D M3, UCS E180D M2, UCS E1120D M3
- CSP 5200, CSP 5400

Design



Network Settings & Image Repository

- DHCP, DNS, NTP, Syslog and SNMP Server for that Site
- Credentials
 - CLI
 - SNMP
 - HTTP (Read & Write) – UI Credential of NFVIS
- IP Address Pools (LAN, Service, Management & WAN-Internal)
- SP Profile – Needed but reserved for future
- Image Repository – Upload ISRv, ASA v, vWAAS or 3rd Party images

Network Profile

Cisco DNA Center DESIGN POLICY PROVISION

Add NFVIS Profile

1 Router WAN Configuration

Name *
vBranch

Service Providers *
1

Devices *
1

ENCs Services

Device Tag: vbranchTag
Device Type: Cisco 5400 Enterprise Network Compute System

Service Configuration

Device Name *
Router-1-1

Type *
isrv

Image *
isrv-universalk9.16.12.01a.tar.gz

Profile *
ISRv-mini

vNIC Mapping

Interface	vNIC	Assign IP Address
GE0-0	1	<input type="checkbox"/>
mgmt-net	2	<input type="checkbox"/>
SRIOV-3	3	<input checked="" type="checkbox"/>

Cancel Save

Network Profile – Changes in DNAC 1.3.3

- No fixed topologies
- All network parameters optional
- Flexibility to draw connections
- Default service chain based on rules, editable for advanced users
- SR-IOV mapping
- Hostname Configuration
- Multiple Router configuration

Network Profile

- ENCS Switch Configuration
 - L2 mode for Integrated Switch
 - Access or Trunk mode

The screenshot shows the 'Add NFVIS Profile' configuration page in Cisco DNA Center. The page is divided into four steps: 1. Router WAN Configuration (completed), 2. Integrated Switch Configuration (current step), 3. Custom Configuration, and 4. Summary. The current step is titled 'L2 FOR ENCS - vbranchTag' and contains a table for configuring VLANs.

Type*	VLAN ID/Allowed VLAN*	Description*
Access x v	120	Vlan120

Below the table is an 'Add Row' button. At the bottom of the page are 'Cancel', 'Back', and 'Next' buttons.

Network Profile

- Custom Configuration

The screenshot shows the Cisco DNA Center interface for configuring a Network Profile. The top navigation bar includes 'Cisco DNA Center', 'DESIGN', 'POLICY', and 'PROVISION'. Below the navigation, there are four steps: 'Router WAN Configuration', 'Integrated Switch Configuration', 'Custom Configuration' (the current step, highlighted with a blue circle and the number 3), and 'Summary' (highlighted with a grey circle and the number 4). The main content area is titled 'OnBoarding Template(s)' and 'Day-N Template(s)'. It contains a paragraph explaining that the selected template will be applied during first-time provisioning and that editing it will not affect re-provisioning. Below this is a table titled 'Attach Template(s)' with columns for 'Device Type', 'Device Tag', and 'Template'. Two rows are visible, both with 'vbranchTag' as the device tag and 'Select...' as the template choice. At the bottom right, there are 'Cancel', 'Back', and 'Next' buttons.

Cisco DNA Center DESIGN POLICY PROVISION

Router WAN Configuration Integrated Switch Configuration **3** Custom Configuration 4 Summary

OnBoarding Template(s) Day-N Template(s)

Template selected here will be applied to the device during first time provisioning as an initial configuration. Editing or changing the template will not take effect during re-provisioning flow. For templates to appear here, please add a tag to the template while creating them, matching with the device tag in the profile.

Attach Template(s)

Device Type	Device Tag ¹	Template
Cisco 5400 Enterprise Network Compute System	vbranchTag	Select... ▼
Cisco Integrated Services Virtual Router	vbranchTag	Select... ▼

Cancel Back Next

Summary

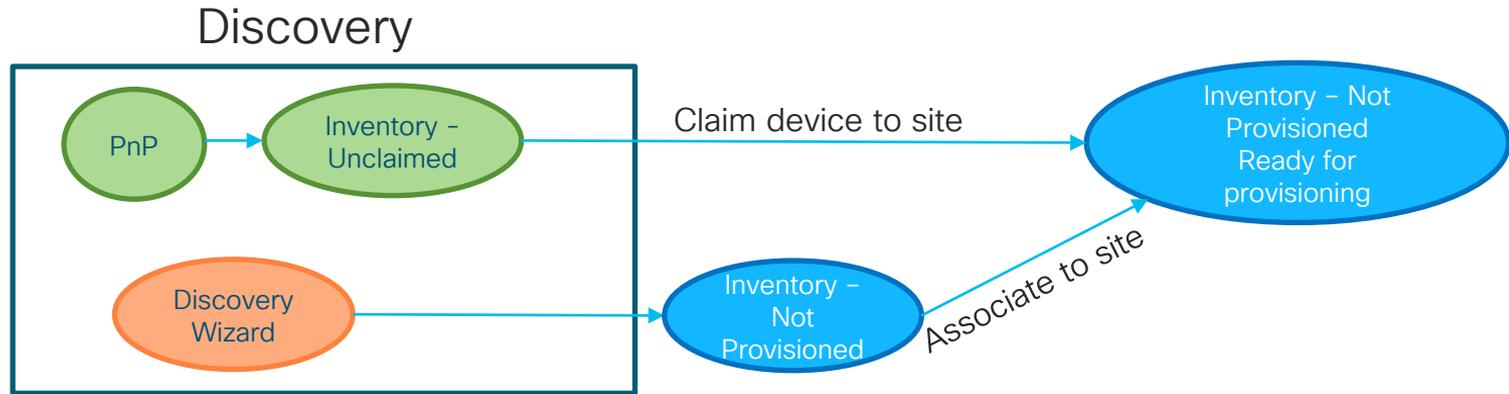
- Detailed summary of the profile is available
- Each device selection populates the configuration details
- Hardware recommendation provided depending on the profile configuration

The screenshot displays the Cisco DNA Center interface with the following components:

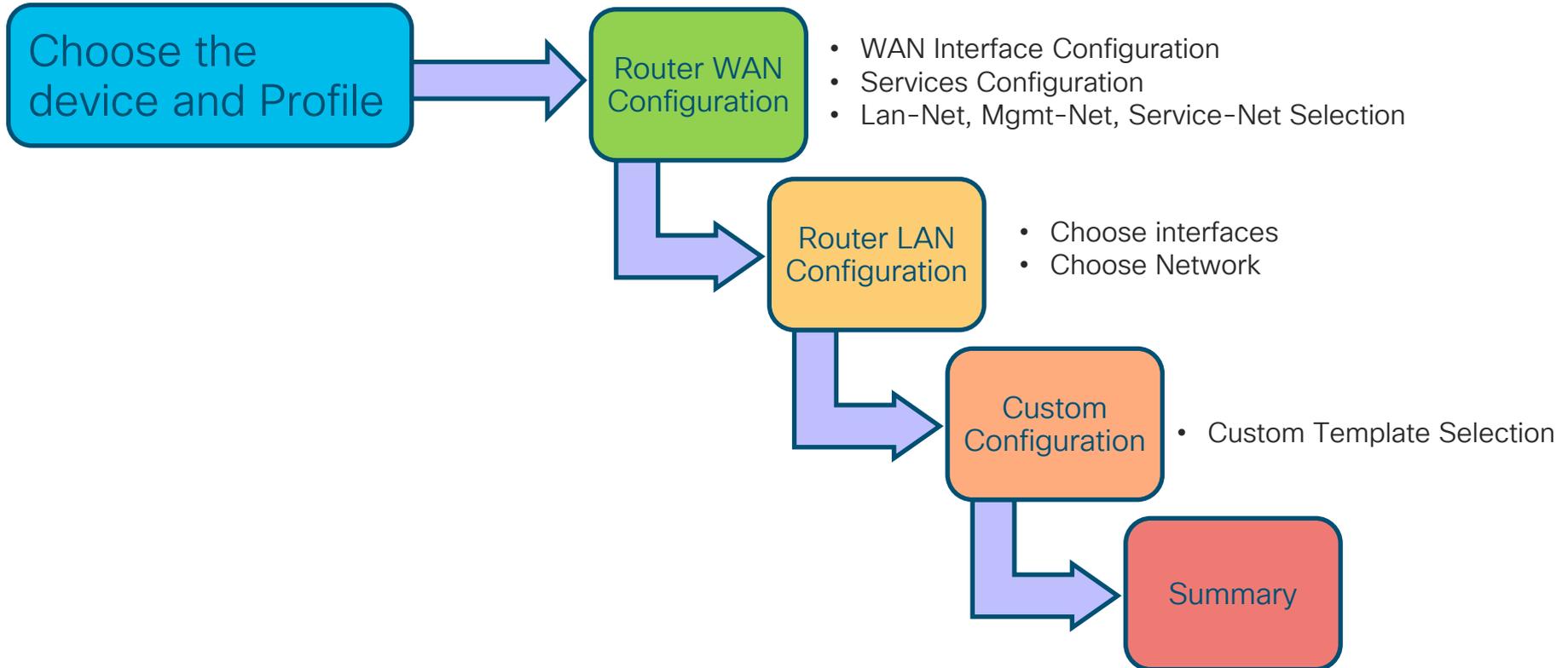
- Navigation:** Cisco DNA Center | DESIGN | POLICY | PROVISION
- Diagram:** A cloud icon labeled "VzWProfile" is connected to a device icon labeled "Cisco 5400 Enterprise Net... vbranchTag" with "1 Service(s)".
- Section:** Cisco 5400 Enterprise Network Compute System Specifications
- Hardware Recommendation:**
 - Recommended Model : ENCS5406/K9
 - System Requirements : CPU 6, RAM 64 GB, STORAGE 64 GB
- Hardware Configuration:**
 - Router-1-1
 - CPU : 1CPU
 - Memory : 4096 MB
 - Storage : 8192 MB
 - Profile : ISRv-mini

Provision

Device Discovery for Provisioning



Provisioning Workflow

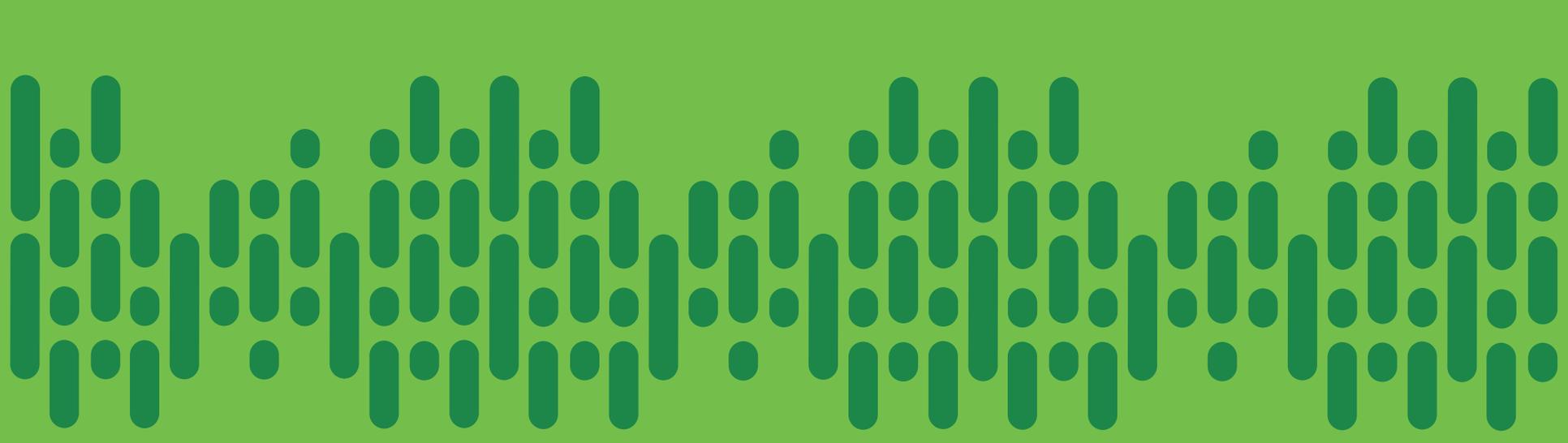


Provision Sites

The screenshot shows the Cisco DNA Center interface in the 'PROVISION' tab. The 'Device Inventory' section is active, displaying a table of devices. The table has columns for Tags, Device Name, Device Family, IP Address, Site, Serial Number, Uptime, OS Version, OS Image, Last Sync Status, Credential Status, Last Provisioned Time, and Provision Status. One device is listed with the name 'nfvls' and a status of 'Success', which is circled in red.

Tags	Device Name	Device Family	IP Address	Site	Serial Number	Uptime	OS Version	OS Image	Last Sync Status	Credential Status	Last Provisioned Time	Provision Status
<input checked="" type="checkbox"/>	nfvls nfvls	NFVIS	10.201.174.100	...CDN-5/RCDN5-1	FGL202711RR		3.11.2-FC2	Cisco NFV... Tag Golden	Managed	Not Provisioned	May 03 2019 11:27:52	Success

- Multiple site deployments are supported for similar device types
- All these sites should belong to the same profile
- Max 10 devices can be deployed simultaneously
- If profile exists for a selected device type then it will navigate to ENFV provision UI screens
- Select the device & go through the provision workflow



Demo – VM Provisioning using Cisco DNA Center

Troubleshooting

NFVIS troubleshooting

CLI – tech-support

- CLI Command ‘*tech-support*’ collects all relevant logs from the system. Output at */data/intdatastore/tech-support*
- ‘show system file-list’ – gives location of the file

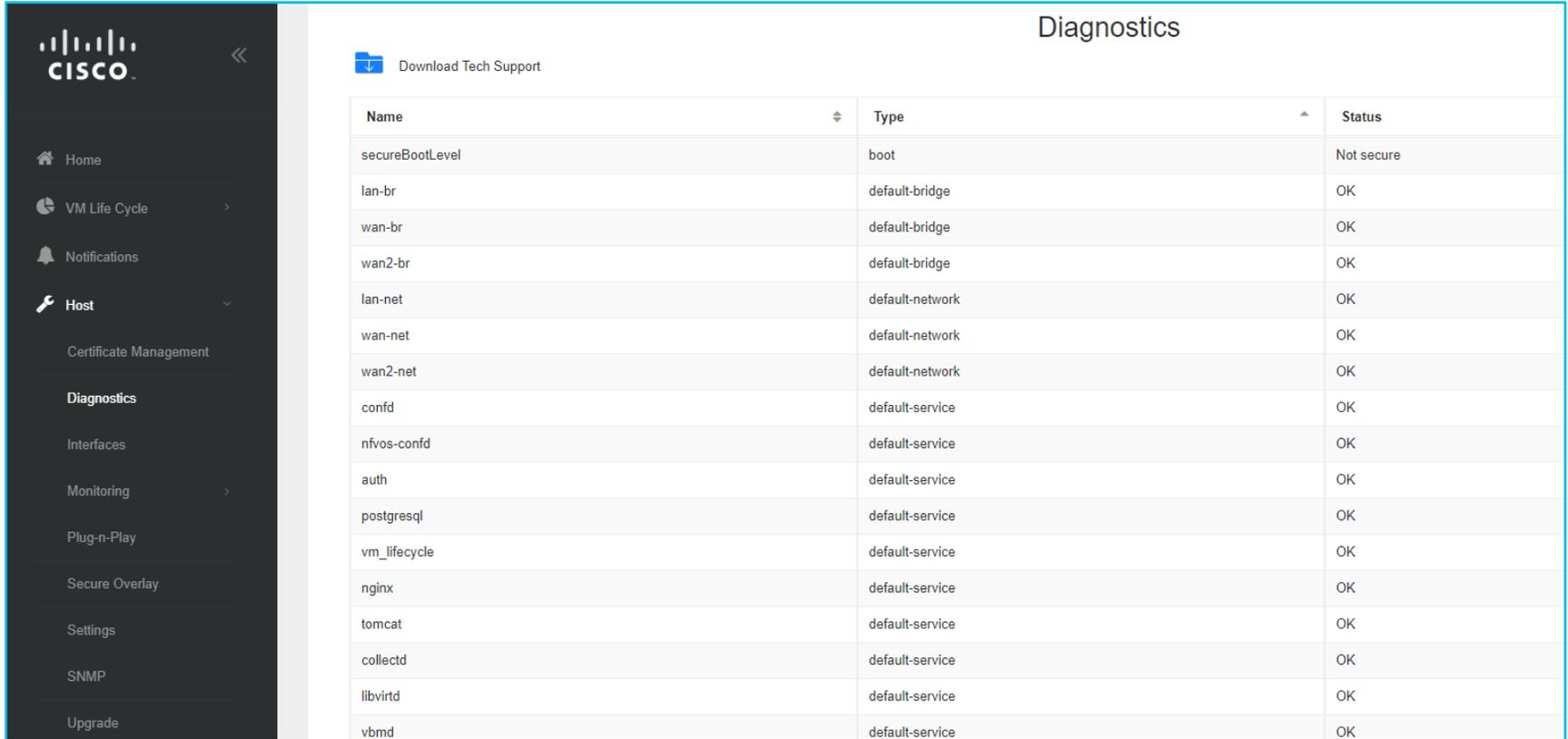
```
nfvis#
nfvis# tech-support
nfvis#
nfvis#
nfvis# show system file-list disk local ! include NFVIS
1 NFVIS_nfvis_2019-05-03T16-37-45.tar.gz /data/intdatastore/tech-support 1.8M UM Package 2019-05-03 16:37:45
nfvis#
nfvis#
nfvis#
```

GUI – tech-support

The screenshot displays the Cisco GUI's Diagnostics section. On the left sidebar, the 'Diagnostics' menu item is highlighted with a red circle. The main content area shows a 'Download Tech Support' button, also circled in red, positioned above a table of system components. The table lists various components such as secureBootLevel, lan-br, wan-br, wan2-br, lan-net, wan-net, and wan2-net, along with their types and current status.

Name	Type	Status
secureBootLevel	boot	Not secure
lan-br	default-bridge	OK
wan-br	default-bridge	OK
wan2-br	default-bridge	OK
lan-net	default-network	OK
wan-net	default-network	OK
wan2-net	default-network	OK

Service Status



The screenshot displays the Cisco VM Life Cycle Diagnostics interface. On the left is a dark sidebar with navigation options: Home, VM Life Cycle, Notifications, Host, Certificate Management, Diagnostics (highlighted), Interfaces, Monitoring, Plug-n-Play, Secure Overlay, Settings, SNMP, and Upgrade. The main content area is titled 'Diagnostics' and includes a 'Download Tech Support' button. Below this is a table with three columns: Name, Type, and Status. The table lists various services and their current status.

Name	Type	Status
secureBootLevel	boot	Not secure
lan-br	default-bridge	OK
wan-br	default-bridge	OK
wan2-br	default-bridge	OK
lan-net	default-network	OK
wan-net	default-network	OK
wan2-net	default-network	OK
confd	default-service	OK
nfvos-confd	default-service	OK
auth	default-service	OK
postgresql	default-service	OK
vm_lifecycle	default-service	OK
nginx	default-service	OK
tomcat	default-service	OK
collectd	default-service	OK
libvirt	default-service	OK
vbmd	default-service	OK

Port Spanning



- Interfaces
 - Physical Interface
 - LAN SRIOV
 - VM's vNIC
- Sample Configuration
 - *configure terminal*
 - *monitor session 1*
 - *bridge wan-br*
 - *source interface GE0-0*
 - *destination vm-vnic Linux2 0*
 - *commit*

Port Spanning

- Verification

- *Show system monitor session*

- system monitor session 1
bridge wan-br
destination_vlan ""
destination_interface vnic0
source_vlans ""
source_rx_interfaces "GE0-0"
source_tx_interfaces "GE0-0"
source_all false
statistics "tx_bytes=142660, tx_packets=1380"

Packet Capture - CLI



- Packet capture on a physical port
 - `tcpdump port eth0`
 - Output: pcap-location /data/intdatastore/pktpcaptures/tcpdump_eth0.pcap
- Packet capture on a vNIC:
 - `tcpdump time 10 vnic tenant-name admin deployment-name rcdn5-4-rcdn5408-isrv vm-name rcdn5-4-rcdn5408-isrv vnic-id 3`
 - Output: pcap-location /data/intdatastore/pktpcaptures/rcdn5-4-rcdn5408-isrv_rcdn5-4-rcdn5408-isrv_vnic3.pcap

Packet Capture - GUI

The screenshot displays the Packet Capture GUI. On the left is a dark sidebar with navigation options: Home, VM Life Cycle, Deploy, Image Repository, Manage, Networking, Resource Allocation, VM Monitoring, Notifications, Host, Switch, About, ENFV Channel, and Make a Wish.

The main content area features a table with the following data:

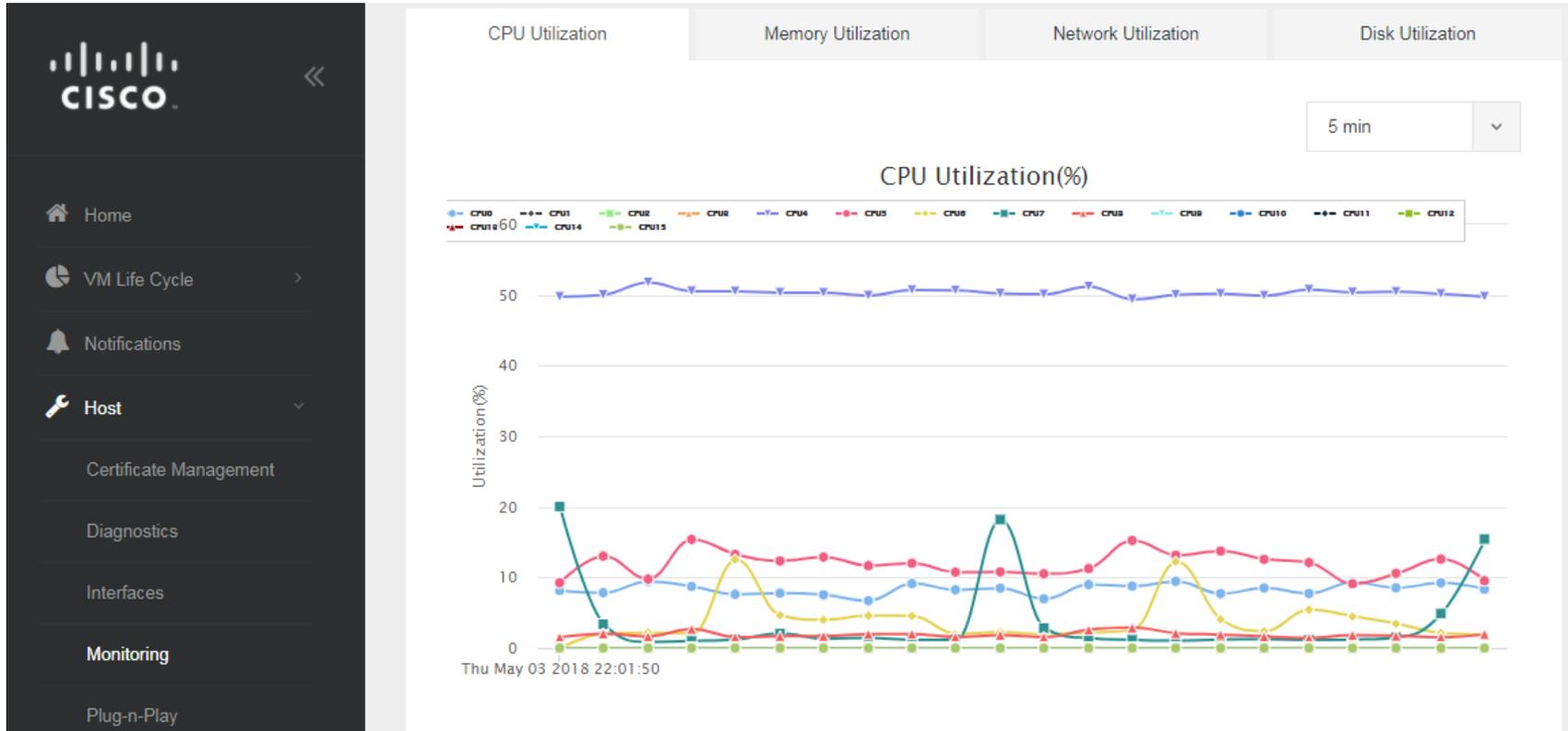
Name	Status	Profile	Port Forwarding	0	1	2
rcdn5-4-rcdn5408-isrv	Active	ISRV-medium	20022 => 22	internal	GE0-0-SRIOV-1	LAN-SRIOV-1

Below the table, it says "Showing 1 to 1 of 1 entries".

A network diagram is shown below the table, with a note: "*Click on Icon to show details". The diagram illustrates a network topology with several components: wan-net, mgmt-net, service-net, and LAN3-78. A central node is labeled "rcdn5-4-rcdn5408-isrv". A blue circle with a plus sign and a capture icon is positioned over the "LAN3-78" connection. A "Start Capture" dialog box is open, showing a list of capture durations: 10s, 20s, 30s, and 60s.

On the right side of the diagram, there is a vertical axis labeled "packets/s" with a scale from 0 to 0.75. Below this is a legend for "vnic0" and a section for "Vnic" with "vnic3" listed.

Host System Monitoring



Troubleshooting VM related issues

Image Registration Logs

The screenshot displays the Cisco VM Life Cycle console interface. On the left is a dark sidebar with the Cisco logo and navigation menu items: Home, VM Life Cycle, Deploy, Image Repository, Manage, Networking, Resource Allocation, VM Monitoring, Notifications, and Host. The main content area is titled 'Image Registration' and contains two sub-sections: 'Images' and 'Profiles'.

The 'Images' section features a table with the following data:

Image Name	State	Type	Version	Action
isrv-universalk9.16.06.02.tar.gz	ACTIVE	ROUTER	16.06.02	
isrv-universalk9.16.6.02.tar.gz	ERROR	OTHER	NA	

Below the table, it indicates 'Showing 1 to 2 of 2 entries' and includes pagination controls for 'Previous', '1', and 'Next'. The 'Profiles' section below it shows a table with the following data:

Profile	CPU	Memory (MB)	Disk (MB)	Source Image	Action
ISRV-medium	4	4096	8192	isrv-universalk9.16.06.02.tar.gz	

Image Registration Logs - Success

The screenshot displays the Cisco VM Life Cycle interface. On the left is a dark navigation sidebar with the Cisco logo and menu items: Home, VM Life Cycle, Deploy, Image Repository, Manage, Networking, Resource Allocation, VM Monitoring, Notifications, and Host. The main content area shows the 'Debug Logs' for the image 'isrv-universalk9.16.06.0 2.tar.gz'. At the top right of the main area, it says '17:20:39 Welcome admin administrators' and 'Return To Image Repository' with a refresh icon. Below the title, there is a 'Show 10 entries' dropdown and a search box. The logs are presented in a table with three columns: Time, Log-Level, and Log.

Time	Log-Level	Log
2018-02-16 03:29:19,986	UI_INFO	Onboarding embedded profile - image: isrv-universalk9.16.06.02.tar.gz profile: ISRV-medium
2018-02-16 03:29:19,388	UI_INFO	Onboarding embedded profile - image: isrv-universalk9.16.06.02.tar.gz profile: ISRV-small
2018-02-16 03:29:18,952	UI_INFO	Upload image to VIM complete : isrv-universalk9.16.06.02.tar.gz
2018-02-16 03:29:18,952	UI_INFO	Image successfully created in VIM : isrv-universalk9.16.06.02.tar.gz
2018-02-16 03:29:18,952	UI_INFO	Onboarding embedded profile - image: isrv-universalk9.16.06.02.tar.gz profile: ISRV-mini
2018-02-16 03:29:13,896	UI_INFO	Image upload to VIM in progress, sleeping for 5 seconds to allow download to complete :isrv-universalk9.16.06.02.tar.gz
2018-02-16 03:29:08,711	UI_INFO	Image upload to VIM in progress, sleeping for 5 seconds to allow download to complete :isrv-universalk9.16.06.02.tar.gz
2018-02-16 03:28:59,971	UI_INFO	Image upload to VIM in progress, sleeping for 5 seconds to allow download to complete :isrv-universalk9.16.06.02.tar.gz

Image Registration Logs - Failure

Home

VM Life Cycle

Deploy

Image Repository

Manage

Networking

Resource Allocation

VM Monitoring

Notifications

Host

Debug Logs isrv-universalk9.16.6.02.tar.gz

[Return To Image Repository](#)

Show entries

Time	Log-Level	Log
2018-05-03 22:38:45,906	ERROR	Image creation failed on VIM : isrv-universalk9.16.6.02.tar.gz
2018-05-03 22:38:45,905	ERROR	VIM Error Code for creating image object: 500, VIM Response: "Mismatched checksum found for: image_properties.xml please verify the file contents. Expected:58c91998e9822cc5b6c6d342d704bef29434a1e8 Actual:508bee6bef9a58660e99e313b31f59252a57e9af"
2018-05-03 22:38:45,904	WARN	VIM returned error status code: 500 on attempt 4.
2018-05-03 22:38:20,205	WARN	VIM returned error status code: 500 on attempt 3.
2018-05-03 22:37:54,462	WARN	VIM returned error status code: 500 on attempt 2.
2018-05-03 22:37:28,635	WARN	VIM returned error status code: 500 on attempt 1.
2018-05-03 22:37:06,847	UI_INFO	Uploading image to VIM : isrv-universalk9.16.6.02.tar.gz
2018-05-03 22:37:06,794	UI_INFO	Testing for presence of local image file: //data/intdatastore/uploads/isrv-universalk9.16.6.02.tar.gz

NFVIS Notification - GUI



Home

VM Life Cycle

Deploy

Image Repository

Manage

Networking

Resource Allocation

VM Monitoring

Notifications

Host

About

Switch

ENFV Channel

Make a Wish

NFVIS

ENCS5408/K9 NFVIS-3.12.2-FC2

Sun Dec 22, 10:32:09 PM Welcome admin administrators

Notifications

Show 10 entries

Date	Event	UserID	Description	Status
2019-12-22 20:03:34 UTC	RBAC_LOGIN_FAILURE	admin	User admin's login from maapi failed	FAILURE
2019-12-22 20:03:32 UTC	RBAC_LOGIN_FAILURE	admin	User admin's login from maapi failed	FAILURE
2019-12-22 20:03:31 UTC	RBAC_LOGIN_FAILURE	admin	User admin's login from maapi failed	FAILURE
2019-12-22 20:03:28 UTC	RBAC_LOGIN_FAILURE	admin	User admin's login from maapi failed	FAILURE
2019-12-22 18:27:50 UTC	OVS_DPKD_SUCCESS	admin	OVS-DPKD enabled	SUCCESS
2019-12-22 16:22:51.052 UTC	VM_STOPPED	admin	VM stop successful: ROUTER	SUCCESS
2019-12-22 16:15:38 UTC	RBAC_LOGIN_FAILURE	admin	Login with invalid username from cli failed	FAILURE
2019-12-20 18:29:17 UTC	RBAC_LOGIN_FAILURE	admin	User admin's login from maapi failed	FAILURE
2019-12-20 18:29:15 UTC	RBAC_LOGIN_FAILURE	admin	User admin's login from maapi failed	FAILURE
2019-12-20 18:29:12 UTC	RBAC_LOGIN_FAILURE	admin	User admin's login from maapi failed	FAILURE

Showing 1 to 10 of 351 entries Previous **1** 2 3 4 5 ... 36 Next

NFVIS Notification - CLI

- Gives information on event changes in the system
- NFVIS sends notifications for
 - vmlcEvents (VM Lifecycle)
 - nfvisEvents (NFVIS)

```
rcdn5408B# show notification stream vmlcEvent last 1
notification
eventTime 2018-05-04T03:38:46.063+00:00
vmlcEvent
status FAILURE
status_code 500
status_message Image creation failed. VIM Driver: "Mismatched checksum found for: image_properties.xml please verify
the file contents. Expected:58c91998e9822cc5b6c6d342d704bef29434a1e8
Actual:508bee6bef9a58660e99e313b31f59252a57e9af"
user_name admin
image isrv-universalk9.16.6.02.tar.gz
vmlcEvent event
type CREATE_IMAGE
rcdn5408B#
```

Verifying Day 0 config

Step 1: Get the list of VNFs running on NFVIS

```
nfvis# support virsh list
Id Name State
-----
19 1509553386.ROUTER running
```

Step 2: Next check if there is a config drive generated with the day 0 configuration you added to the package

```
nfvis# support show config-drive 19
-rw-r--r--. 1 qemu qemu 397312 Nov 1 16:23 /cisco/esc/esc_database/nodejs/VM/ae828bab-3e90-4a53-ba97-14aa0db258f2/ae828bab-3e90-4a53-ba97-14aa0db258f2-hdd.config
```

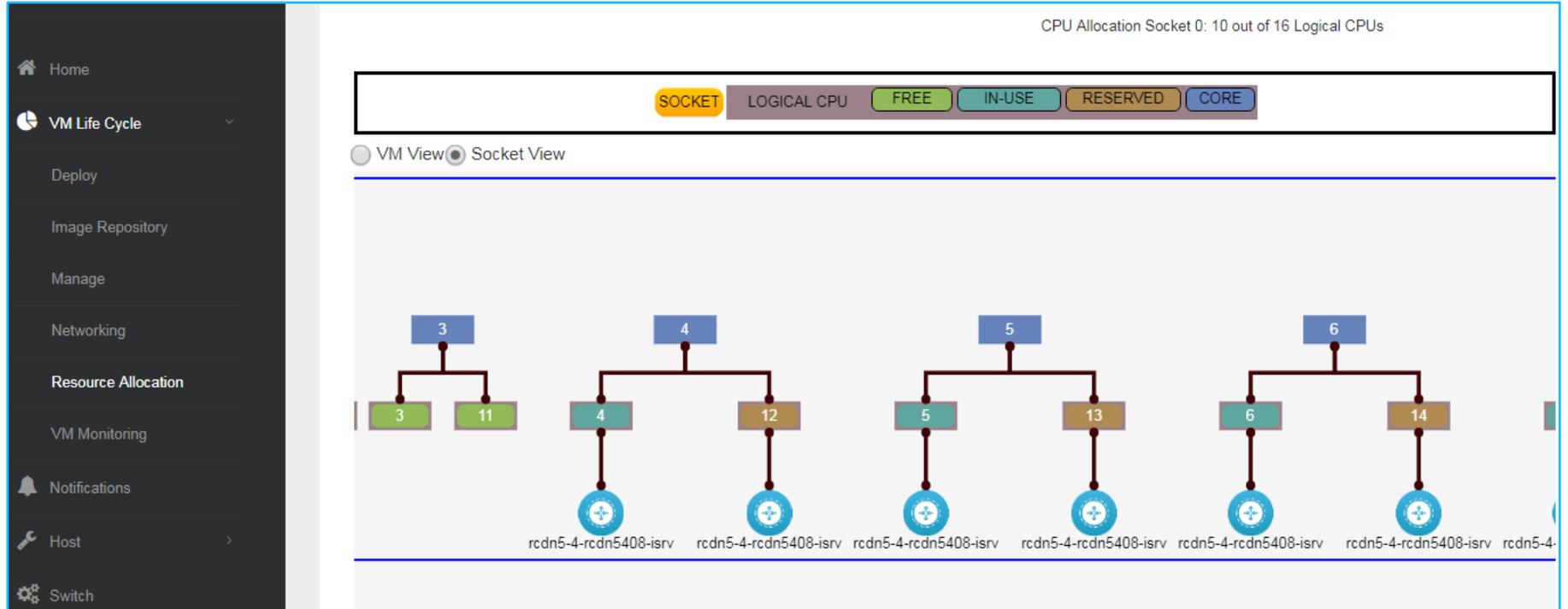
Step 3: Once verified that config drive is present, next look at the contents of the drive by using

```
nfvis# support show config-drive content 19
```

At the tail end you should see the configuration that you packaged with the VNF

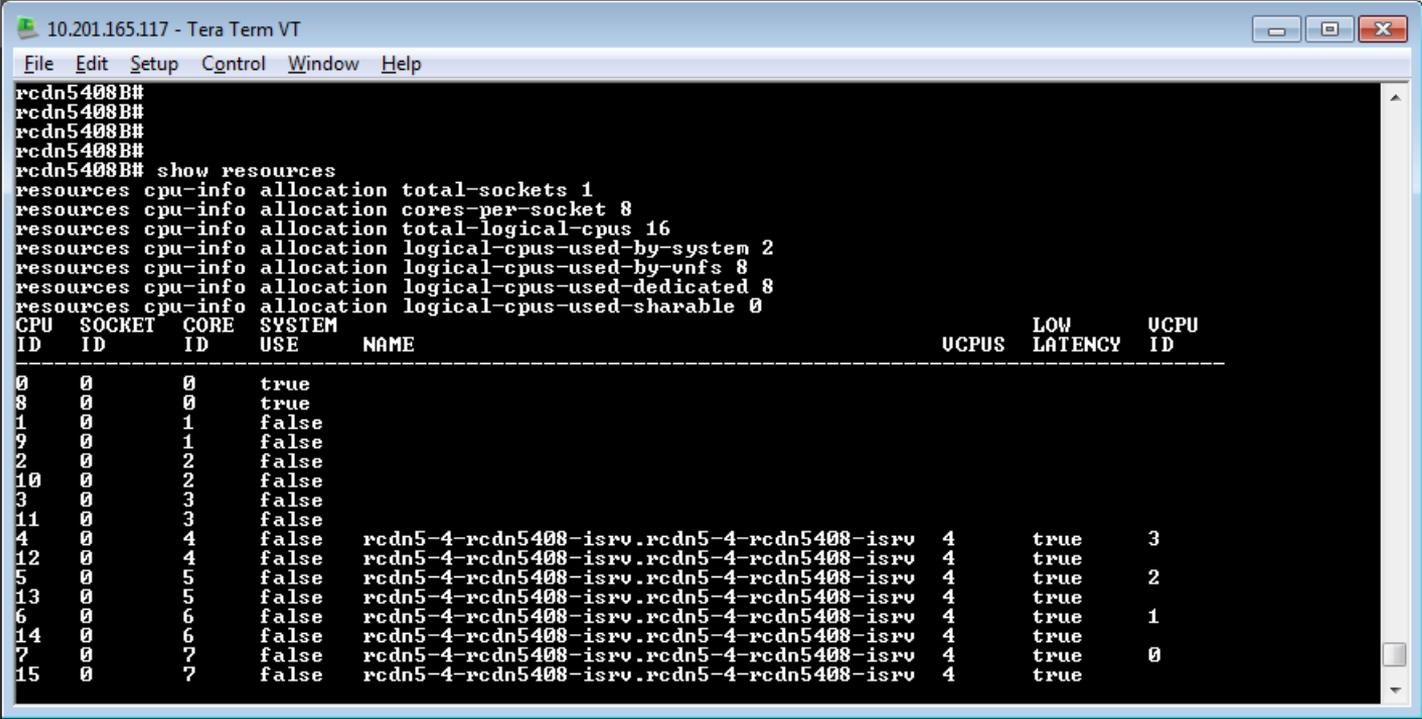
Deployment Troubleshooting

- Low Latency – One dedicated physical core for each vCPU



Deployment Troubleshooting

vcpu count unavailable



```
10.201.165.117 - Tera Term VT
File Edit Setup Control Window Help
rcdn5408B#
rcdn5408B#
rcdn5408B#
rcdn5408B#
rcdn5408B# show resources
resources cpu-info allocation total-sockets 1
resources cpu-info allocation cores-per-socket 8
resources cpu-info allocation total-logical-cpus 16
resources cpu-info allocation logical-cpus-used-by-system 2
resources cpu-info allocation logical-cpus-used-by-vnfs 8
resources cpu-info allocation logical-cpus-used-dedicated 8
resources cpu-info allocation logical-cpus-used-sharable 0
CPU SOCKET CORE SYSTEM
ID ID ID USE NAME UCPUS LOW LATENCY UCPU
ID ID ID USE NAME UCPUS LATENCY ID
-----
0 0 0 true
8 0 0 true
1 0 1 false
9 0 1 false
2 0 2 false
10 0 2 false
3 0 3 false
11 0 3 false
4 0 4 false rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv 4 true 3
12 0 4 false rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv 4 true
5 0 5 false rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv 4 true 2
13 0 5 false rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv 4 true
6 0 6 false rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv 4 true 1
14 0 6 false rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv 4 true
7 0 7 false rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv 4 true 0
15 0 7 false rcdn5-4-rcdn5408-isrv.rcdn5-4-rcdn5408-isrv 4 true
```

DPDK Troubleshooting

- Check status of DPDK on NFVIS
 - `nfvis# show system settings-native dpdk-status`
- Output when DPDK enabled successfully:
 - `system settings-native dpdk-status enabled`
- Output when DPDK failed to enable:
 - `system settings-native dpdk-status error`
- Syslog & Event Notification: OVS_DPDK_SUCCESS or OVS_DPDK_FAILURE (Truncated output)
 - `nfvis# show notification stream nfvisEvent`
 - `eventTime 2019-02-27T22:39:52.016203+00:00`
 - `nfvisEvent`
 - **`status_message OVS-DPDK enabled`**
 - **`event_type OVS_DPDK_SUCCESS`**

Enabling DPDK - Troubleshooting

- nfvis_config.log

```
2019-07-08 18:35:38,565 INFO [subscribe_twophase:] [] _iter_fn_prep(self,
kp=/system:system/settings/dpdk, op=4, oldv=None, newv=enum<1>, state)
2019-07-08 18:35:38,821 INFO [subscribe_twophase:] [] _iter_fn(self, kp=/system:system/settings/dpdk,
op=4, oldv=None, newv=enum<1>, state)
2019-07-08 18:35:38,916 INFO [dpdk:] [] Acquired CPU: [2, 38, 18, 54]
2019-07-08 18:35:43,933 INFO [dpdk:] [] Stopped VM(s): []
2019-07-08 18:35:44,052 INFO [dpdk:] [] Discovered 2 NUMA nodes
2019-07-08 18:35:44,052 INFO [dpdk:] [] Allocating 2048 hugepages on node0
2019-07-08 18:35:44,064 INFO [dpdk:] [] Allocating 2048 hugepages on node1
2019-07-08 18:35:44,078 INFO [dpdk:] [] Allocated 2048 hugepages on node0
2019-07-08 18:35:44,078 INFO [dpdk:] [] Allocated 2048 hugepages on node1
2019-07-08 18:35:54,026 INFO [dpdk:] [] Performing DPDK upgrade on the following bridges: ['service-br']
2019-07-08 18:35:58,913 INFO [dpdk:] [] Updated interface eth4-3 to use DPDK
2019-07-08 18:36:01,586 INFO [dpdk:] [] Updated interface eth4-4 to use DPDK
2019-07-08 18:36:01,586 INFO [dpdk:] [] DPDK has been successfully enabled on the system.
2019-07-08 18:36:01,588 INFO [dpdk:] [] VM migration completed successfully
```

Single-IP Troubleshooting

- Nfvis-config.log → Single-ip mode creation

```
2018-12-13 05:36:04,224 INFO [SingleIP_Overlay:QUEUE] [] SingleIP Overlay waiting in select
2018-12-13 05:36:04,226 INFO [SingleIP_Overlay:QUEUE] [] Data received triggered
2018-12-13 05:36:04,230 INFO [SingleIP_Overlay:DEQUEUE] [] Object Dequeued : {u'username': u'admin',
u'event-type': u'SECURE_OVERLAY_CREATE', u'conn-name': u'mgmthub'}
2018-12-13 05:36:04,231 INFO [SingleIP_Overlay:QUEUE] [] Data received : {u'username': u'admin',
u'event-type': u'SECURE_OVERLAY_CREATE', u'conn-name': u'mgmthub'}
2018-12-13 05:36:04,234 INFO [SingleIP_Overlay:Handler] [] Secure Overlay Create called
2018-12-13 05:36:04,236 INFO [SingleIP_Overlay:QUEUE] [] SingleIP Overlay waiting in select
2018-12-13 05:36:04,242 INFO [SingleIP_Overlay:QUEUE] [] Data received triggered
2018-12-13 05:36:04,245 INFO [SingleIP_Overlay:QUEUE] [] Connection Closed from client socket
2018-12-13 05:36:04,252 INFO [SingleIP_Overlay:QUEUE] [] SingleIP Overlay waiting in select
2018-12-13 05:36:04,373 INFO [SingleIP_Overlay:] [] Setting secure overlay state: start, active_br: wan-br
2018-12-13 05:36:18,633 INFO [SingleIP_Overlay:] [] Setting secure overlay state: up, active_br: None
```

Single-IP Troubleshooting

- Nfvis-config.log → VM deployed; WAN IP released

```
2018-12-13 05:59:08,545 INFO [SingleIP_Overlay:VMLC_EVENT] [] event_type: VM_DEPLOYED, status:
SUCCESS, depname: ROUTER, vm_group: ROUTER, user_name: admin
2018-12-13 05:59:08,672 INFO [SingleIP_Overlay:VMLC_EVENT] [] enqueue event VM_DEPLOYED.....
2018-12-13 05:59:08,694 INFO [SingleIP_Overlay:DEQUEUE] [] Object Dequeued : {u'status': u'SUCCESS',
u'username': u'admin', u'vm-name': u'ROUTER.ROUTER', u'event-type': u'VM_DEPLOYED'}
2018-12-13 05:59:08,695 INFO [SingleIP_Overlay:QUEUE] [] Data received : {u'status': u'SUCCESS',
u'username': u'admin', u'vm-name': u'ROUTER.ROUTER', u'event-type': u'VM_DEPLOYED'}
2018-12-13 05:59:08,698 INFO [SingleIP_Overlay:QUEUE] [] SingleIP Overlay waiting in select
2018-12-13 05:59:08,699 INFO [SingleIP_Overlay:Handler] [] VM event VM_DEPLOYED received
2018-12-13 05:59:08,702 INFO [SingleIP_Overlay:Handler] [] Successfully terminated secure overlay
connectivity thread
2018-12-13 05:59:13,756 INFO [SingleIP_Overlay:] [] Setting secure overlay state: down, active_br: int-
mgmt-net-br
2018-12-13 05:59:13,786 INFO [SingleIP_Overlay:Handler] [] Releasing wan ip
2018-12-13 05:59:13,788 INFO [SingleIP_Overlay:] [] Removing ip address and netmask from bridge
2018-12-13 05:59:13,899 INFO [SingleIP_Overlay:] [] Configuring static IP: bridge(wan-br) IP=; netmask=;
gateway=
2018-12-13 05:59:14,197 INFO [SingleIP_Overlay:] [] Updating static IP= and netmask=
2018-12-13 05:59:14,202 INFO [SingleIP_Overlay:] [] Updating ip
2018-12-13 05:59:14,211 INFO [SingleIP_Overlay:] [] Updating netmask
2018-12-13 05:59:14,219 INFO [SingleIP_Overlay:] [] Setting default gateway in config
2018-12-13 05:59:14,221 INFO [SingleIP_Overlay:] [] Removing gateway
```

Single-IP Troubleshooting

Nfvis-config.log → VM Alive, NFVIS re-establishes IPSec tunnel

```
2018-12-13 06:01:47,588 INFO [SingleIP_Overlay:VMLC_EVENT] [] event_type: VM_ALIVE, status: SUCCESS, depname: ROUTER, vm_group: ROUTER, user_name: admin
```

```
2018-12-13 06:01:47,700 INFO [SingleIP_Overlay:VMLC_EVENT] [] enqueue event VM_ALIVE...
```

...

```
2018-12-13 06:01:47,709 INFO [SingleIP_Overlay:QUEUE] [] Data received : {u'status': u'SUCCESS', u'username': u'admin', u'vm-name': u'ROUTER.ROUTER', u'event-type': u'VM_ALIVE'}
```

```
2018-12-13 06:01:47,712 INFO [SingleIP_Overlay:DEQUEUE] [] Object Dequeued : {u'status': u'SUCCESS', u'username': u'admin', u'vm-name': u'ROUTER.ROUTER', u'event-type': u'VM_ALIVE'}
```

```
2018-12-13 06:01:47,717 INFO [SingleIP_Overlay:QUEUE] [] SingleIP Overlay waiting in select
```

```
2018-12-13 06:01:47,721 INFO [SingleIP_Overlay:Handler] [] VM event VM_ALIVE received
```

...

```
2018-12-13 06:02:01,948 INFO [SingleIP_Overlay:Handler] [] Secure overlay configured - restarting overlay
```

```
2018-12-13 06:02:01,961 INFO [SingleIP_Overlay:] [] Setting secure overlay state: down, active_br: int-mgmt-net-br
```

```
2018-12-13 06:02:01,987 INFO [SingleIP_Overlay:] [] Setting secure overlay state: start, active_br: int-mgmt-net-br
```

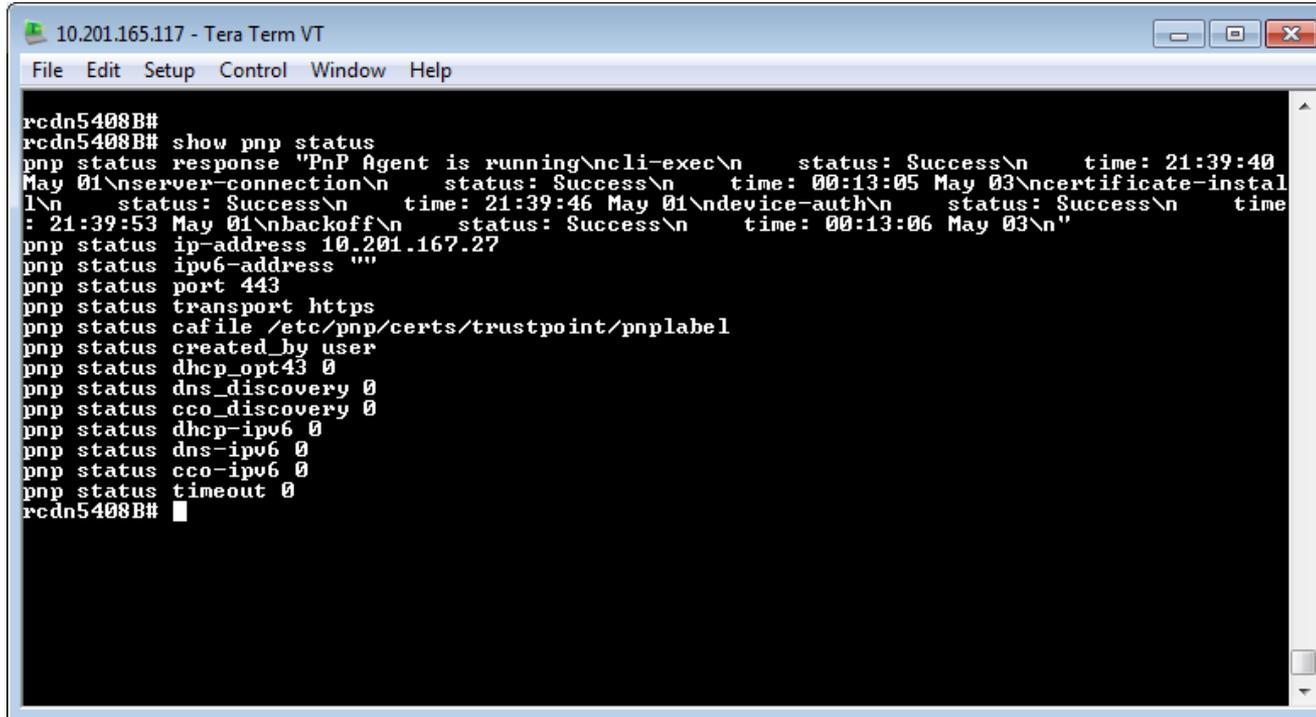
```
2018-12-13 06:02:16,145 INFO [SingleIP_Overlay:] [] Setting secure overlay state: up, active_br: None
```

```
2018-12-13 06:02:16,170 INFO [SingleIP_Overlay:DEQUEUE] [] Length before dequeue : 0
```

Provisioning Troubleshooting

PnP Status - CLI

show pnp status



```
10.201.165.117 - Tera Term VT
File Edit Setup Control Window Help

rcdn5408B#
rcdn5408B# show pnp status
pnp status response "PnP Agent is running\ncli-exec\n      status: Success\n      time: 21:39:40
May 01\nserver-connection\n      status: Success\n      time: 00:13:05 May 03\ncertificate-install
l\n      status: Success\n      time: 21:39:46 May 01\ndevice-auth\n      status: Success\n      time
: 21:39:53 May 01\nbackoff\n      status: Success\n      time: 00:13:06 May 03\n"
pnp status ip-address 10.201.167.27
pnp status ipv6-address ""
pnp status port 443
pnp status transport https
pnp status cafile /etc/pnp/certs/trustpoint/pnplabel
pnp status created_by user
pnp status dhcp_opt43 0
pnp status dns_discovery 0
pnp status cco_discovery 0
pnp status dhcp-ipv6 0
pnp status dns-ipv6 0
pnp status cco-ipv6 0
pnp status timeout 0
rcdn5408B#
```

PnP Logs

The screenshot shows the Cisco NFVIS interface. The left sidebar contains the following menu items: Home, VM Life Cycle, Notifications, Host, Certificate Management, Diagnostics, Interfaces, Monitoring, **Plug-n-Play** (circled in red), Secure Overlay, and Settings. The main content area is titled 'Plug-n-Play' and displays the following configuration details:

- PNP Agent Status: Running (with refresh and status icons)
- Server Connection Status: Success
- Created By: user
- Method: Static Automatic
- Transport: HTTP HTTPS
- Upload Certificate File: Choose File (No file chosen)
- PNP Server IPv4 or IPv6 Address: 10.88.244.138
- PNP Server Port: 443

An 'Edit' button is located at the bottom of the configuration area. A 'LOG' icon in the top right corner of the configuration area is circled in red.

Cisco DNA Center - Provisioning Status

Last updated: 11:17 am [Refresh](#) [Network Telemetry](#) [Upgrade Readiness](#) [Update Status](#)

OS Image ?	Last Sync Status	Credential Status ?	Last Provisioned Time	Provision Status	
Cisco NFV... Tag Golden	Managed	Not Provisioned	May 03 11:17:28		

Cisco DNA Center **DESIGN** **POLICY** **PROVISION** ASSURANCE PLATFORM

Devices **Fabric**

Provision Logs - nfvis

Provision Logs (1)

Provision Status

RUNNING

Details

Site Name : RCDNS-1 Site Profile : ENCSRCDN Site Profile Version : 1 Start Time : 5/3/2019, 11:13:41 AM End Time : Not yet available

Start **Refresh**

0 hrs 0 min 0 secs 255 msec ✓ Successful

Preparing for deployment

State: Preparing for deployment
Run Status: SUCCESS
Status Message: SPF execution completed successfully for task : 64a9bd33-916e-4f58-920e-57421847bc31
Entry Time: 5/3/2019, 11:13:47 AM
Exit Time: 5/3/2019, 11:13:47 AM

0 hrs 0 min 18 secs 530 msec ✓ Successful

Deactivate VNFs

Serial Number : FGL202711RR IP Addr : 10.201.174.100 [Request Payload](#)

State: Deactivate VNFs
Run Status: SUCCESS
Status Message: Provisioning Completed for ROUTER



Cisco DNA Center Logs

- Cisco DNA Center Login: `ssh -p 2222 maglev@<CiscodnaCenter-ip>`
 - Enfv – `'magctl service logs -r nfv-provisioning-service'`
 - Swim – `'magctl service logs -r swim-service'`
 - Inventory – `'magctl service logs -r apic-em-inventory-manager-service'`
 - PnP: `'magctl service logs -r onboarding-service'`

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.

Continue your education



Demos in the
Cisco campus



Walk-in labs



Meet the engineer
1:1 meetings



Related sessions



Thank you





You make **possible**