Cisco Virtualized Infrastructure Manager Installation Guide, 2.0

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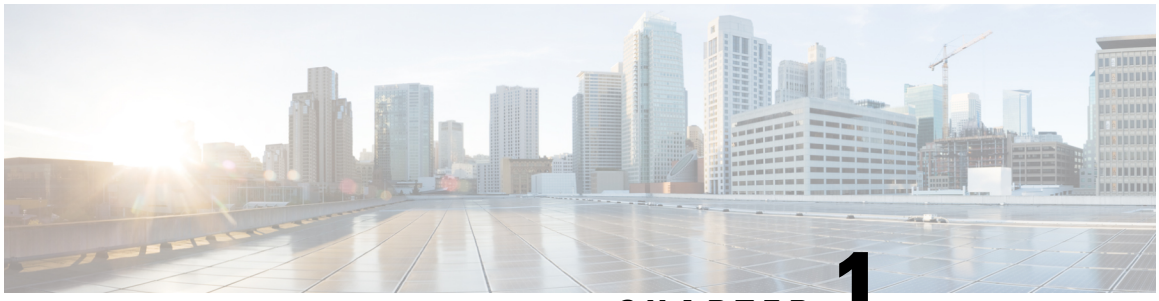


CHAPTER 1

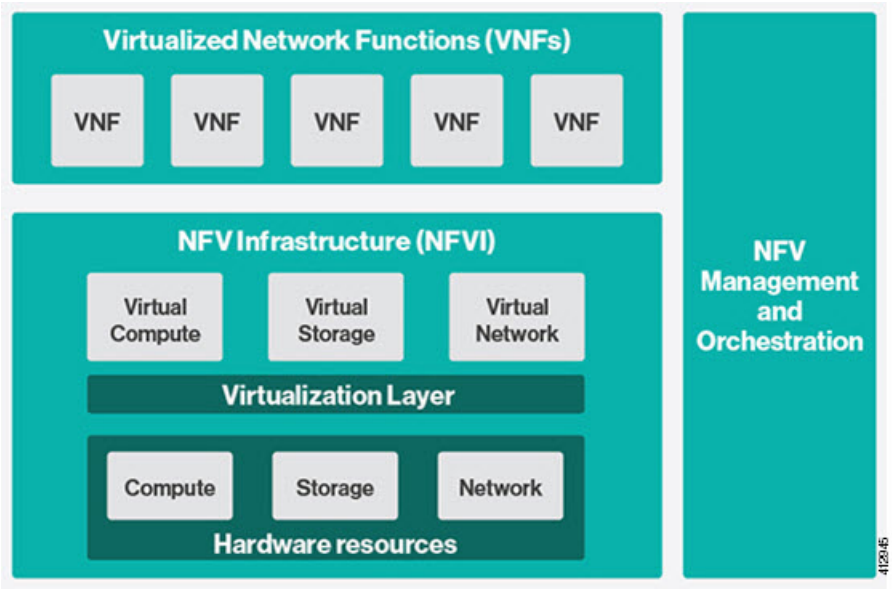
Overview to Cisco NFVI

This section contains the following topics:

Overview to Cisco NFV Infrastructure

Cisco Network Function Virtualization Infrastructure (NFVI) provides the virtual layer and hardware environment in which virtual network functions (VNFs) can operate. VNFs provide well-defined network functions such as routing, intrusion detection, domain name service (DNS), caching, network address translation (NAT) and other network functions. While these network functions require a tight integration between network software and hardware in the past, the introduction to VNFs have helped decouple (losely couple) the software from the underlying hardware. The following figure shows the high-level NFVI architecture.

Figure 1: General NFV Infrastructure



Cisco NFVI features a virtual infrastructure layer (Cisco VIM) that embeds the Red Hat OpenStack Platform (OSP).Cisco VIM includes the Newton release of OpenStack, the open source cloud operating system that controls large pools of compute, storage, and networking resources. Cisco VIM manages the OpenStack compute, network, and storage services, and all NFVI management and control functions. Key Cisco NFVI roles include:

- Control (including Networking)
- Compute
- Storage
- Management (including logging, and monitoring)

Hardware used to create the Cisco NFVI pods include:

- Cisco UCS® C240 M4—Performs management and storage functions and services. Includes dedicated Ceph (UCS 240-M4) distributed object store and file system. (Only Red Hat Ceph is supported).
- Cisco UCS C220/240 M4—Performs control and compute services.
- Cisco UCS B200 M4 blades—Can be used instead of the UCS C220 for compute and control services. The B200 blades and C240 Ceph server are connected with redundant Cisco Fabric Interconnects managed by UCS Manager.

The UCS C240 and C220 servers are M4 Small Form Factor (SFF) models with Cisco FlexFlash 64 GB Secure Digital cards and two 24 solid state storage disks (SSDs). Each UCS C240, C220, and B200 has two 10 GE Cisco UCS Virtual Interface Cards.

The B-Series pod consists of Cisco UCS B200 M4 blades for the Cisco NFVI compute and controller nodes with dedicated Ceph on a UCS C240 M4. The blades and the Ceph server are connected to redundant fabric interconnects (FIs) managed by Cisco UCS Manager. When you install Cisco VIM on a B-Series pod, you can dynamically allocate VLANs on the provider networks for both Virtio and SRIOV using the optional

Cisco UCS Manager plugin. The Cisco VIM installer performs bare metal installation and deploys OpenStack services using Docker™ containers to allow for OpenStack services and pod management software updates.

The following table shows the functions, hardware, and services performed by Cisco NFVI nodes.

Table 1: Cisco NFVI Node Functions

Function	Number	Hardware	Services
Management	1	UCS C240 M4 SFF with 8, 16, or 24 1.2 TB HDDs (24 is recommended)	• Cisco VIM Installer • Cobbler server • Docker Registry • ELK server
Control	3	• UCS C220 M4 with two 1.2 TB HDDs, or • UCS B200 with two 1.2 TB HDDs	• Maria Database/Galera • RabbitMQ • HA Proxy/Keepalive • Identity Service • Image Service • Compute management • Network service • Storage service • Horizon dashboard • Logstash forwarder
Compute	2+	• UCS C220 M4 with two 1.2 TB HDDs, or • UCS B200 with two 1.2 TB HDDs	• Virtual Networking Service • Compute service • Logstash forwarder
Storage	3 or more	SSD and HDD drives must be in a 1:5 ratio per storage node. Storage node configuration options: • UCS C240 M4 with two internal SSDs*, one external SSDs, and five 1.2 TB HDDs, or • UCS C240 M4, with two internal SSDs*, four SSDs and 20 1.2 TB HDDs	• Storage service

Function	Number	Hardware	Services
ToR	2	Recommended N9K switch software version: • OVS/VLAN, LB/VXLAN and ML2/VPP • 7.0(3)I4(6) • 7.0(3)I6(1). VTS based installation: • 7.0(3)I2(2a) • 7.0(3)I2(2c)	• Top of Rack services

Note Internal SSD is the boot device for storage node.

Note Users can use any ToR that supports virtual port channel. We recommend you to use N9K SKUs as TOR, so that they can take advantage of automated ToR configuration feature which is released as part of Cisco VIM.

Software applications that manage Cisco NFVI hosts and services include:

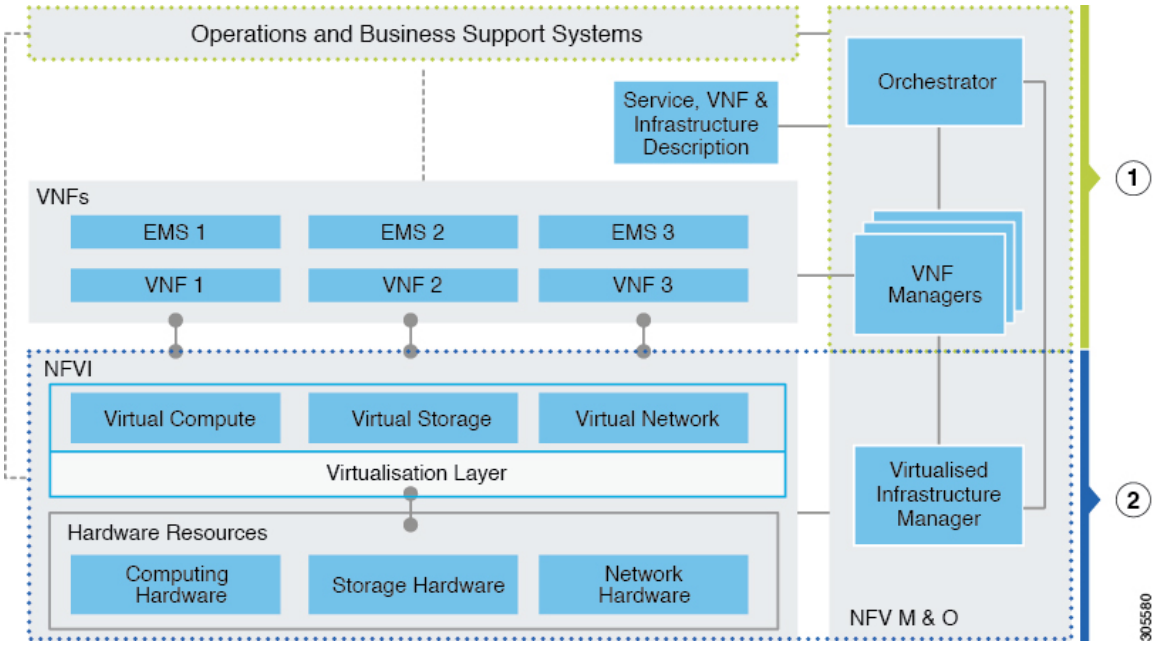
- Red Hat Enterprise Linux 7.3 with OpenStack Platform 10.0—Provides the core operating system with OpenStack capability. RHEL 7.3 and OPS 10.0 are installed on all Cisco NFVI UCS servers.
- Cisco Virtual Infrastructure Manager (VIM)—An OpenStack orchestration system that helps to deploy and manage an OpenStack cloud offering from bare metal installation to OpenStack services, taking into account hardware and software redundancy, security and monitoring. Cisco VIM includes the OpenStack Newton release with additional features and usability enhancements tested for functionality, scale, and performance.
- Cisco Insight—Deploys, provisions, and manages Cisco VIM on Cisco UCS servers.
- Cisco UCS Manager—Used to perform certain management functions when UCS B200 blades are installed. Supported UCS Manager firmware versions are 2.2(5a) and above.
- Cisco Integrated Management Controller (IMC)—Provides embedded server management for Cisco UCS C-Series Rack Servers. Supported Cisco IMC firmware versions for fresh install of Cisco VIM 2.0 is: 2.0(13i) or above. Pods running VIM 1.0 release will continue to work with2.0(3i), 2.0(6d), 2.0(6f), 2.0(8d), 2.0(8g), 2.0(9c), 2.0(9e), 2.0(10d), and 2.0(10e). 2.0(10e) is going through the upgrade. If the box is running with Intel NIC, Cisco IMC firmware versions of 2.0(13e) or above is recommended. Under no circumstances can the Cisco IMC version be running 3.0 series.
- Cisco Virtual Topology System (VTS)—is a standards-based, open, overlay management and provisioning system for data center networks. It automates DC overlay fabric provisioning for physical and virtual workloads. This is an optional service that is available through Cisco VIM.

- Cisco Virtual Topology Forwarder (VTF)—Included with VTS, VTF leverages Vector Packet Processing (VPP) to provide high performance Layer 2 and Layer 3 VXLAN packet forwarding.

Two Cisco VNF orchestration and management applications used with Cisco NFVI include:

- Cisco Network Services Orchestrator, enabled by Tail-f—Provides end-to-end orchestration spanning multiple network domains to address NFV management and orchestration (MANO) and software-defined networking (SDN). (For information about Cisco NSO, see Network Services Orchestrator Solutions.)
- Cisco Elastic Services Controller—Provides a single point of control to manage all aspects of the NFV life cycle for VNFs. ESC allows you to automatically instantiate, monitor, and elastically scale VNFs end-to-end. (For information about Cisco ESC, see the Cisco Elastic Services Controller Data Sheet.)

Figure 2: NFVI Architecture With Cisco NFVI, Cisco NSO, and Cisco ESC



At a high level the NFVI architecture includes a VNF Manager and the NFV Infrastructure.

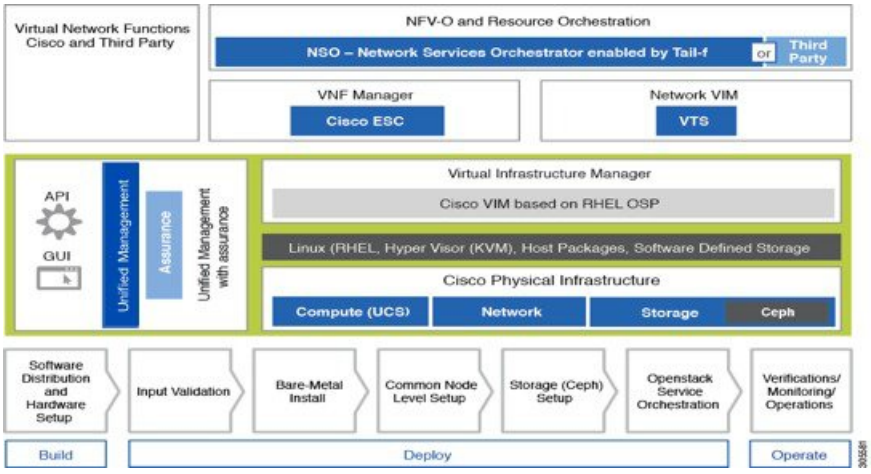
1	• Cisco Network Services Orchestrator • Cisco Elastic Services Controller
2	Cisco NFVI: • Cisco VIM + • Cisco UCS and Cisco Nexus Hardware + • Logging and Monitoring Software + • Cisco Virtual Topology Services (optional) + • Cisco Insight (optional)

For cloud networking, Cisco NFVI supports either Linux bridge over Virtual Extensible LAN (VXLAN) or Open vSwitch over VLAN as the cloud network solution for both UCS B- and C-Series pods. However, the UCS B-Series pods using the Cisco UCS Manager plugin supports only OVS/VLAN as a tenant network. Both B-Series and C-Series deployments support provider networks over VLAN. In addition, in a C-series pod, you can choose to run with augmented performance mechanism by replacing OVS/LB with ML2/VPP (virtual packet processor). Also, in a C-series pod, you can choose to have the cloud integrated with VTC (virtual topology system), which is an SDN controller option.

The Cisco NFVI uses OpenStack services running inside containers with HAProxy load balancing and providing high availability to API and management network messaging. Transport Layer Security (TLS) protects the API network from external clients to the HAProxy. Cisco VIM installation also includes service assurance, OpenStack CloudPulse, built-in control, and data plane validation. Day two pod management allows you to add and remove compute and Ceph nodes, and replace controller nodes. The Cisco VIM installation embeds all necessary RHEL licenses as long as you use the Cisco VIM BOM and the corresponding release artifacts.

The following illustration shows a detailed view of the Cisco NFVI architecture and the Cisco NFVI Installation flow.

Figure 3: Detailed Cisco NFVI Architecture View

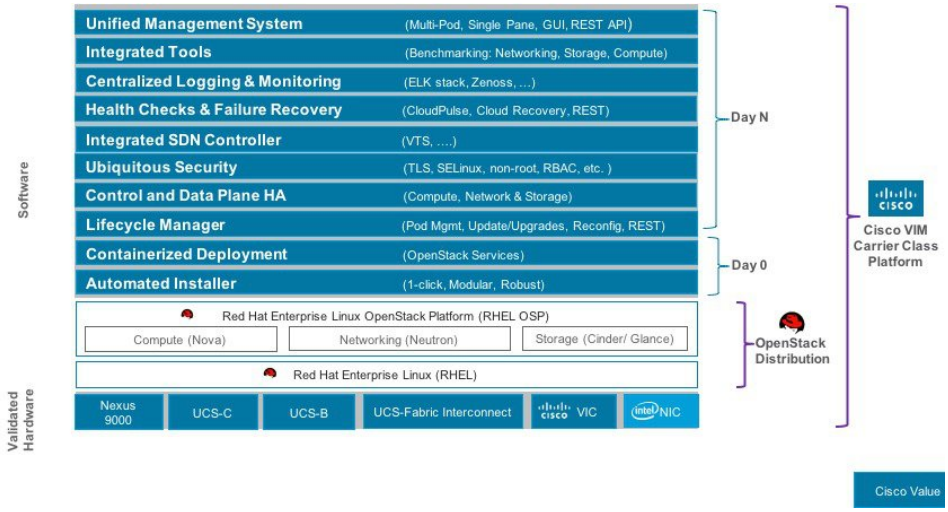


Overview to Cisco Virtual Infrastructure Manager

Cisco Virtual Infrastructure Manager (VIM) 2.0 is a fully automated cloud lifecycle management system. VIM helps to bring up a fully functional cloud in hours, with integrated end-to-end control and data plane verification in place. Beyond day 0 cloud bring up and deployment, VIM offers fully automated day 1 to day n cloud lifecycle management. These include capabilities such as pod scaling (expansion), software update, upgrade, or reconfigure parameters, consolidated logging with rotation and export, software update and upgrade. These have been implemented in line with the operational and security best practices of service providers and enterprises.

The following figure provides the high-level overview of all day-0 and day-n items of Cisco VIM.

Figure 4: Cisco VIM Capability Overview



Features of Cisco VIM

Cisco VIM 2.0 is a only standalone fully automated cloud lifecycle manager offering from Cisco for private cloud. The current version of VIM, integrates with Cisco C or B-series UCS servers and Cisco or Intel NIC. This document and its accompanying admin guide will guide the cloud administrators to setup and manage the private cloud. Listed in table is the summary of the feature set that is offered.

Feature Name	Comments
OpenStack Version	RHEL 7.3 with OSP 10 (Newton).
Hardware Support Matrix	1. UCS C220/B200 M4 controller or compute with Intel V3 (Haswell). 2. UCS C240 M4 controller or compute + Intel V4 (Broadwell).
NIC support	1. Cisco VIC: VIC 1227, 1240, 1340, 1380. 2. Intel NIC: X710.
ToR and FI support	1. For VTS based installation, use the following Nexus version-7.0(3)I2(2a) and 7.0(3)I2(2c) 2. For mechanism driver other than VTS, use the following Nexus software version 7.0(3)I4(6) 7.0(3)I6(1) 3. UCS-FI-6296
Mechanism Drivers	OVS/VLAN, Linuxbridge/VXLAN, ML2VPP (Fast Networking, Fast Data FD.io > ML2/VPP/VLAN, based on the FD.io VPP fast virtual switch)
SDN Controller Integration	VTS; ACI (ships in the night).
Install Methodology	Fully automated online or offline.

Scale	1. Compute: 40 hosts 2. Ceph OSD: 20 hosts
Automated Pod Life Cycle Management	1. Add or remove compute and Ceph nodes and replace controller. 2. Reconfiguration of passwords and selected optional services. 3. Automated software update.
Platform security	Secure OS, RBAC, Network isolation, TLS, Source IP filtering, Keystone v3, Bandit, CSDL compliant, hardened OS, SELinux.
EPA	NUMA, CPU pinning, huge pages, SRIOV with Intel NIC.
HA and Reliability	1. Redundancy at hardware and software level. 2. Automated backup and restore of management node.
Unified Management Support	Single pane of glass in a single or multi instance (HA) mode: Supports multi-tenancy and manages multiple pods from one instance.
Central Logging	ELK integrated with external syslog for log offload.
VM Migration	Cold migration and resizing.
Storage	Object store with SwiftStack, Block storage with Ceph.
Monitoring	"Collectd" (system statistics collection daemon) , or third party integration with Zenoss (Called NFVIMON).
Integrated Test Tools	1. Open Source Data-plane Performance Benchmarking: VMTP, NFVBench. 2. Services Health Checks Integration: Cloudpulse and Cloudsanity.
POD Type	1. Dedicated controller, compute and storage node. 2. Micro pod: Integrated controller, compute and storage node. 3. VMTP: An open source data plane VM to VM performance benchmarking tool. 4. NFVBench: An open source NFVI data plane and service chain performance benchmarking tool. 5. CloudPulse and CloudSanity: Platform services integrated health check tools.

Cisco NFVI Networking Overview

Cisco VIM supports installation on two different type of pods. The B-series and C-series offering supports NICs that are from Cisco (called as Cisco VIC). You can choose the C-series pod to run in a pure Intel NIC environment, and thereby obtain SRIOV support on the C-series pod. This section calls out the differences in networking between the Intel NIC and Cisco VIC installations.

To achieve network level security and isolation of tenant traffic, Cisco VIM segments the various OpenStack networks. The Cisco NFVI network includes six different segments in the physical infrastructure (underlay). These segments are presented as VLANs on the Top-of-Rack (ToR) Nexus switches (except for the provider network) and as vNIC VLANs on Cisco UCS servers. You must allocate subnets and IP addresses to each segment. Cisco NFVI network segments include: API, external, management and provisioning, storage, tenant and provider.

API Segment

The API segment needs one VLAN and two IPv4 addresses (four if you are installing Cisco VTS) (not a full subnet) in an externally accessible subnet different from the subnets assigned to other Cisco NFVI segments. These IP addresses are used for:

- OpenStack API end points. These are configured within the control node HAProxy load balancer.
- Management node external connectivity.
- The Cisco Virtual Topology Services (VTS) (if included in your Cisco NFVI package) Virtual Topology Controller (VTC) node (optional for VTS).
- VTC (optional for VTS).

External Segment

The external segment needs one VLAN to configure the OpenStack external network. Provide the VLAN during installation in the the Cisco NFVI setup_data.yaml file, but configure the actual subnet using the OpenStack API after the installation. Then use the external network to assign OpenStack floating IP addresses to VMs running on Cisco NFVI.

Management and Provisioning Segment

The management and provisioning segment needs one VLAN and one subnet with an address pool large enough to accommodate all the current and future servers planned for the pod for initial provisioning (PXE boot Linux) and, thereafter, for all OpenStack internal communication. This VLAN and subnet can be local to Cisco NFVI for C-Series deployments. For B-Series pods, the UCS Manager IP and management network must be routable. You must statically configure Management IP addresses of Nexus switches and Cisco UCS server Cisco IMC IP addresses, redundant0 , not DHCP. They must be through the API segment. The management/provisioning subnet can be either internal to Cisco NFVI (that is, in a lab it can be a non-routable subnet limited to Cisco NFVI only for C-Series pods), or it can be an externally accessible and routable subnet. All Cisco NFVI nodes (including the Cisco VTC node) need an IP address from this subnet.

Storage Segment

Cisco VIM has a dedicated storage network used for Ceph monitoring between controllers, data replication between storage nodes, and data transfer between compute and storage nodes. The storage segment needs one VLAN and /29 or larger subnet internal to Cisco NFVI to carry all Ceph replication traffic. All the participating nodes in the pod, have IP addresses on this subnet.

Tenant Segment

The tenant segment needs one VLAN and a subnet large enough to manage pod tenant capacity internal to Cisco NFVI to carry all tenant virtual network traffic. Only Cisco NFVI control and compute nodes have IP addresses on this subnet. The VLAN/subnet can be local to Cisco NFVI.

Provider Segment

Provider networks are optional for Cisco NFVI operations but are often used for real VNF traffic. You can allocate one or more VLANs for provider networks after installation is completed from OpenStack.

Cisco NFVI renames interfaces based on the network type it serves. The segment Virtual IP (VIP) name is the first letter of the segment name. Combined segments use the first character from each segment for the VIP, with the exception of provisioning whose interface VIP name is mx instead of mp to avoid ambiguity with the provider network. The following table shows Cisco NFVI network segments, usage, and network and VIP names.

Table 2: Cisco NFVI Networks

Network	Usage	Network Name	VIP Name
Management/Provisioning	• OpenStack control plane traffic. • Application package downloads. • Server management; management node connect to servers on this network. • Host default route. • PXE booting servers during bare metal installations.	Management and provisioning	mx
API	• Clients connect to API network to interface with OpenStack APIs. • OpenStack Horizon dashboard. • Default gateway for HAProxy container. • Integration with endpoints served by SwiftStack cluster for native object storage, cinder backup service or Identity service with LDAP.	api	a
Tenant	VM to VM traffic. For example, VXLAN traffic.	tenant	t
External	Access to VMs using floating IP addresses.	external	e
Storage	Transit network for storage back-end. Storage traffic between VMs and Ceph nodes.	storage	s
Provider Network	Direct access to existing network infrastructure.	provider	p
Installer API	• Administrator uses installer API network to ssh to the management node. • Administrator connects to installer API to interface with secured services. Example: Kibana on the management node.	VIM installer API	br_api

For each C-series pod node, two vNICs are created using different ports and bonded for redundancy for each network. Each network is defined in setup_data.yaml using the naming conventions listed in the preceding table. The VIP Name column provides the bonded interface name (for example, mx or a) while each vNIC name has a 0 or 1 appended to the bonded interface name (for example, mx0, mx1, a0, a1).

The Cisco NFVI installer creates the required vNICs, host interfaces, bonds, and bridges with mappings created between all elements. The number and type of created vNICs, interfaces, bonds, and bridges depend on the Cisco NFVI role assigned to the UCS server. For example, the controller node has more interfaces than the compute or storage nodes. The following table shows the networks that are associated with each Cisco NFVI server role.

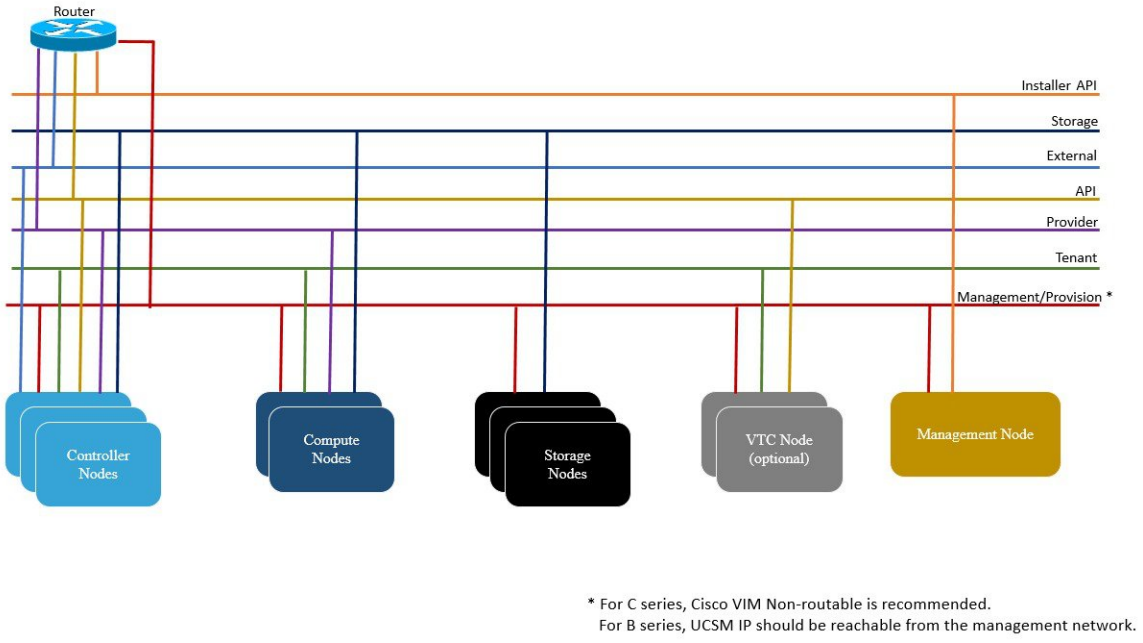
Table 3: Cisco NFVI Network-to-Server Role Mapping

	Management Node	Controller Node	Compute Node	Storage Node
Management/Provisioning	+	+	+	+
API		+		
Tenant		+	+	
Storage		+	+	+
Provider			+	
External		+		

In the initial Cisco NFVI deployment, two bridges are created on the controller nodes, and interfaces and bonds are attached to these bridges. The br_api bridge connects the API (a) interface to the HAProxy. The HAProxy and Keepalive container has VIPs running for each OpenStack API endpoint. The br_mgmt bridge connects the Management and Provisioning (mx) interface to the HAProxy container as well.

The following diagram shows the connectivity between Cisco NFVI nodes and networks.

Figure 5: Cisco NFVI Network Connectivity



Supported Layer 2 networking protocols include:

- Virtual extensible LAN (VXLAN) over a Linux bridge.
- VLAN over Open vSwitch(SRIOV with Intel 710NIC).
- VLAN over ML2/VPP for C-series Only.
- For UCS B-Series pods, Single Root Input/Output Virtualization (SRIOV). SRIOV allows a single physical PCI Express to be shared on a different virtual environment. The SRIOV offers different virtual functions to different virtual components, for example, network adapters, on a physical server.

Any connection protocol can be used unless you install UCS B200 blades with the UCS Manager plugin, in which case, only OVS over VLAN can be used. The following table shows the available Cisco NFVI data path deployment combinations.

Table 4: Cisco NFVI Data Path Deployment Combinations

NFVI Pod Type	Mechanism Driver	Tenant Virtual Network Encapsulation		Provider Virtual Network Encapsulation	SRIOV for VM	PCI Passthrough Ports	MTU Values	
		VLAN	VxLAN	VLAN			1500	9000
UCS C-series	LinuxBridge	No	Yes	Yes	No	No	Yes	No
UCS C-series	Openvswitch	Yes	No	Yes	Yes*	No	Yes	Yes
UCS C-series	ML2/VPP(L2)	Yes	No	Yes	No	No	Yes	Yes
UCS C-series	ML2/VPP(L3)**	Yes	No	Yes	No	No	Yes	Yes
UCS C-series	VTF with VTC***	No	Yes	Yes	No	No (except through DPDK)	Yes	Yes
UCS C-series	Openvswitch	Yes	No	Yes	Yes	No	Yes	Yes

Note ** Tech Preview feature.

Note *** VTF with VTC is only supported on C-series Cisco VIC.

Note SRIOV is supported on C-series with Intel NIC over Provider Network

Pod with Intel NICs In case of the pod having Intel NICs (X710), the networking is slightly different. First of all, the requirement is to have atleast two NICs (4x10G) single server, so that we can support NIC level redundancy. Each NIC is connected to each ToR (connections explained later in the chapter). Since vNICs are not supported in the Intel card, the idea is to bond the physical interfaces at the host and then create

sub-interfaces based on the segment VLAN. Lets call the two NIC cards as NIC_1 and NIC_2 and call their four ports as A, B, C, D. Unlike Cisco VIC based pod, the traffic here is classified into the following.

1. Control Plane.
2. Data plane (external, tenant and non-SRIOV provider network).
3. SRIOV (optional for provider network); if SRIOV is used the Data plane network only carries external and tenant network traffic.

Control Plane.

The control plane is responsible for carrying all the control and management traffic of the cloud. The traffic that flows through control plane are:

1. Management/Provision.
2. Storage
3. API

The control plane interface is created by bonding the NIC_1 A port with NIC_2 A port. The bonded interface name is called as samx, indicating that it is carrying Storage, API, Management/Provision traffic (naming convention is similar to Cisco VIC pod). The slave interfaces (physical interfaces) of the bonded interface are renamed as samx0 and samx1. samx0 belongs to NIC_1 and samx1 belongs to NIC_2. Sub interfaces are then carved out of this samx interface based on the Storage, API VLANs. The management/provision traffic will be untagged/native VLAN in order to support pxe booting.

Data Plane

The data plane is responsible for carrying all the VM data traffic. The traffic that flows through the data plane are

- Tenant
- Provider
- External

The data plane is created by bonding the NIC_1 B port with NIC_2 B port. The bonded interface name here would be pet, indicating that it is carrying Provider, External and Tenant traffic. The slave interfaces of this bonded interface would be visible as pet0 and pet1. pet0 belongs to the NIC_1 and pet1 belongs to NIC_2.

In case of OVS/VLAN, the "pet" interface is used as it is (trunked to carry all the data VLANs) to the Openstack cloud, as all the tagging and untagging happens at the Openstack level. In case of Linux Bridge/VXLAN, there will be sub-interface for tenant VLAN to act as the VXLAN tunnel endpoint.

SRIOV

In case of Intel NIC pod, the third port from each NIC can be used for SRIOV traffic. This is optional and is set/unset through a setup_data.yaml parameter. Unlike the control and data plane interfaces, these interfaces are not bonded and hence there is no redundancy. Each SRIOV port can have maximum of 32 Virtual Functions and the number of virtual function to be created are configurable through the setup_data.yaml. The interface names of the sriov will show up as sriov0 and sriov1 on each host, indicating that sriov0 belongs to NIC_1 C port and sriov1 belongs to NIC_2 C port.

In the case of Intel NIC testbeds, the following table summarizes the above discussion

Network	Usage	Type of traffic	Interface name
Control Plane	To carry control/management traffic	Storage, API, Management/Provision	samx
Data Plane	To carry data traffic	Provider, External, Tenant	pet
SRIOV	To carry SRIOV traffic	SRIOV	sriov0, sriov1

The following table shows the interfaces that are present on each type of server (role based).

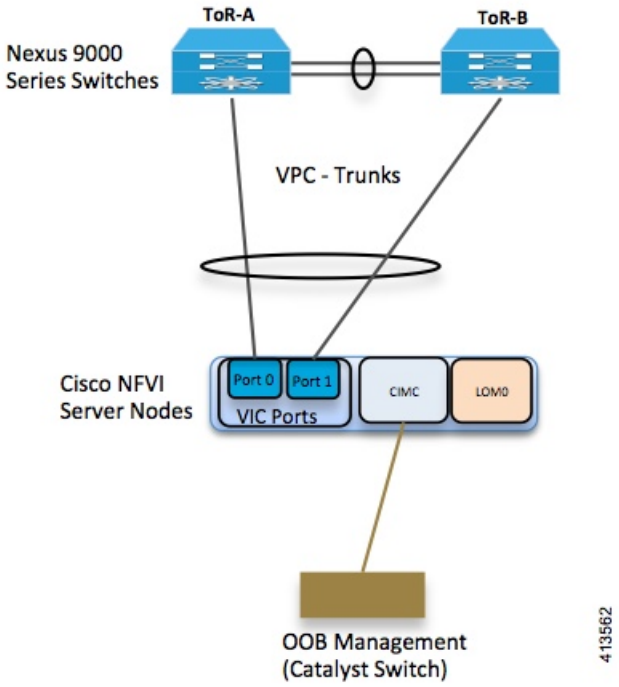
	Management Node	Controller Node	Compute Node	Storage Node
Installer API	+			
Control plane	+	+	+	+
Data plane		+	+	
SRIOV			+	

Note On an Intel testbed, all kind of OpenStack networks should be created using **physnet1** as the physnet name.

UCS C-Series Network Topologies

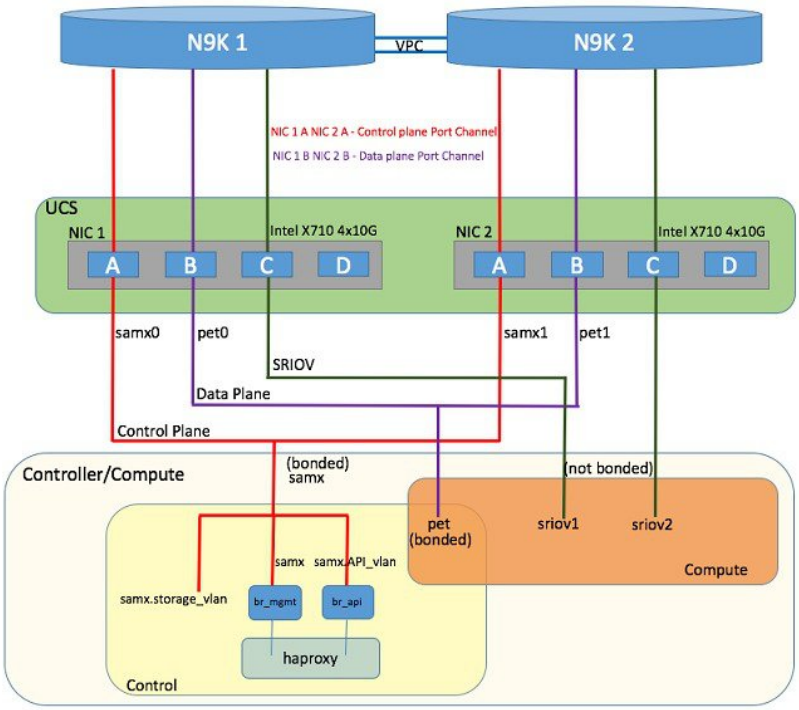
Cisco NFVI UCS servers connect to the ToR switches using Cisco UCS dual-port Virtual Interface Cards (VICs). The VIC is an Enhanced Small Form-Factor Pluggable (SFP+) 10 Gigabit Ethernet and Fibre Channel over Ethernet (FCoE)-capable PCI Express (PCIe) card designed for Cisco UCS C-Series Rack Servers. Each port connects to a different ToR using a Virtual Port Channel (VPC). Each VIC is configured with multiple vNICs that correspond to specific Cisco VIM networks. The UCS Cisco IMC port is connected to an out-of-band (OOB) Cisco management switch. The following figure shows the UCS C-Series pod Cisco NFVI host to ToR topology.

Figure 6: UCS C-Series Host to ToR Topology



In the case of Intel NIC, a single two port Cisco VIC in the preceding diagram, is replaced with two 4-port 710 Intel NIC. The addition of an extra Intel NIC has been done to incorporate the user request of providing card level redundancy which the Cisco VIC solution does not have.

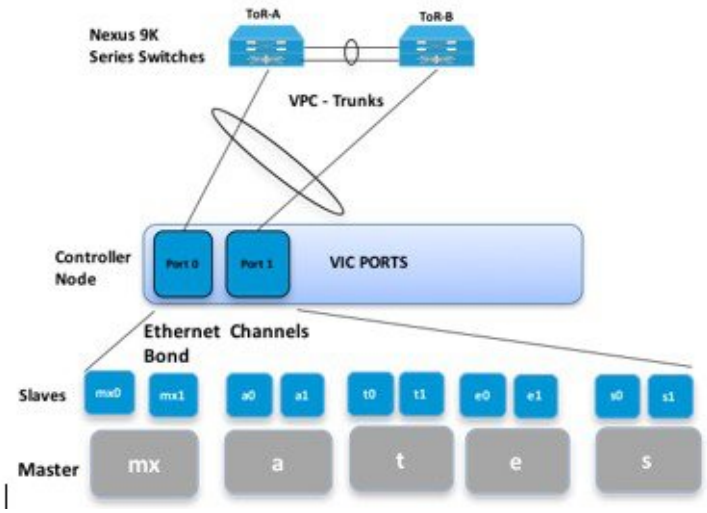
Figure 7: UCS C-Series Intel NIC Details



Of the four ports that are available in each NIC card, port A is used for management traffic (provision, API, storage, etc), whereas the port B is used for data plane (tenant and provider network) traffic. Port C is dedicated for SRIOV (configured optionally based on setup_data.yaml). Sub-interfaces are carved out of the data and control plane interfaces to provide separate traffic based on specific roles. While port A and B from each NIC help in forming bonded interface, port C, over which SRIOV traffic for provider network flows is not bonded. Extreme care should be taken during pod setup, so that ports A, B and C for the Intel NIC is connected to the ToRs. In the current offering Port D is not used.

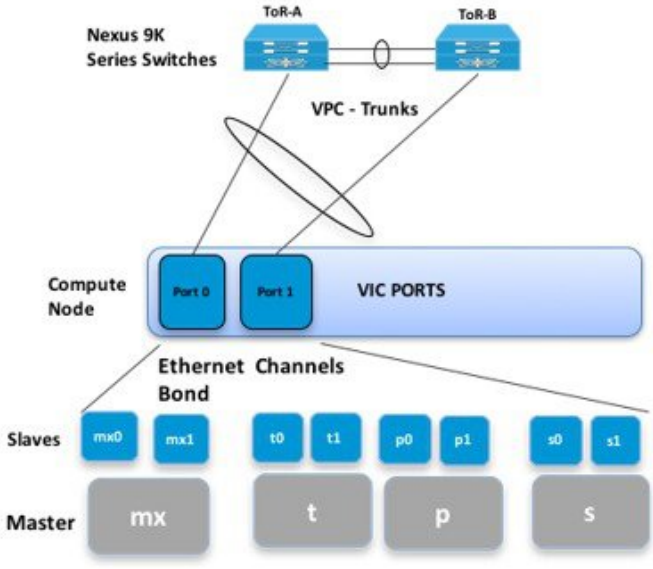
The Cisco NFVI controller node has four bonds: mx, a, t, and e. Each has a slave interface that is named with the network name association and a mapped number. For example, the management and provisioning network, mx, maps to mx0 and mx1, the API network, a, to a0 and a1, and so on. The bonds map directly to the vNICs that are automatically created on the controller node when it is deployed. The following figure shows the controller node network-to-bond-to-vNIC interface mapping.

Figure 8: Controller Node Network to Bond Mapping



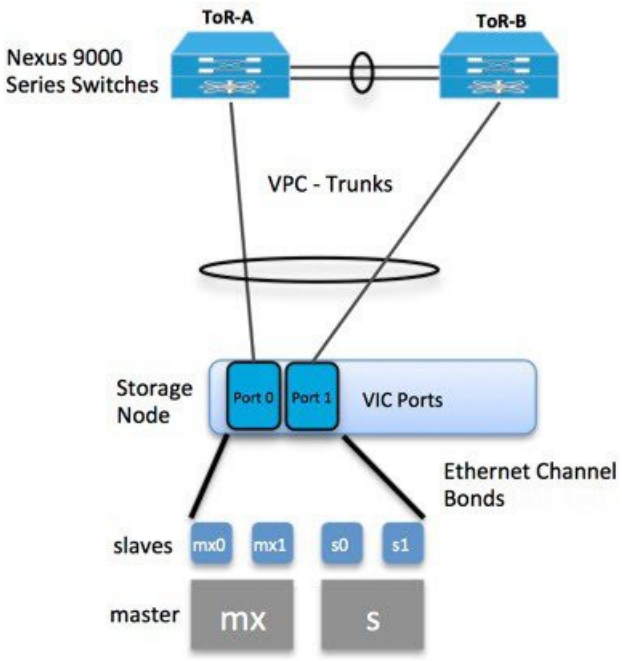
The Cisco NFVI compute node has three bonds: mx, t, and p. Each has a slave interface that is named with the network name association and a mapped number. For example, the provider network, p, maps to p0 and p1. The bonds map directly to the vNICs that are automatically created on the compute node when it is deployed. The following figure shows the compute node network-to-bond-to-vNIC interfaces mapping.

Figure 9: Compute Node Network to Bond Mapping



The Cisco NFVI storage node has two bonds: mx and s. Each has a slave interface that is named with the network name association and a mapped number. For example, the storage network, s, maps to s0 and s1. Storage nodes communicate with other storage nodes over the mx network. The storage network is only used for Ceph backend traffic. The bonds map directly to the vNICs that are automatically created on the storage node when it is deployed. The following figure shows the network-to-bond-to-vNIC interfaces mapping for a Cisco NFVI storage node.

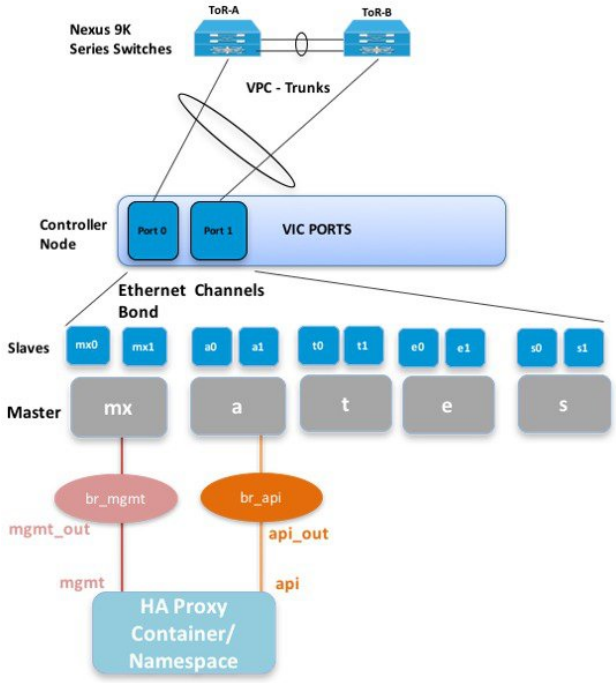
Figure 10: Storage Node Networking to Bond Mapping



The initial Cisco NFVI installation creates two bridges on the controller nodes and interfaces and bonds are attached to the bridges. The br_api bridge connects the API (a) interface to the HAProxy container. The HAProxy and Keepalive container has VIPs running for each OpenStack API endpoint. The br_mgmt bridge connects the Management and Provisioning (mx) interface to the HAProxy container as well.

The figure below shows the connectivity between the mx interface and the br_mgmt bridge. It also shows the connectivity between the br_mgmt and the HAProxy container/namespace using mgmt_out and mgmt interfaces. The figure shows the connectivity between the api interface and the br_api bridge as well as the link between the br_mgmt bridge and the HAProxy container using api_out and mgmt_out interfaces.

Figure 11: Bridge and Network Namespace Layout



A sample routing table is shown below. br_api is the default route and br_mgmt is local to the pod.

```
[root@c43-bot-mgmt ~]# ip route
default via 172.26.233.193 dev br_api  proto static  metric 425
172.26.233.0/25 dev br_mgmt  proto kernel  scope link  src 172.26.233.104  metric 425
172.26.233.192/26 dev br_api  proto kernel  scope link  src 172.26.233.230  metric 425

[root@c43-bot-mgmt ~]# ip addr show br_api
6: br_api: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP
    link/ether 58:ac:78:5c:91:e0 brd ff:ff:ff:ff:ff:ff
    inet 172.26.233.230/26 brd 172.26.233.255 scope global br_api
       valid_lft forever preferred_lft forever
    inet6 fe80::2c1a:f6ff:feb4:656a/64 scope link
       valid_lft forever preferred_lft forever

[root@c43-bot-mgmt ~]# ip addr show br_mgmt
7: br_mgmt: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP
    link/ether 58:ac:78:5c:e4:95 brd ff:ff:ff:ff:ff:ff
    inet 172.26.233.104/25 brd 172.26.233.127 scope global br_mgmt
       valid_lft forever preferred_lft forever
    inet6 fe80::403:14ff:fef4:10c5/64 scope link
       valid_lft forever preferred_lft forever
```

Cisco VIM Management Node Networking

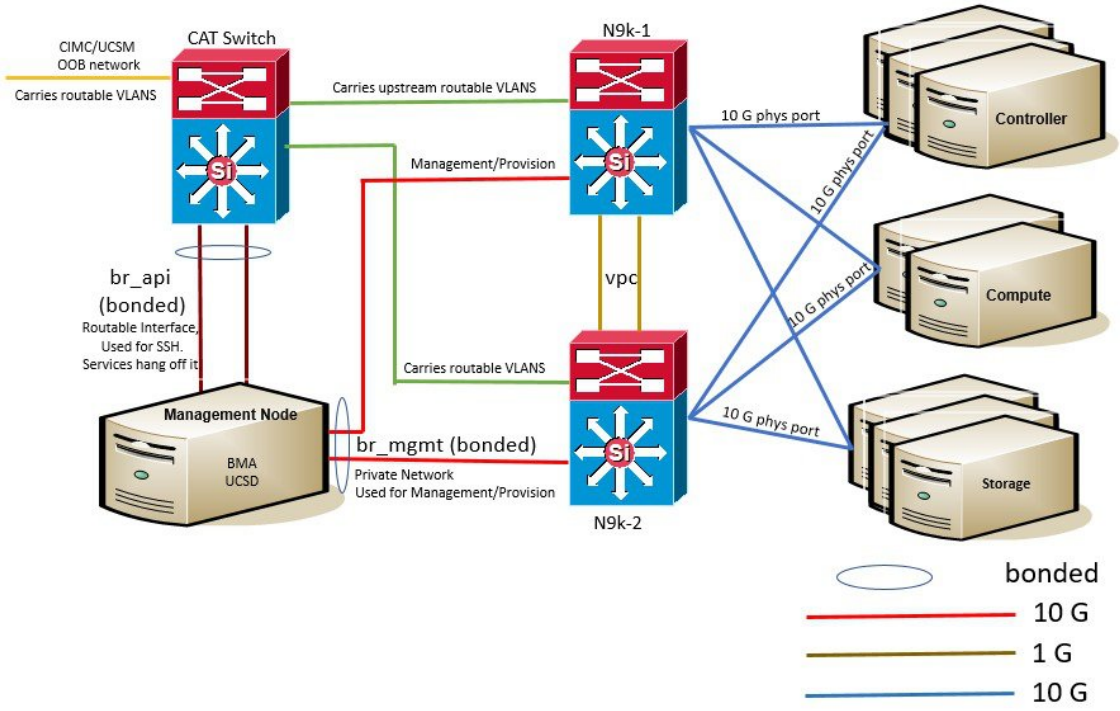
In Cisco VIM, the management node has two interfaces. One for API and the other for provisioning. This was primarily done for security reasons so that internal pod management or control plane messages (RabbitMQ, Maria DB and so on) do not leak out, and hence reduce the attack vector to the pod. As the name indicates, the API interface is to access the VIM installer API and also is used to SSH to the management node. All

external services (installer API, Insight, ELK and so on) are password protected and hangs off the API interface. Default route of the management node points to the API interface.

The second interface, also called the provisioning interface is used to PXE boot the various nodes that constitute the OpenStack pod. Typically, this is a non-routable interface reserved for OpenStack management traffic.

In the case of B-series pod, the networks between provisioning and the UCSM IP need to be routable. Proper ACL should be applied in the upstream router so that other networks does not interfere with the provisioning network. Depending on the overall deployment, the management node will also act as a jump-server to the OpenStack nodes. Listed figure is the high level layout of the Cisco VIM pod, along with the management-node networking design.

Figure 12: Cisco VIM Management Node Networking



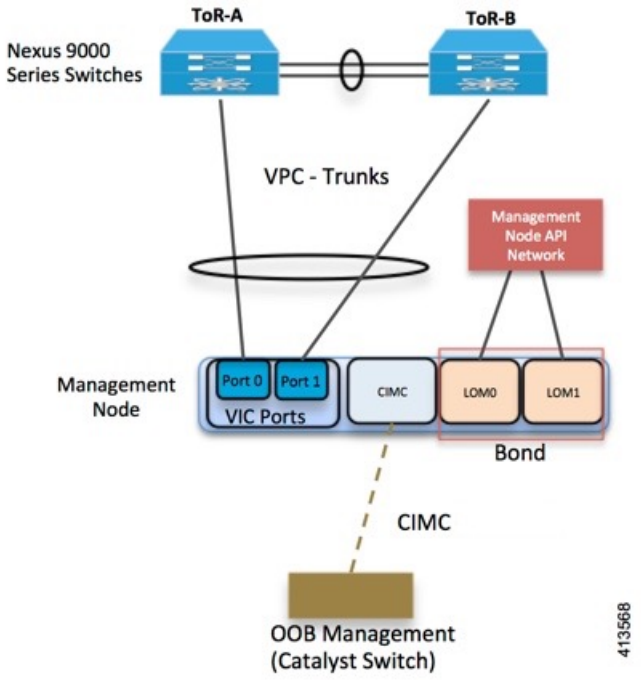
Cisco NFVI UCS C-Series management node physically connects to the network. Unlike other nodes, the management node does not use multiple vNICs corresponding to specific Cisco NFVI networks. Instead, it connects to the management and API networks using two different physical connections. The management node connects to the management network using a Cisco two-port VIC with each port connecting to a different ToR switch in a VPC configuration. The Cisco VIC card utilizes the default vNICs, but requires the vNICs to be in trunk mode and the default VLAN set to the management network VLAN. The management node connects to the API network using both one Gbps LAN On Motherboard (LOM) ports connected in a port channel configuration. These ports can either connect to the Nexus 9000 Series switch in a VPC configuration, or to an operator-managed switch(es), depending on how the operator wants to segment their network. The Cisco IMC port can optionally be connected to an out-of-band management Catalyst switch.

Management node services, which are required to start the other topology nodes, listen on the management network and the traffic flowing over the vNICs. These services, as well as many of the other management network services, are unsecured. Secure management node services listen on the management node API network, and their traffic flows over the LOM ports. This service division allows tenants to utilize tighter

network access control to the management network than the management node API network. The following figure shows the Cisco NFVI management node (UCS C-Series) API network connections.

Note Connecting Cisco IMC port to a Cisco OOB management switch is optional.

Figure 13: Management Node API Network Connections

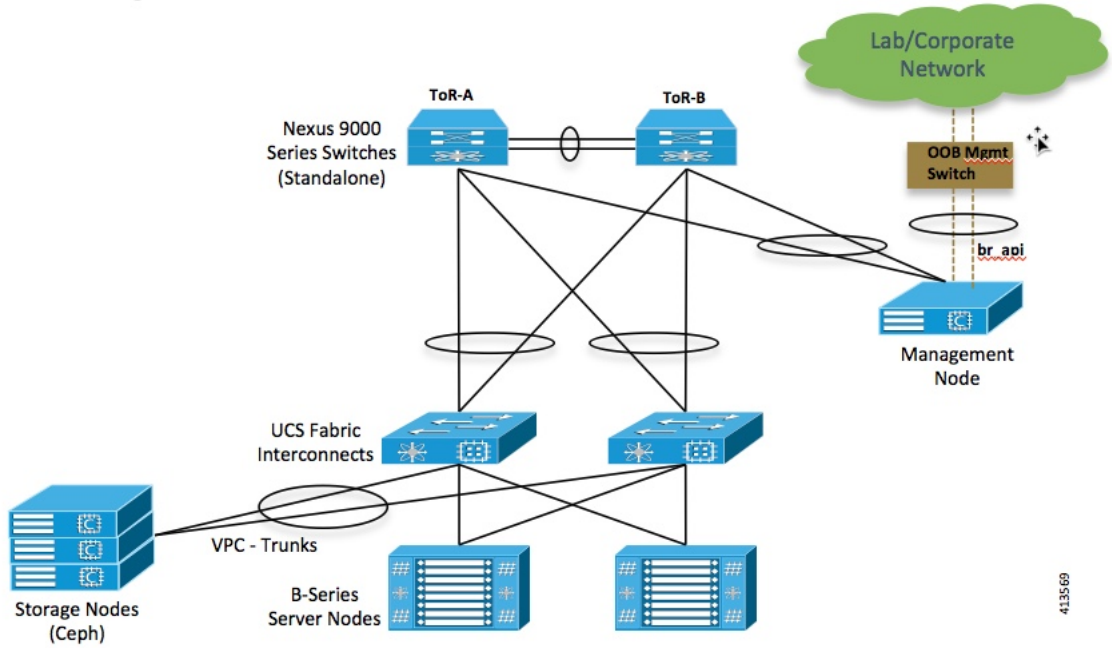


UCS C-Series and B-Series Topologies

You can deploy Cisco NFVI using a combination of Cisco C-Series and B-Series servers. The figure below shows a high-level view of Cisco UCS C-Series and B-Series servers used in a Cisco NFVI deployment. The C-Series management node is connected to the Nexus 9000 Series ToRs through the Cisco VIC in a VPC configuration. The UCS Fabric Interconnects (FIs) are connected to the ToRs and the UCS B-Series blade chassis is connected to the FIs. The C-Series storage nodes are connected to the ToRs as well. The networking segment layout discussed in Cisco NFVI Networking Overview, on page 8 is the same for a C-Series-only implementation or the C-Series and B-Series design shown below with two exceptions:

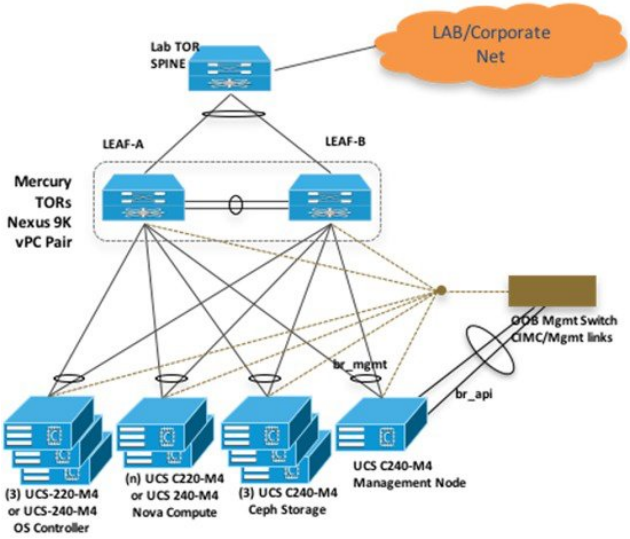
- For the UCS B-Series, the Cisco UCS Manager IP address must be available to the Cisco NFVI management network. For UCS C-Series, this requirement is optional.
- The UCS Manager cluster and VIP connections are usually not attached to one of the Cisco NFVI network segments.

Figure 14: UCS B-Series Topology



For C-Series pods, each host has a 2x10 GE Cisco network card 1227 from which the installer creates two vNICs for each network to ensure the network topology has built-in redundancy. The provider network, if needed, is also created from the same network card. Each link of a given network type terminates to a unique Nexus 9000 switch, which acts as the ToR. The Nexus 9000s are configured in VPC mode to ensure network redundancy is built into the design from the beginning. The networking redundancy is extended to the management node, which has a redundant vNIC for the installer API and management or provisioning networks. The figure shows the C-Series topology.

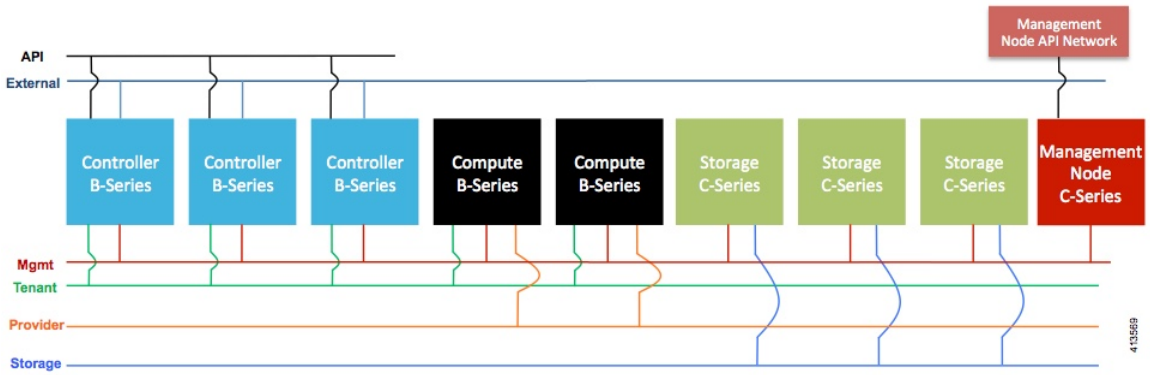
Figure 15: Cisco NFVI C-Series Topology



Note While the figure depicts UCS 220 M4s as controller and compute, it also supports UCS 240 M4s as control and compute nodes.

Cisco NFVI uses multiple networks and VLANs to isolate network segments. For the UCS C-Series management and storage nodes, VLANs are trunked between the ToR switches and the Cisco VICs on the C-Series nodes. For the UCS B-Series controllers and compute nodes, VLANs are trunked between the ToR switches, the UCS Fabric Interconnects, and the B-Series blades. The figure shows the network segments and how each node is attaches to them. The network segments are VLANs that are trunked between the respective upstream switch/FI and the C-Series or B-Series node.

Figure 16: Network and VLAN Layout for Combined C-Series and B-Series Installation



Cisco NFVI High Availability

Cisco NFVI high availability (HA) is provided by HAProxy, a single-threaded, event-driven, non-blocking engine combining a very fast I/O layer with a priority-based scheduler. HAProxy architecture is layered with bypass mechanisms at each level to ensure data does not reach higher levels than needed. Most processing is performed in the kernel.

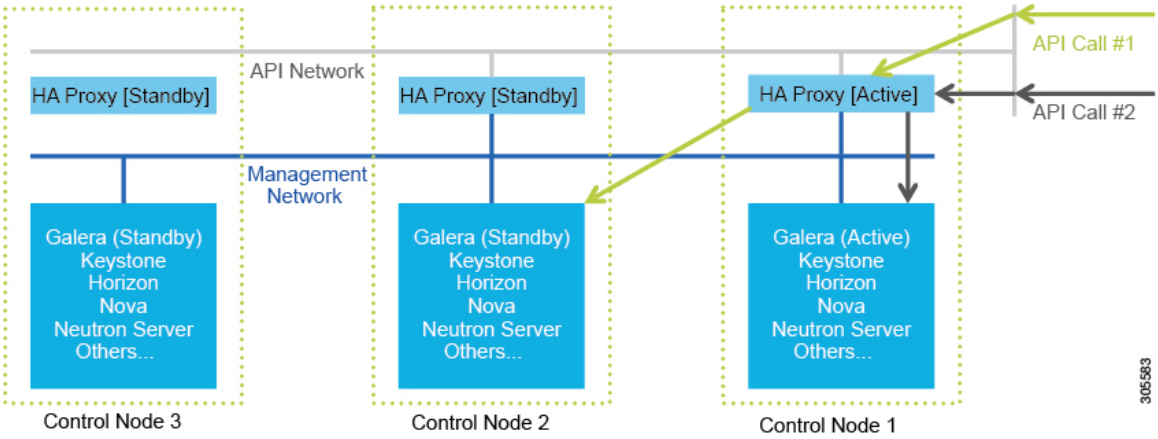
The following figure shows a detailed view of Cisco NFVI controllers connecting to the API and Management and Provisioning network. It also shows how the bridges are configured and the roles of the HAProxy container and network namespace. The dedicated HAProxy container network namespace was created to avoid split default gateway problems. The namespace allows API segment ingress and egress traffic to have a different default gateway than the one configured on each controller host for non-API traffic. In the illustration, two of the three Cisco NFVI controllers have HAProxy containers as well as a dedicated Linux network namespace. (Cisco NFVI supports three HAProxy containers.)

In the figure, Control Node 1 is attached to the API network segment through the br_api bridge. The br_api bridge connects to the Linux network namespace where the HAProxy container has an interface mapped through the api < > api_out interface mapping shown in the previous figure. The HAProxy container has a default gateway configured that points to the upstream API Layer 3 First Hop Redundancy Protocol (FHRP) VIP. This gateway is used for HAProxy container incoming and outgoing API traffic.

Outside traffic coming in through the API interface is routed into the API network. The traffic traverses the br_api bridge, goes into the Linux network namespace and then the API VIP (based on IP address/port) that is listening on the HAProxy container. The HAProxy container establishes a connection with the backend

API endpoint (for example, the OpenStack Horizon dashboard) and the return traffic will pass back through the container and back out the API network following the default gateway for the container on the API network. All other non-API traffic such as the management access over SSH to the Cisco VIM controller will come into the management/provisioning network and access the node directly. Return traffic will use the host-level default gateway configured on the Linux (RHEL) operating system.

Figure 17: HAProxy Control Node Flow



If an HA event occurs in a Cisco NFVI pod, Cisco VIM automatically shuts down machines by failing over services. Examples include:

- For API servers, HAProxy automatically ensures that other redundant control services handle requests, avoiding the shutdown/terminated/non-responding one.
- For quorum services, such as Galera, the remaining members of the quorum continue to provide service and HAProxy ensures that new requests go to the remaining processes.
- For an active/standby process such as HAProxy, the system moves the endpoint IP to a standby copy and continues to operate.

All of these behaviors are automatic and do not require manual intervention. When the server is restarted, the services automatically come into service and are added to the load balancing pool, joining their quorums or are added as backup services, depending on the service type.

While manual intervention is generally not needed, some specific failure scenarios (for example, Mariadb, rabbit) can cause problems that require manual intervention. For example, if a complete network failure occurs, the Galera and RabbitMQ clusters can go into three-way partition. While Cisco NFVI cluster is resilient to single-point failures, two switches failing simultaneously—something highly unlikely in long-running systems—can sometimes happen due to administrative error, in which case, manual intervention is needed. To repair the pod, the management node must be up and running and all the nodes accessible through password-less SSH from the management node. From the installer-<tagid> dir, execute:

```
cd installer-<tagid>/
./ciscovimclient/ciscovim cluster-recovery
```

Control nodes will recover after the network partitions are resolved. After executing this command, control nodes services should come back to working state. To make sure Nova services are good across the compute nodes, execute the following command after sourcing /root/openstack-configs/openrc:

```
# nova service-list
```

To check for the overall cloud status, execute the following:

```
# cd installer-<tagid>/tools
# ./cloud_sanity.py -c all
```

Cisco NFVI Storage Node Overview

Block Storage

Cisco NFVI storage nodes utilize Ceph, an open source software for creating redundant, scalable data storage using clusters of standardized servers to store petabytes of accessible data. OpenStack Object Storage is a long-term storage system for large amounts of static data that can be retrieved, leveraged, and updated. It uses a distributed architecture with no central point of control, providing greater scalability, redundancy, and permanence. Objects are written to multiple hardware devices, with the OpenStack software responsible for ensuring data replication and integrity across the cluster. Storage clusters scale horizontally by adding new nodes. if a node fail, OpenStack replicates its content across other active storage nodes. Because Ceph uses software logic to ensure data replication and distribution across different devices, inexpensive commodity hard drives and servers can be used in lieu of more expensive equipment.

Cisco NFVI storage nodes include object storage devices (OSDs), hard disk drives (HDDs), and solid state drives (SSDs). OSDs organize data into containers called objects that a user or application determines are related. The objects reside in a flat address space where they all exist at the same level and cannot be placed inside one another. Each OSD has a unique object identifier (OID) that allows the Cisco NFVI control node to retrieve it without knowing the physical location of the data it contains.

HDDs store and retrieve digital information using one or more rigid rapidly rotating disks coated with magnetic material. The disks are paired with magnetic heads arranged on a moving actuator arm, which read and write data to the disk surfaces. Data is accessed in a random-access manner; individual data blocks can be stored or retrieved in any order and not only sequentially. HDDs are a type of non-volatile memory, retaining stored data even when powered off.

SSDs are solid-state storage devices that use integrated circuit assemblies as memory to store data persistently. SSDs primarily use electronic interfaces compatible with traditional block input/output (I/O) hard disk drives, which permit simple replacements in common applications.

Cisco NFVI storage nodes are managed by the control node applications including Ceph monitoring dashboard, Glance, and Cinder. The Ceph monitoring dashboard provides a view into the overall storage node health. Glance virtualizes pools of block storage devices and provides a self-storage API to request and consume those resources. Cinder is an OpenStack block storage service designed to present storage resources to the OpenStack compute node.

In 2.0 release of Cisco VIM, depending on the customer needs, the number of OSDs a pod can have is between 3 and 20.

Object Storage

Cisco VIM provides an integration with SwiftStack, an object storage solution. In this case, the SwiftStack is installed and managed outside the Cisco VIM ahead of time, and the VIM orchestrator adds the relevant Keystone configuration to access the SwiftStack endpoint. In addition to Keystone integration, the Cinder service is also configured to support backup of the volumes to SwiftStack object store. In the current integration, the SwiftStack endpoint has to be in a network routable to/from the CiscoVIM API network (as the VIM API is the same as the Keystone public endpoint network). In the current release, because of limitations in SwiftStack, Cisco VIM is integrated only with KeystoneV2.

Overview to Cisco Virtual Topology System

The Cisco Virtual Topology System (VTS) is a standards-based, open, overlay management and provisioning system for data center networks. It automates data center overlay fabric provisioning for both physical and virtual workloads.

Cisco VTS provides a network virtualization architecture and software-defined networking (SDN) framework that meets multitenant data center cloud service requirements. It enables a policy-based approach for overlay provisioning.

Cisco VTS automates network overlay provisioning and management tasks, integrates with OpenStack and simplifies the management of heterogeneous network environments. Cisco VTS provides an embedded Cisco VTS GUI and a set of northbound Representational State Transfer (REST) APIs that can be consumed by orchestration and cloud management systems.

Cisco VTS architecture has two main components: the Policy Plane and the Control Plane. These perform core functions such as SDN control, resource allocation, and core management function.

- Policy Plane—Enables Cisco VTS to implement a declarative policy model that captures user intent and converts it into specific device-level constructs. Cisco VTS includes a set of modular policy constructs that can be organized into user-defined services for use cases across service provider and cloud environments. The policy constructs are exposed through REST APIs that can be consumed by orchestrators and applications to express user intent, or instantiated through the Cisco VTS GUI. Policy models are exposed as system policies or service policies.
- Control Plane—Serves as the SDN control subsystem that programs the various data planes including the VTFs residing on the x86 servers, hardware leafs, DCI gateways. The control plane hosts the Cisco IOS XRv Software instance that provides route peering capabilities between the DCI gateways or to a BGP route reflector. (Cisco IOS XRv is the virtualized version of Cisco IOS XR Software.) The control plane enables an MP-BGP EVPN-based control plane for VXLAN overlays originating from leafs or software VXLAN tunnel endpoints (VTEPs)

The Cisco NFVI implementation of Cisco VTS includes the VTS Virtual Topology Forwarder (VTF). VTF provides a Layer 2/Layer 3 (L2/L3) software switch that can act as a software VXLAN terminal endpoint (VTEP). VTF is a lightweight, multitenant software data plane designed for high performance packet processing on x86 servers. VTF uses Vector Packet Processing (VPP). VPP is a full-featured networking stack with a software forwarding engine. VTF leverages VPP and the Intel Data Path Development Kit (DPDK) for high performance L2, L3, and VXLAN packet forwarding.

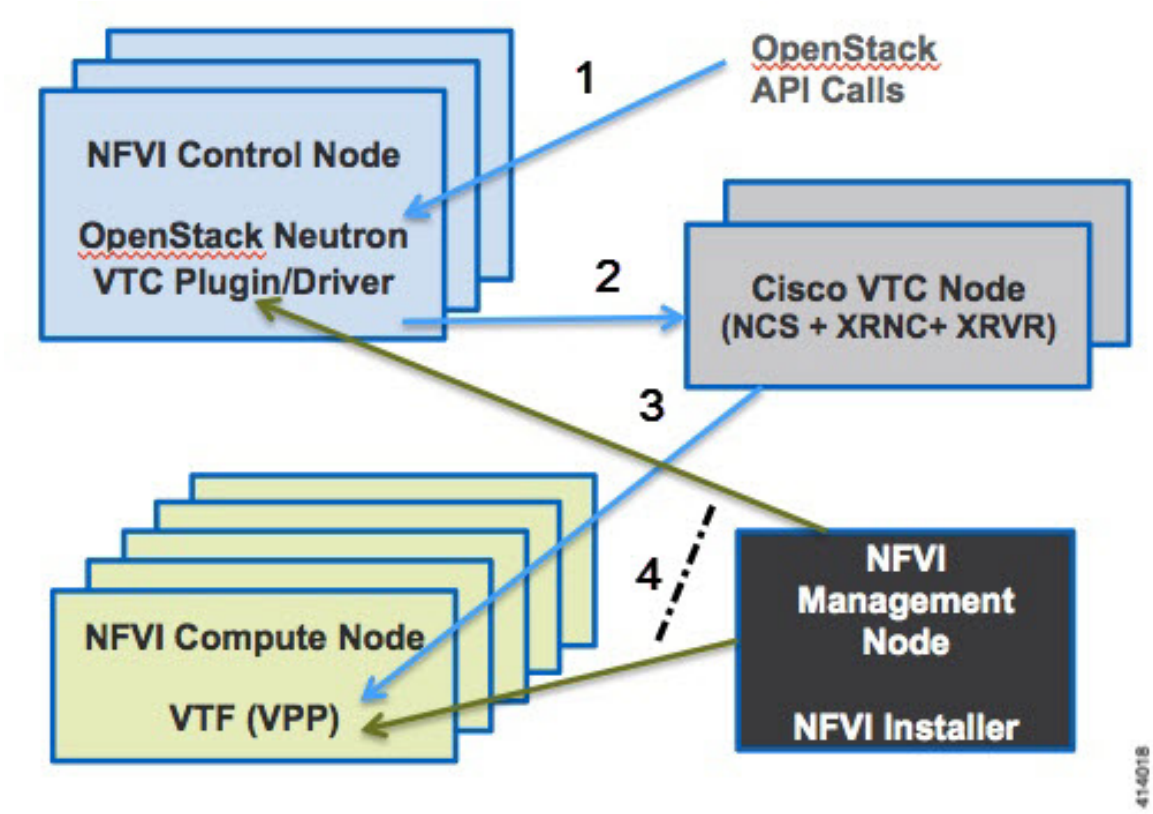
VTF allows Cisco VTS to terminate VXLAN tunnels on host servers by using the VTF as a software VXLAN Tunnel Endpoint (VTEP). Cisco VTS also supports hybrid overlays by stitching together physical and virtual endpoints into a single VXLAN segment.

The figure below shows the Cisco VTS architecture and high-level flow when installed in Cisco NFVI. Cisco VTS is installed on separate UCS servers, the Virtual Topology Controller plugin is installed on the control node, and the VTF is installed on the compute node.

1. The OpenStack user invokes the OpenStack Neutron API.
2. Neutron uses the VTS plugin and driver to make calls to the VTC REST API.
3. VTS control components interact with the VTF agent to carry out the corresponding dataplane setup.

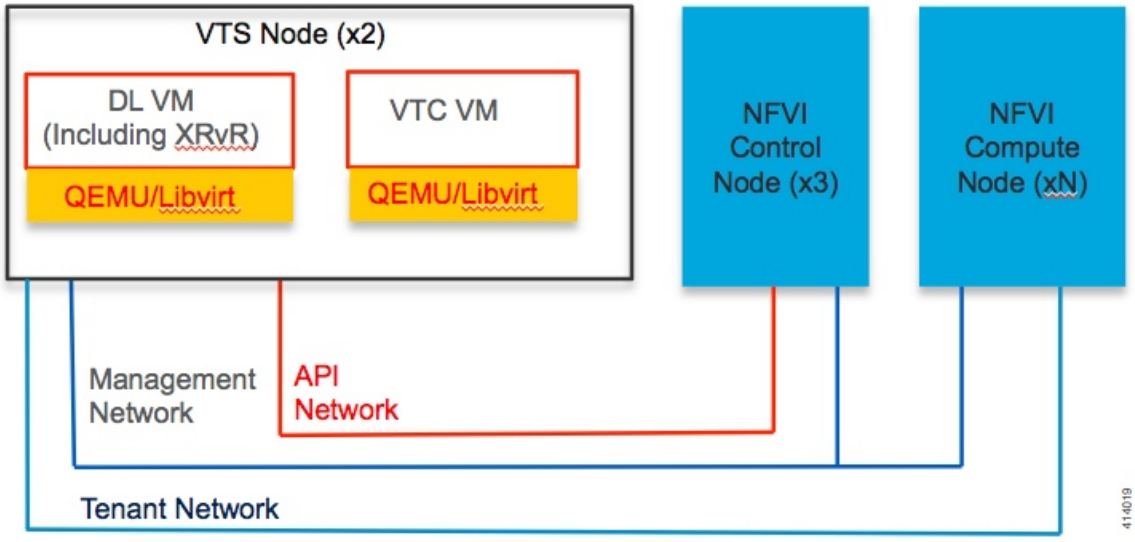
4. During Cisco NFVI installation, the Cisco NFVI Installer installs the OpenStack Neutron VTC plugin and driver on the Cisco NFVI controller node, and installs the VTF component (including VPP) on the Cisco NFVI compute node.

Figure 18: Cisco VTS in Cisco NFVI



The following illustration shows the Cisco NFVI networking after Cisco VTS is installed. The SDN controller nodes are an addition to the existing Cisco NFVI pod.

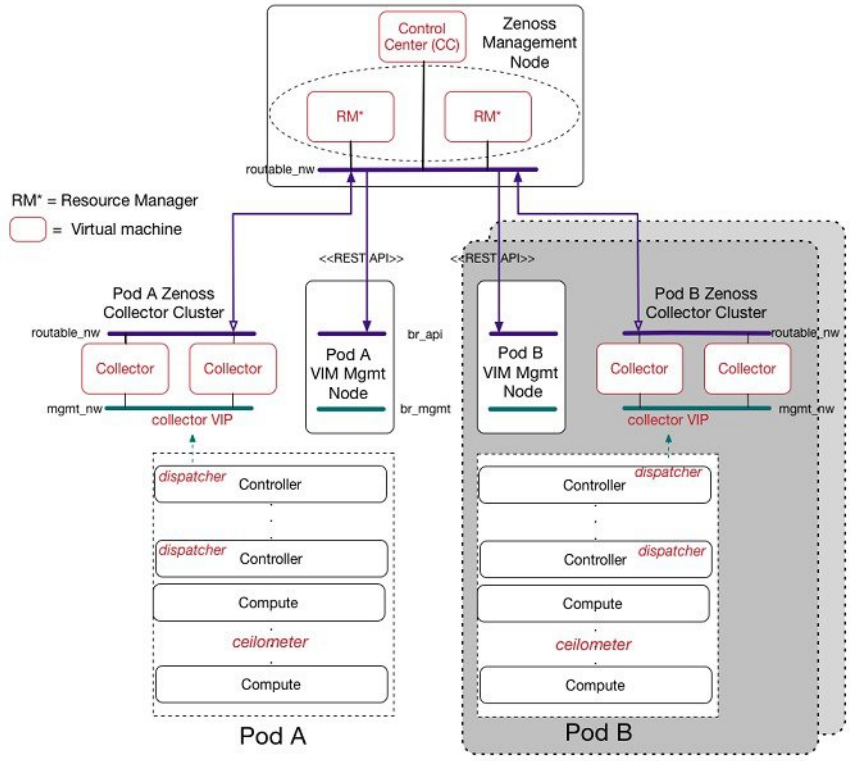
Figure 19: Cisco VTS Networking Inside Cisco NFVI



Overview to Cisco NFVIMON

Cisco VIM solution uses Cisco NFVI Monitor (NFVIMON) to monitor the health and performance of the NFVI. This includes monitoring both the physical and logical components of one or multiple NFVI pods. The NFVIMON feature is enabled by Zenoss which provides for extensive monitoring and collection of performance data for various components of the cloud infrastructure including Cisco UCS blade and rack servers, service profiles, Nexus top of rack switches, fabric interconnects, and also the OpenStack instances. The monitoring system is designed such that it can monitor single or multiple pods from a single management system. NFVIMON is integrated into Cisco VIM as an optional component. NFVIMON is enabled by extending the **setup_data.yaml** file with relevant information. To enable NFVIMON refer to Enabling NFVIMON on Cisco VIM, on page 108. Also, NFVIMON can be enabled on an existing pod, through the reconfigure option. To reconfigure through Insight UI, refer Reconfigure Optional Services, on page 157. Then, the pod is added as a new VIM resource to be monitored in the Monitoring UI.

Figure 20: NFVIMON Architecture



The NFVIMON architecture supports monitoring of one or more Cisco VIM pods. There is no limit on the number of pods, but note that the setup supports up to **2600 managed resources** across pods, where a managed resource is a physical device, network device or virtual machine tracked from a monitoring perspective.

NFVIMON consists of four components: dispatcher, collector, resource manager (RM) and control-center (CC) with Cisco Zenpacks. As NVIFMON is a third party software, make sure its integration into VIM is loosely coupled and the VIM automation only deals with installing the minimal software piece (dispatcher) needed to monitor the pod. The installing of the other NFVIMON components (collector, resource manager (RM) and control-center (CC) with Cisco NFVI Zenpacks) are Cisco Advance Services led activity and those steps are outside the scope of the current install guide. Make sure that you have engaged with Cisco Advance Services on the planning, image information (of collector(CC) with Cisco NFVI Zenpacks and RM), and installation of the NFVIMON accessories along with its network requirements. You can start with one Cisco VIM pod (pod A in the picture) and two external nodes (one to host 2 Collector VMs and one for remote management to host 1 control-center with Cisco Zenpacks and 2 RM VMs) of multiple pods.

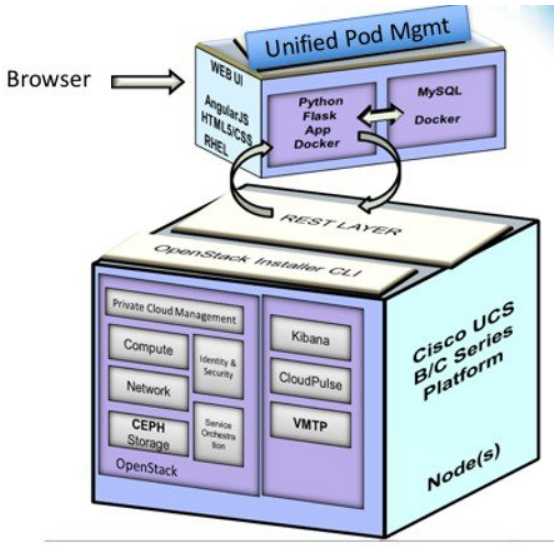
Cisco VIM pods can be monitored at the time of installing with NFVIMON enabled, or by adding NFVIMON as a post install feature. Install the collectors manually in the external collector node, and now the pod is added for monitoring in the control center. Also, it should be noted that NFVIMON is only supported on a pod running Keystone v2.

Overview to Cisco VIM Insight

CiscoVIM Insight, a light-weight UI, is introduced in Cisco VIM to ease the deployment and management of the NFVI platform. Also, Cisco VIM Insight offers a single pane of glass service to provide deployment visualization and to manage multiple Cisco VIM pods thereby reducing user-errors.

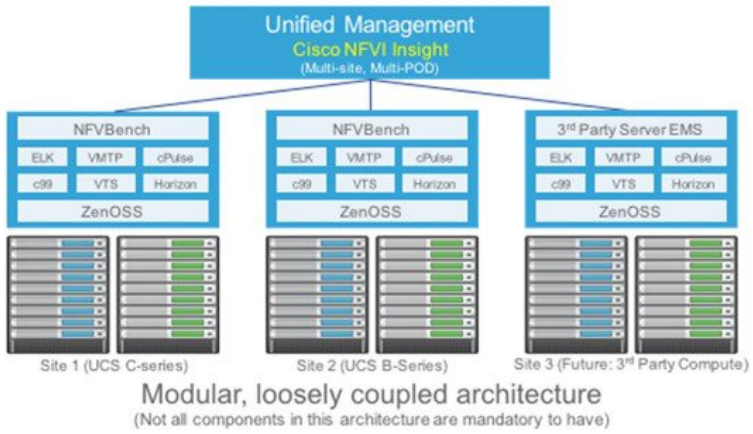
Cisco VIM Insight supports multi-tenancy with local RBAC support and is easily integrated with the CiscoVIM REST layer. The container based UI platform is loosely coupled, and can help manage multiple CiscoVIM pods right from day-0, or later in the lifecycle of the cloud.

Figure 21: Cisco VIM Insight Interaction with a Pod



The architecture of the CiscoVIM Insight is light-weight, hierarchical and scalable. While it introduces an ease of management from the global UI, each local site is autonomous with localized toolsets. The Global Unified Management UI, provides ease of management with multi-site multi-pod capability for distributed NFV deployment at scale. Also, CiscoVIM Insight is designed to operate in HA as an option. The platform is a modular, loosely coupled architecture, that will provide the capability to manage multiple pods, with RBAC support as shown in the figure .

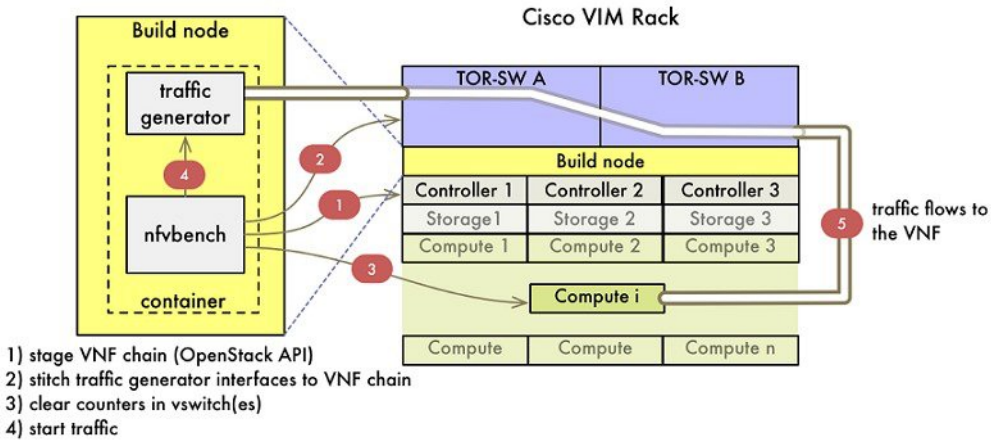
Figure 22: Cisco VIM Insight Architecture



Overview to NFVBench

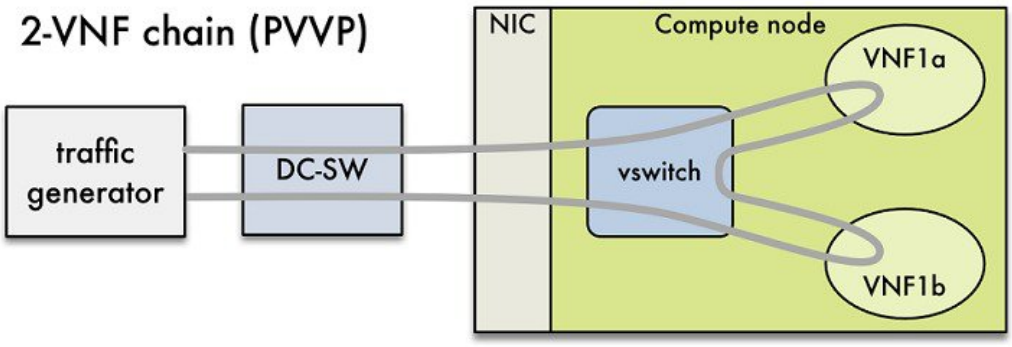
NFVBench is a containerized network benchmarking tool introduced in Cisco VIM, to bring consistent methodology to measure network performance of the cloud. NFVBench is offered in a container that is pre-installed on the management node.

Figure 23: Order of steps performed in nfvbench test



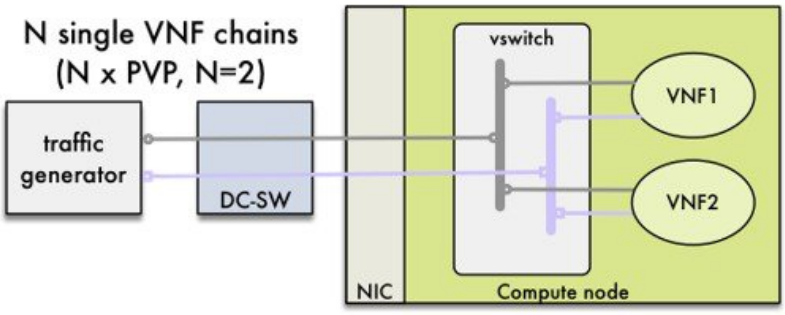
The main goal of NFVBench is to measure cloud performance based on real cloud deployments and not on synthetic, hypothetical lab test environment. Therefore, during the test, the packet path must traverse through every network element that participates in the production environment; that is traffic flows through switch (ToR) to v-switch on compute node, continues to VM representing any basic VNF in NFV deployment and comes back similar way on different ports. Network performance or throughput is computed based on sent and received traffic.

Figure 24: Packet path with two VNFs



Also it helps to verify network configuration and possible bottlenecks. Reports from NFVBench show data measurements from every element in path, which makes it easier to detect configuration errors or potential bottlenecks. NFVBench sends Layer2 or Layer3 packets generated by open-source traffic generator (TRex) already included in container. Advanced testing using NFVBench allows to conduct multi-chaining and multi-flow testing. The multi-chaining testing enables to run multiple parallel independent packet paths at the same time, while the multi-flow testing performs IP ranging in packet headers within every chain.

Figure 25: Multi-chaining example with two chains

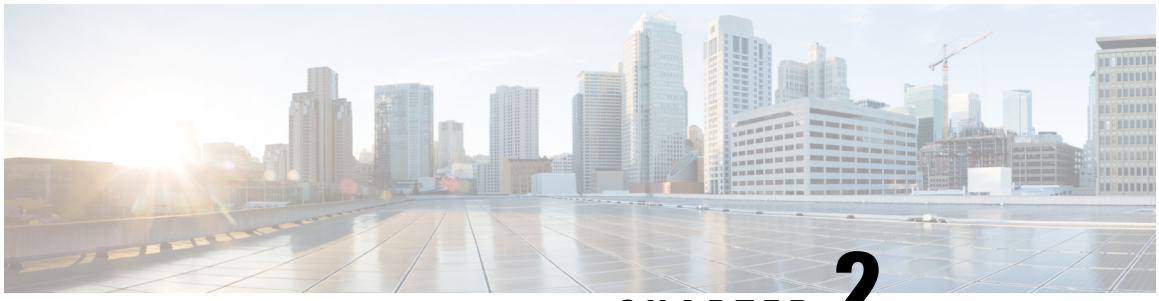


NDR/PDR and Fixed Rate Tests

NDR/PDR Test: NFVBench offers a more advanced test (called the NDR/PDR test), provides information about network throughput using any of the standard defined packet sizes - 64B, IMIX, 1518B. NDR (No Drop Rate) value represents throughput at which no packets are dropped (this is in reality satisfied by less than 0.001 % of packets being dropped). Similarly, PDR (Partial Drop Rate) represents throughput at which only small number of packets is dropped (usually less than 0.1 % of packets sent).

Fixed Rate Test: NFVBench offers a simple test to run traffic at fixed rate, which verifies that every network component of packet path works properly. It is also very useful for identifying bottlenecks in the test environment. Traffic generator generates packets at fixed rate for period of time specified by user. From the statistics collected, drop rates and latencies are computed and displayed.

Both the NDR/PDR Test and Fixed Rate Test types of test provide good way of verifying network performance of NFV solution.



CHAPTER 2

Cisco NFVI Installation Overview

The Cisco NFVI installation overview topic provides an installation map to guide you through the procedures needed to complete Cisco NFVI installation.

Overview to Cisco NFVI Installation

Cisco NFVI installation is divided into two processes:

- Preparation—Preparing the Cisco NFVI pod hardware and configuring all supporting applications including the Cisco Integrated Management Controller (IMC) and the Cisco UCS Manager.
- Installation—Installing the Cisco NFVI component applications includes: Cisco Virtual Infrastructure Manager (VIM), Cisco Insight (Unified Management) and Cisco Virtual Topology System (VTS) including Virtual Topology Forwarder (VTF). The applications you install depend on your Cisco NFVI package.

The sequence in which you perform Cisco NFVI installations depends on the component applications you install. For example, if you are installing Cisco VTS, you will install VTC, before you install Cisco VIM or Cisco Insight. If you are installing Cisco VIM Insight, you will begin the Cisco VIM Management Node installation, then install Insight and complete the Cisco VIM installation through Cisco VIM Insight. If you have Cisco VIM without other Cisco NFVI applications, you only need to complete the Cisco VIM installation procedure.

In addition to the sequence of Cisco NFVI component installations, two other considerations are important:

- **Internet Access**—Internet access is required to download the Cisco NFVI installation files from the Cisco NFVI download site (cvim-registry.com). If your management node has Internet access, you can download the files directly to it. If you do not have Internet access, you need an alternate server with internet access so that you can download the installation files to a USB stick. You will then use the USB stick to copy the installation files to the management node.
- **Cisco NFVI Configurations**—Before you begin the Cisco NFVI installation, take time to familiarize yourself with the parameters you will provision either during or immediately following Cisco NFVI installation. Configurations are provided in the setup_data.yaml file. If you are installing Cisco VIM and not Cisco VIM Insight, you enter the configurations directly into the setup_data.yaml file with a yaml editor. Examples of setup_data file (for C and B-series) are available at the openstack-configs directory in the target install directory in the management node. To see the Cisco NFVI data and OpenStack parameters you must run Setting Up the Cisco VIM Data Configurations, on page 89and Setting Up the Cisco VIM OpenStack Configurations, on page 98 . If you are installing Cisco VIM Insight, you can

run Cisco NFVI using Insight UI wizard. For information, see Installing Cisco VIM Insight (Tech Preview) , on page 113

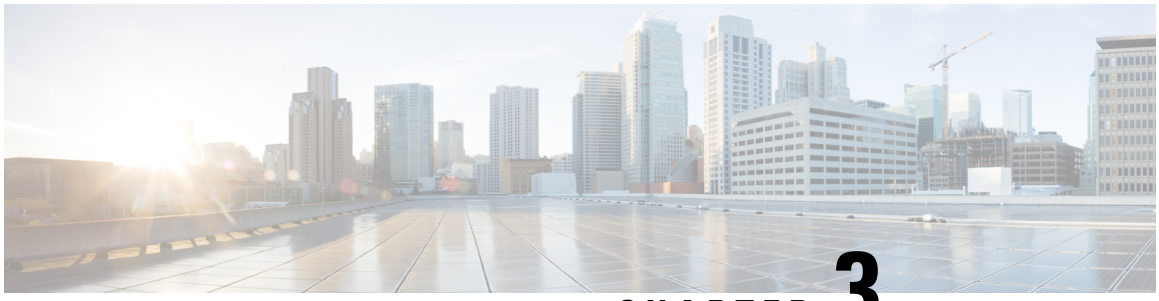
Installation procedures in this guide are designed for one of several Cisco NFVI license options:

- Cisco NFVI Basic—Includes Cisco Virtual Infrastructure Manager (VIM). Cisco VIM is an OpenStack Newton release software solution with additional features and usability enhancements tested for functionality, scale, and performance.
- Cisco NFVI Standard—Includes Cisco VIM and Cisco VIM Insight. Cisco VIM Insight deploys, provisions, and manages Cisco NFVI on Cisco UCS servers.
- Cisco NFVI with third party monitoring - Includes Cisco VIM with or without Cisco VIM Insight based on the preceding choice with monitoring of the pod through Zenoss.
- Optional Cisco NFVI Applications—Cisco Virtual Topology System(VTS) is an optional application that can be installed with Cisco VIM by itself and with Cisco VIM Insight. Cisco VTS is a standards-based, open software-overlay management and provisioning system. It automates data center network fabric provisioning for virtual and physical infrastructure.

The following table lists the procedures you will complete for each option. If you have purchased Cisco VIM, you need to perform additional manual installation procedures. If you purchased Cisco VIM and Insight, you can perform many of the Cisco VIM manual setup and configuration procedures though the Unified management system also called VIM Insight. It should be noted that a cloud installed through Cisco VIM 2.0 from CLI, can be managed through Cisco VIM Insight later in the life-cycle. However, once the VIM Insight starts managing a cloud, we recommend you to continue using it to manage the cloud subsequently. Review the table to make sure you fully understand the installation sequence before you begin.

#	Chapter Title	Audience	Notes
1	Overview to Cisco NFVI, on page 1	Pod Administrator	Understanding the Cisco NFVI architecture and networking helps ensure a successful installation.
2	Cisco NFVI Installation Overview, on page 33	Pod Administrator	Provides a map through the Installation Guide chapters.
3	Preparing for Cisco NFVI Installation, on page 41	Pod Administrator	You must complete procedures in this chapter before starting Cisco NFVI installation.
4	Preparing for Installation on Servers Without Internet Access, on page 37	End users	Complete this chapter only if your management node does not have Internet access.
5	Installing Cisco VTS, on page 57	End users	Complete only if your implementation includes Cisco Virtual Topology System. If yes, you install Cisco VTS before you install other Cisco NFVI applications.
6	Installing Cisco VIM, on page 83	Pod Administrator	All users complete a portion of the Installing Cisco VIM procedure. Users with Cisco VIM Insight will proceed to the Cisco VIM Insight installation, while users with only Cisco VIM will complete the full procedure.
7	Installing Cisco VIM Insight (Tech Preview) , on page 113	End users	Complete only if your implementation includes Cisco VIM Insight.

#	Chapter Title	Audience	Notes
8	Installing Cisco VIM through Cisco VIM Insight (Tech Preview) , on page 125	End users	Complete only if you have Cisco VIM Insight. In this procedure you will install and configure Cisco VIM.
9	Verifying the Cisco NFVI Installation, on page 159	Pod Administrator	Provides methods that you can use to verify the Cisco NFVI installation.



CHAPTER 3

Preparing for Installation on Servers Without Internet Access

Complete the following procedure if your monitoring node does not have access to the Internet. In this case, you must download the Cisco NFVI installation files to a 64 GB (minimum) USB 2.0 stick on a staging server that has Internet access, then use the USB stick to copy the files to the management node. If your management node has Internet access, you can skip this chapter.

• Preparing to Install Cisco NFVI on Management Nodes Without Internet Access, on page 37

Preparing to Install Cisco NFVI on Management Nodes Without Internet Access

The following procedure tells you how to download the Cisco NFVI installation files onto a USB stick mounted on a staging server with Internet access. You will then use the USB to load the Cisco NFVI installation files onto the management node that does not have Internet access.

Note We recommend you to use Virtual Network Computing (VNC), other terminal multiplexer, or similar screen sessions to complete these steps.

Before you begin

This procedure requires a CentOS 7 staging server (VM, laptop, or UCS server) with a 64 GB USB 2.0 stick. The staging server must have Internet access (wired access is recommended) to download the Cisco VIM installation files, which you will load onto the USB stick. You will then use the USB stick to load the installation files onto the management node. The installation files are over 25 GB in size; downloading them to the USB stick might take several hours depending on the speed of your Internet connection, so plan accordingly. Before you begin, disable the CentOS sleep mode.

Step 1 On the staging server, use yum to install the following packages:

- PyYAML (yum install PyYAML)
- python-requests (yum install python-requests)

Step 2 Connect to the Cisco VIM software download site using a web browser and login credentials provided by the account representative and download the **getartifacts.py** script from external registry:

```
# download the new getartifacts.py file (see example below)
curl -o getartifacts.py
https://username:password@cvim-registry.com/mercury-releases/mercury-rhel7-osp10/releases/<2.0.n>/getartifacts.py


curl -o getartifacts.py-checksum.txt
https://username:passwordcvim-registry.com/mercury-releases/mercury-rhel7-osp10/releases/<2.0.n>//getartifacts.py-checksum.txt

# calculate the checksum and verify that with one in getartifacts.py-checksum.txt
sha512sum getartifacts.py

# Change the permission of getartificats.py
chmod +x getartifacts.py
```

Step 3 Run **getartifacts.py**. The script formats the USB 2.0 stick and downloads the installation files. You must provide the registry username and password, tag ID, and USB partition on the staging server.

```
# cd <installer-xxx>/tools/
# ./getartifacts.py -h
usage: getartifacts.py [-h] -t TAG -u USERNAME -p PASSWORD -d DRIVE
                       [--proxy PROXY] [--retry]
                       [--artifacts [ARTIFACTS [ARTIFACTS ...]]]

Script to pull container images en masse.

optional arguments:
  -h, --help            show this help message and exit
  -t TAG, --tag TAG     installer version to pull
  -u USERNAME, --username USERNAME
                        Registry username
  -p PASSWORD, --password PASSWORD
                        Registry password
  -d DRIVE, --drive DRIVE
                        Provide usb drive path
  --proxy PROXY         https_proxy if needed
  --retry               Try to complete a previous fetch
  --artifacts [ARTIFACTS [ARTIFACTS ...]]
                        Artifact List values(space separated): core insight
                        all

This script pulls images from remote registry and copies the contents to usb drive
```

To identify the USB drive, execute the **lsblk** command before and after inserting the USB stick. The command displays a list of available block devices. The output data will help you to find the USB drive location. Provide the entire drive path in the –d option instead of any partition.

For example:

sudo ./getartifacts.py **-t <tag_id> -u <username> -p <password> -d </dev/sdc> [--artifacts …] [--proxy proxy.example.com]** –

For example: To download only the insight artifacts, execute the following command:

sudo ./getartifacts.py **-t <tag_id> -u <username> -p <password> -d </dev/sdy/>-- artifacts insight**

Note We recommend you not to remove the USB stick, while the synchronization is under way.

Note Sometimes executing getartifacts.py errors out with the following message: *stderr: mount: wrong fs type, bad option, bad superblock on /dev/sdy1, missing codepage or helper program, or other error.* This typically points to a bad superblock and the mount fails. Reformatting the drive might help in this case, use the fsck command to recover the drive: **fsck.ext4 -pv /dev/sdc .**

Note Given the size of the artificats (>25G) we recommend you to execute this step over a wired internet connection. This step typically takes few hours to download and populate data on USB stick, depending on the internet connectivity.

The getartifacts.py script downloads the following:

- Core Packages
  - buildnode-K9.iso
  - mercury-installer.tar.gz
  - registry-2.3.1.tar.gz
- Optional: Unified Management Package called Insight
  - insight-K9.tar.gz
  - mariadb-app-K9.tar.gz
  - haproxy-K9.tar.gz
- Respective checksums

Step 4 Verify the integrity of the downloaded artifacts and the container images by running the following command:

```
# create a directory
sudo mkdir -p /mnt/Cisco

# /dev/sdc is the USB drive, same as supplied in getartifacts.py python script
sudo mount /dev/sdc1 /mnt/Cisco
cd /mnt/Cisco

# execute the test-usb help to look at the options
./test-usb -h

usage: ./test-usb [-h] -- Show this program to check integrity of artifacts in this USB stick
                  [-c] -- Check integrity of only core artifacts in this USB stick
                  [-i] -- Check integrity of only insight artifacts in this USB stick
                  [-a] -- Check integrity of all (core and insight) artifacts in this USB stick
                  [-l] -- Location of artifacts

# execute the verification script
./test-usb

# failures will be explicitly displayed on screen, sample success output below
# sample output of ./test-usb execution with 2.0.x release
#./test-usb
INFO: Checking the integrity of this USB stick
INFO: Checking artifact buildnode-K9.iso
INFO: Checking artifact registry-2.3.1.tar.gz
INFO: Checking required layers:
INFO: 548 layer files passed checksum.

Following output shows the result when using -a option
# ./test-usb -a
INFO: Checking the integrity of this USB stick
INFO: Checking artifact buildnode-K9.iso
INFO: Checking artifact registry-2.3.1.tar.gz
```

```
INFO: Checking artifact mariadb-app-K9.tar.gz
INFO: Checking artifact haproxy-K9.tar.gz
INFO: Checking artifact insight-K9.tar.gz
INFO: Checking required layers:
INFO: 548 layer files passed checksum.
```

If a failure occurs, an error message is displayed.

For example:

```
# ./test-usb
INFO: Checking the integrity of this USB stick
INFO: Checking artifact buildnode-K9.iso
ERROR: Checksum for artifact buildnode-K9.iso does not match ('SHA512 (buildnode-K9.iso) =
96ec62a0932a0d69daf60acc6b8af2dc4e5eca132cd3781fc17a494592feb52a7f171eda25e59c0d326fbb09194eeda66036cbdc3870dafe74f59cf1f2dce225'
 != 'SHA512 (buildnode-K9.iso) =
a6a9e79fa08254e720a80868555679baeea2dd8f26a0360ad47540eda831617bea0514a117b12ee5f36415b7540afa112a1c904cd69e40d704a8f25d78867acf')
INFO: Checking artifact registry-2.3.1.tar.gz
ERROR: Artifact registry-2.3.1.tar.gz is not present
INFO: Checking required layers:
ERROR: Layer file sha256:002aa1f0fbdaea7ea25da1d906e732fe9a9b7458d45f8ef7216d1b4314e05207 has a bad
 checksum
ERROR: Layer file sha256:5be3293a81773938cdb18f7174bf595fe7323fdc018c715914ad41434d995799 has a bad
 checksum
ERROR: Layer file sha256:8009d9e798d9acea2d5a3005be39bcbfe77b9a928e8d6c84374768ed19c97059 has a bad
 checksum
ERROR: Layer file sha256:ea55b2fc29b95d835d16d7eeac42fa82f17e985161ca94a0f61846defff1a9c8 has a bad
 checksum
INFO: 544 layer files passed checksum.
```

Step 5 To resolve download artifact failures, unmount the USB and run the getartifacts command again with the --retry option.

```
sudo ./getartifacts.py -t <tag_id> -u <username> -p <password> -d </dev/sdc> --retry
```

Step 6 Mount the USB and then run the test-usb command to validate if all the files are downloaded:

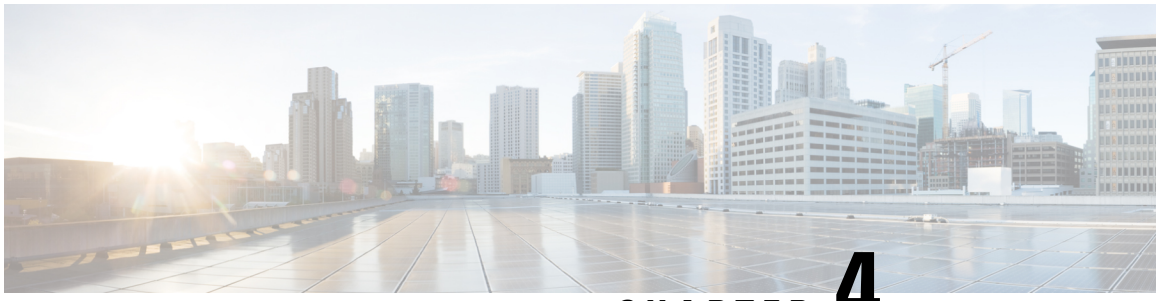
```
# /dev/sdc is the USB drive, same as supplied in get artifacts.py python script
sudo mount /dev/sda1 /mnt/Cisco
cd /mnt/Cisco

# execute the verification script
./test-usb

# In case of failures the out of the above command will explicitly display the same on the screen
```

Step 7 After the USB integrity test finishes, unmount the USB stick by running the following command:

```
sudo umount /mnt/Cisco
```



CHAPTER 4

Preparing for Cisco NFVI Installation

Before you can install and configure Cisco NFVI, you must complete the following hardware and application preparation procedures provided in the following topics.

Installing the Cisco NFVI Hardware

The Cisco UCS C-Series or B-Series hardware must be powered up, before you can install the Cisco Virtualization Infrastructure Manager (VIM). Depending upon the pod type, the CIMC connection or UCSM IP has to be configured ahead of time.The following table lists the UCS hardware options and network connectivity protocol that can be used with each, either virtual extensible LAN (VXLAN) over a Linux bridge, VLAN over OVS or VLAN over VPP. If Cisco Virtual Topology Services, an optional Cisco NFVI application, is installed, Virtual Topology Forwarder (VTF) can be used with VXLAN for tenants, and VLANs for providers on C-Series pods.

Table 5: Cisco NFVI Hardware and Network Connectivity Protocol

UCS Pod Type	Compute and Controller Node	Storage Node	Network Connectivity Protocol
C-Series	UCS C220/240 M4.	UCS C240 M4 (SFF) with two internal SSDs.	VXLAN/Linux Bridge or OVS/VLAN or VPP/VLAN.
C-Series with Cisco VTS	UCS C220/240 M4.	UCS C240 M4 (SFF) with two internal SSDs.	For tenants: VTF with VXLAN. For providers: VLAN

UCS Pod Type	Compute and Controller Node	Storage Node	Network Connectivity Protocol
C-Series Micro Pod	UCS 240 M4 with 12 HDD and 2 external SSDs.	Not Applicable as its integrated with Compute and Controller.	OVS/VLAN
B-Series	UCS B200 M4.	UCS C240 M4 (SFF) with two internal SSDs.	VXLAN/Linux Bridge or OVS/VLAN.
B-Series with UCS Manager Plugin	UCS B200 M4s	UCS C240 M4 (SFF) with two internal SSDs.	OVS/VLAN

Note The storage nodes boot off two internal SSDs. It also has four external solid state drives (SSDs) for journaling, which gives a 1:5 SSD-to-disk ratio (assuming a chassis filled with 20 spinning disks). Each C-Series pod has either a 2 port 10 GE Cisco vNIC 1227 card or 2 of 4 port Intel 710 X card. UCS M4 blades only support Cisco 1340 and 1380 NICs. For more information about Cisco vNICs, see LAN and SAN Connectivity for a Cisco UCS Blade. Cisco VIM has a micro pod which works on Cisco VIC 1227 with OVS/VLAN as the virtual network protocol. The micro pod supports customers with a small, functional, but redundant cloud. The first manifestation of the micro-pod will work on Cisco VIC (1227) with OVS/VLAN as the virtual network protocol.

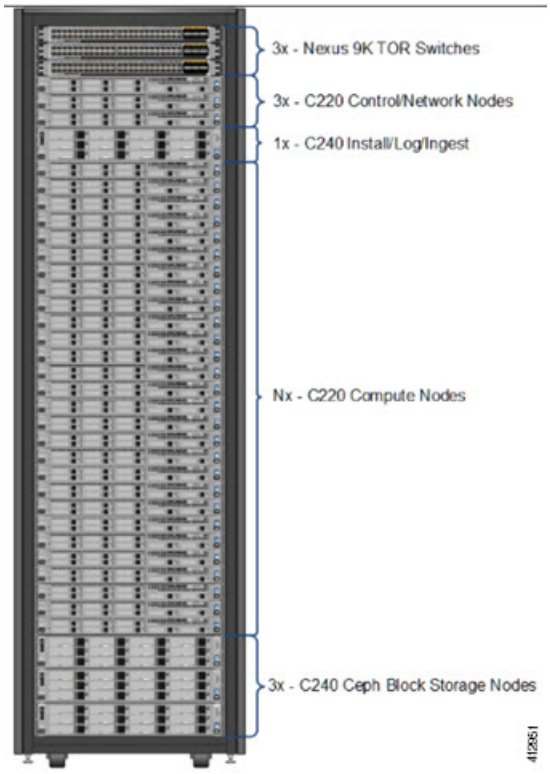
In addition, the Cisco Nexus 9372 or 93180YC, or 9396PX must be available to serve the Cisco NFVI ToR function .

After verifying that you have the required Cisco UCS servers and blades and the Nexus 93xx, install the hardware following procedures at the following links:

- Cisco UCS C220 M4 Server Installation and Service Guide
- Cisco UCS C240 M4 Server Installation and Service Guide
- Cisco UCS B200 Blade Server and Installation Note
- Cisco Nexus 93180YC,9396PX, 9372PS and 9372PX-E NX-OS Mode Switches Hardware Installation Guide

The figure below shows a C-Series Cisco NFVI pod. Although the figure shows a full complement of UCS C220 compute nodes, the number of compute nodes can vary, depending on your implementation requirements. The UCS C220 control and compute nodes can be replaced with UCS 240 series. However in that case the number of computes fitting in one chassis system will be reduced by half.

Figure 26: Cisco NFVI C-Series Pod



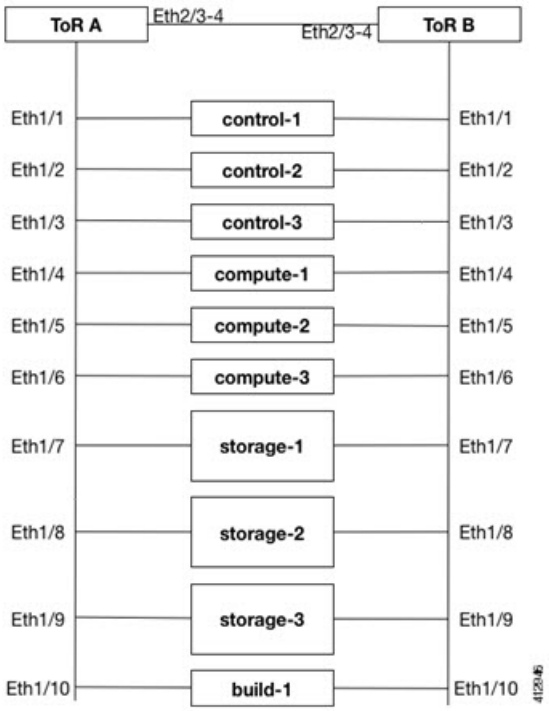
Note The combination of UCS-220 and 240 within the compute and control nodes is not supported.

Configuring ToR Switches for C-Series Pods

During installation, the Cisco VIM installer creates vNIC's on each of the two physical interfaces and creates a bond for the UCS C-Series pod. Before this occurs, you must manually configure the ToR switches to create a vPC with the two interfaces connected to each server. Use identical Cisco Nexus 9372 , or 93180YC, or 9396PX switches for the ToRs. The recommended N9K TOR software versions for setup with mechanism driver as OVS/VLAN, ML2/VPP or LB/VXLAN: 7.0(3)I4(6) 7.0(3)I6(1) and the recommended N9K software version for setup with mechanism driver as VTS: 7.0(3)I2(2a) 7.0(3)I2(2c)

Complete the following steps to create a vPC on a pair of Cisco Nexus ToR switches. The steps will use the following topology as an example. Modify the configuration as it applies to your environment. In Cisco VIM, we have introduced a feature called auto-configuration of ToR (for N9K series only). This is an optional feature, and if you decide to take this route, the following steps can be skipped.

Figure 27: ToR Configuration Sample



Step 1 Change the vPC domain ID for your configuration. The vPC domain ID can be any number as long as it is unique. The IP address on the other switch mgmt0 port is used for the keepalive IP. Change it to the IP used for your network.

For the preceding example, the configuration would be:

```
ToR-A (mgmt0 is 172.18.116.185)
feature vpc
vpc domain 116
peer-keepalive destination 172.18.116.186
ToR-B (mgmt0 is 172.18.116.186)
feature vpc
vpc domain 116
peer-keepalive destination 172.18.116.185
```

Because both switches are cabled identically, the remaining configuration is identical on both switches. In this example, topology Eth2/3 and Eth2/4 are connected to each other and combined into a port channel that functions as the vPC peer link.

```
feature lacp
interface Ethernet2/3-4
channel-group 116 mode active
interface port-channel116
switchport mode trunk
vpc peer-link
```

Step 2 For each VLAN type, (mgmt_vlan, tenant_vlan_range, storage, api, external, provider), execute the following on each ToR:

```
vlan <vlan_type>
    no shut
```

Step 3 Configure all the interfaces connected to the servers to be members of the port channels. In the example, only ten interfaces are shown. But you must configure all interfaces connected to the server.

Note *If interfaces have configurations from previous deployments, you can remove them by entering* ***default interface Eth1/1-10****, then* ***no interface Po1-10****.*

1. **For deployment with any mechanism driver on Cisco VIC**

   There will be no configuration differences among different roles (controllers/computes/storages). The same configuration will apply to all interfaces.

```
interface Ethernet 1/1
channel-group 1 mode active
interface Ethernet 1/2
channel-group 2 mode active
interface Ethernet 1/3
channel-group 3 mode active
interface Ethernet 1/4
channel-group 4 mode active
interface Ethernet 1/5
channel-group 5 mode active
interface Ethernet 1/6
channel-group 6 mode active
interface Ethernet 1/7
channel-group 7 mode active
interface Ethernet 1/8
channel-group 8 mode active
interface Ethernet 1/9
channel-group 9 mode active
interface Ethernet 1/10
channel-group 10 mode active
```

2. **For deployment with OVS/VLAN or LinuxBridge on Intel VIC**

   The interface configuration will be the same as Cisco VIC case as shown in the preceding section. However, number of switch interfaces configured will be more in the case of Intel NIC as we have dedicated control, and data physical ports participating in the case of Intel NIC. Also for SRIOV switchport, no port channel is configured, and the participating VLAN will be in trunk mode.

3. **For deployment with ML2/VPP or VTS on Intel VIC (tech preview feature)**

   In this case ML2/VPP or VTS is used as the mechanism driver. The interface configuration varies based on the server roles. Assume Ethernet1/1 to Ethernet1/3 are controller interfaces, Ethernet1/4 to Ethernet1/6 are storage interfaces, and Ethernet1/7 to Ethernet1/10 are compute interfaces. The sample configurations will look like:

```
 interface Ethernet 1/1
channel-group 1 mode active
interface Ethernet 1/2
channel-group 2 mode active
interface Ethernet 1/3
channel-group 3 mode active
interface Ethernet 1/4
channel-group 4 mode active
interface Ethernet 1/5
channel-group 5 mode active
interface Ethernet 1/6
channel-group 6 mode active
interface Ethernet 1/7
channel-group 7
```

```
interface Ethernet 1/8
channel-group 8
interface Ethernet 1/9
channel-group 9
interface Ethernet 1/10
channel-group 10
```

Step 4 Configure the port channel interface to be vPC, and trunk all VLANs. Skip the listen/learn in spanning tree transitions, and do not suspend the ports if they do not receive LACP packets. Also, configure it with large MTU of 9216 (this is important or else Ceph install will hang).The last configuration allows you to start the servers before the bonding is set up.

```
interface port-channel1-9
shutdown
spanning-tree port type edge trunk
switchport mode trunk
switchport trunk allowed vlan <mgmt_vlan, tenant_vlan_range, storage, api, external, provider>
no lacp suspend-individual
mtu 9216
vpc <1-9>
no shutdown
```

Step 5 Identify the port channel interface that connects to the management node on the ToR:

```
interface port-channel10
shutdown
spanning-tree port type edge trunk
switchport mode trunk
switchport trunk allowed vlan <mgmt_vlan>
no lacp suspend-individual
vpc 10
no shutdown
```

Step 6 Check the port channel summary status. The ports connected to the neighbor switch should be in (P) state. Before the server installation, the server facing interfaces should be in (I) state. After installation, they should be in (P) state, which means they are up and in port channel mode.

```
gen-leaf-1# show port-channel summary
Flags: D - Down P - Up in port-channel (members)
I - Individual H - Hot-standby (LACP only)
s - Suspended r - Module-removed
S - Switched R - Routed
U - Up (port-channel)
M - Not in use. Min-links not met
--------------------------------------------------------------------------------
Group Port- Type Protocol Member Ports
Channel
--------------------------------------------------------------------------------
1 Po1(SD) Eth LACP Eth1/1(I)
2 Po2(SD) Eth LACP Eth1/2(I)
3 Po3(SD) Eth LACP Eth1/3(I)
4 Po4(SD) Eth LACP Eth1/4(I)
5 Po5(SD) Eth LACP Eth1/5(I)
6 Po6(SD) Eth LACP Eth1/6(I)
7 Po7(SD) Eth LACP Eth1/7(I)
8 Po8(SD) Eth LACP Eth1/8(I)
9 Po9(SD) Eth LACP Eth1/9(I)
10 Po10(SD) Eth LACP Eth1/10(I)
116 Po116(SU) Eth LACP Eth2/3(P) Eth2/4(P)
```

Step 7 Enable automatic Cisco NX-OS errdisable state recovery:

```
errdisable recovery cause link-flap
errdisable recovery interval 30
```

Cisco NX-OS places links that flap repeatedly into errdisable state to prevent spanning tree convergence problems caused by non-functioning hardware. During Cisco VIM installation, the server occasionally triggers the link flap threshold, so enabling automatic recovery from this error is recommended.

```
errdisable recovery cause link-flap
errdisable recovery interval 30
```

Step 8 If you are installing Cisco Virtual Topology Systems, an optional Cisco NFVI application, enable jumbo packets and configure 9216 MTU on the port channel or Ethernet interfaces. For example:

Port channel:

```
interface port-channel10
   switchport mode trunk
  switchport trunk allowed vlan 80,323,680,860,2680,3122-3250
  mtu 9216
  vpc 10
```

Ethernet:

```
interface Ethernet1/25
    switchport mode trunk
    switchport trunk allowed vlan 80,323,680,860,2680,3122-3250
    mtu 9216
```

Configuring ToR Switches for UCS B-Series Pods

Complete the following steps to create a vPC on a pair of Cisco Nexus ToR switches for a UCS B-Series pod. The steps are similar to configuring ToR switches for C-Series pods, with some differences. In the steps, the two ToR switches are Storm-tor-1 (mgmt0 is 172.18.116.185), and Storm-tor-2 (mgmt0 is 172.18.116.186). Modify the configuration as it applies to your environment. If no multicast or QOS configuration is required, and Auto-configuration of TOR is chosen as an option, the steps listed below can be skipped.

Before you begin

Step 1 Change the vPC domain ID for your configuration. The vPC domain ID can be any number as long as it is unique. The IP address on the other switch mgmt0 port is used for the keepalive IP. Please change it to the IP used for your network. Storm-tor-1 (mgmt0 is 172.18.116.185)

a)

```
feature vpc
vpc domain 116
     peer-keepalive destination 172.18.116.186
for each vlan_type (mgmt_vlan, tenant_vlan_range, storage, api, external, provider); # execute the
following for each vlan
     vlan <vlan_type>
     no shut
vrf context management
     ip route 0.0.0.0/0 172.18.116.1
```

```
interface mgmt0
     vrf member management
     ip address 172.18.116.185/24
```

Storm-tor-2 (mgmt0 is 172.18.116.186)

```
feature vpc
vpc domain 116
     peer-keepalive destination 172.18.116.185
for each vlan_type (mgmt_vlan, tenant_vlan_range, storage, api, external, provider); # execute the
following for each vlan
     vlan <vlan_type>
     no shut
vrf context management
     ip route 0.0.0.0/0 172.18.116.1

interface mgmt0
     vrf member management
     ip address 172.18.116.186/24
```

Step 2 Since both switches are cabled identically, the rest of the configuration is identical on both switches. Configure all the interfaces connected to the fabric interconnects to be in the VPC as well.

```
feature lacp
interface port-channel1
     description “to fabric interconnect 1”
     switchport mode trunk
     vpc 1
interface port-channel2
     description “to fabric interconnect 2”
     switchport mode trunk
     vpc 2
interface Ethernet1/43
     description "to fabric interconnect 1"
     switchport mode trunk
     channel-group 1 mode active
interface Ethernet1/44
     description "to fabric interconnect 2"
     switchport mode trunk
     channel-group 2 mode active
```

Step 3 Create the port-channel interface on the ToR that is connecting to the management node:

```
interface port-channel3
     description “to management node”
     spanning-tree port type edge trunk
     switchport mode trunk
     switchport trunk allowed vlan <mgmt_vlan>
     no lacp suspend-individual
     vpc 3
interface Ethernet1/2
     description "to management node"
     switchport mode trunk
     channel-group 3 mode active
```

Step 4 Enable jumbo frames for each ToR port-channel that connects to the Fabric Interconnects:

```
interface port-channel<number>
     mtu 9216
```

Note You must also enable jumbo frames in the setup_data.yaml file. See the UCS Manager Common Access Information for B-Series Pods topic in Setting Up the Cisco VIM Data Configurations, on page 89

Preparing Cisco IMC and Cisco UCS Manager

Cisco NFVI requires specific Cisco Integrated Management Controller (IMC) and Cisco UCS Manager firmware versions and parameters. The Cisco VIM bare metal installation uses the Cisco IMC credentials to access the server Cisco IMC interface, which you will use to delete and create vNICS and to create bonds. Complete the following steps to verify Cisco IMC and UCS Manager are ready for Cisco NFVI installation:

Step 1 Verify that each Cisco UCS server has one of the following Cisco IMC firmware versions: 2.0(3i), 2.0(6d), 2.0(6f), 2.0(8d), 2.0(8g), 2.0(9c), 2.0(9e), 2.0(10d), 2.0(10e). 2.0(13i) is recommended. For pods running on Intel NIC, CIMC 2.0(13i) or above is recommended. Cisco IMC version cannot be 3.0 series. Though other versions of Cisco IMC works, but they have not been validated. The latest Cisco IMC ISO image can be downloaded from the Cisco Software Download site. For upgrade procedures, see the Cisco UCS C-Series Rack-Mount Server BIOS Upgrade Guide.

Step 2 For UCS B-Series pods, verify that the Cisco UCS Manager version is one of the following: 2.2(5a), 2.2(5b), 2.2(6c), 2.2(6e), 3.1(c).

Step 3 For UCS C-Series pods, verify the following Cisco IMC information is added: IP address, username, and password.

Step 4 For UCS B-Series pods, verify the following UCS Manager information is added: username, password, IP address, and resource prefix. The resource prefix maximum length is 6. The provisioning network and the UCS Manager IP address must be connected.

Step 5 Verify that no legacy DHCP/Cobbler/PXE servers are connected to your UCS servers. If so, disconnect or disable the interface connected to legacy DHCP, Cobbler, or PXE server. Also, delete the system from the legacy cobbler server.

Step 6 Verify Cisco IMC has NTP enabled and is set to the same NTP server and time zone as the operating system.

Installing the Management Node

This procedures installs RHEL 7.3 with the following modifications:

- Hard disk drives are setup in RAID 6 configuration with one spare HDD for eight HDDs deployment, two spare HDDs for 9 to 16 HDDs deployment, or four spare HDDs for 17 to 24 HDDs deployment
- Networking—Two bridge interfaces are created, one for the installer API and one for provisioning. Each bridge interface has underlying interfaces bonded together with 802.3ad. Provision interfaces are 10 GE Cisco VICs. API interfaces are 1 GE LOMs. If the NFVIBENCH, is palnned to be used, another 2xIntel 520 or 4xIntel710 X is needed.
- The installer code is placed in /root/.
- SELinux is enabled on the management node for security.

Before you begin

Verify that the Cisco NFVI management node where you plan to install the Red Hat for Enterprise Linux (RHEL) operating system is a Cisco UCS C240 M4 Small Form Factor (SFF) with) with 8, 16 or 24 hard disk drives (HDDs). In addition, the management node must be connected to your enterprise NTP and DNS servers. If your management node server does not meet these requirements, do not continue until you install a qualified UCS C240 server. Also, verify that the pod has MRAID card.

Step 1 Log into the Cisco NFVI management node.

Step 2 Follow steps in Configuring the Server Boot Order to set the boot order to boot from Local HDD.

Step 3 Follow steps in Cisco UCS Configure BIOS Parameters to set the following advanced BIOS settings:

- PCI ROM CLP—Disabled
- PCH SATA Mode—AHCI
- All Onboard LOM Ports—Enabled
- LOM Port 1 OptionROM—Disabled
- LOM Port 2 OptionROM—Disabled
- All PCIe Slots OptionROM—Enabled
- PCIe Slot:1 OptionROM—Enabled
- PCIe Slot:2 OptionROM—Enabled
- PCIe Slot: MLOM OptionROM—Disabled
- PCIe Slot:HBA OptionROM—Enabled
- PCIe Slot:FrontPcie1 OptionROM—Enabled
- PCIe Slot:MLOM Link Speed—GEN3
- PCIe Slot:Riser1 Link Speed—GEN3
- PCIe Slot:Riser2 Link Speed—GEN3

Step 4 Click **Save Changes**.

Step 5 Add the management node vNICs to the provisioning VLAN to provide the management node with access to the provisioning network:

a) In the CIMC navigation area, click the **Server** tab and select **Inventory**.
b) In the main window, click the **Cisco VIC Adapters** tab.
c) Under Adapter Card, click the **vNICs** tab.
d) Click the first vNIC and choose **Properties**.
e) In the vNIC Properties dialog box, enter the provisioning VLAN in the Default VLAN field and click **Save Changes**.
f) Repeat Steps **a** through **e** for the second vNIC.

Note Delete any additional vNICs configured on the UCS server beyond the two default ones.

Step 6 Download the Cisco VIM ISO image to your computer from the location provided to you by the account team.

Step 7 In CIMC, launch the KVM console.

Step 8 Mount the Cisco VIM ISO image as a virtual DVD.

Step 9 Reboot the UCS server, then press **F6** to enter the boot menu.

Step 10 Select the KVM-mapped DVD to boot the Cisco VIM ISO image supplied with the install artifacts.

Step 11 When the boot menu appears, select **Install Cisco VIM Management Node**. This is the default selection, and will automatically be chosen after the timeout.

Step 12 At the prompts, enter the following parameters:

- Hostname—Enter the management node hostname (The hostname length must be 32 or less characters).
- API address—Enter the management node API address in CIDR (Classless Inter-Domain Routing) format, for example, 172.29.86.62/26.
- Gateway—Enter the API network default gateway IP address.
- DNS server—Enter the DNS server IP address.
- Management IP address—Enter the management node IP address in CIDR format, for example, 10.30.118.69/26. After you enter the management node IP address, the Installation options menu appears. Be careful when entering options, below. In the installation menu, there are more options, only fill in the options listed below (option 8 and 2) and leave everything else as it is. If there is problem to start the installation, enter "r" to refresh the Installation menu.

Step 13 In the Installation menu, select option **8** to enter the root password.

Step 14 At the password prompts, enter the root password, then enter it again to confirm.

Step 15 At the Installation Menu, select option **2** to enter the time zone.

Step 16 At the Timezone settings prompt, enter the number corresponding to your time zone.

Step 17 At the next prompt, enter the number for your region.

Step 18 At the next prompt, choose the city, then confirm the time zone settings.

Step 19 After confirming your time zone settings, enter **b** to start the installation.

Step 20 After the installation is complete, press **Return** to reboot the server.

Step 21 After the reboot, check the management node clock using the Linux **date** command to ensure the TLS certificates are valid, for example:

```
#date
 Mon Aug 22 05:36:39 PDT 2016

To set date:
#date -s '2016-08-21 22:40:00'
Sun Aug 21 22:40:00 PDT 2016

To check for date:
#date
Sun Aug 21 22:40:02 PDT 2016
```

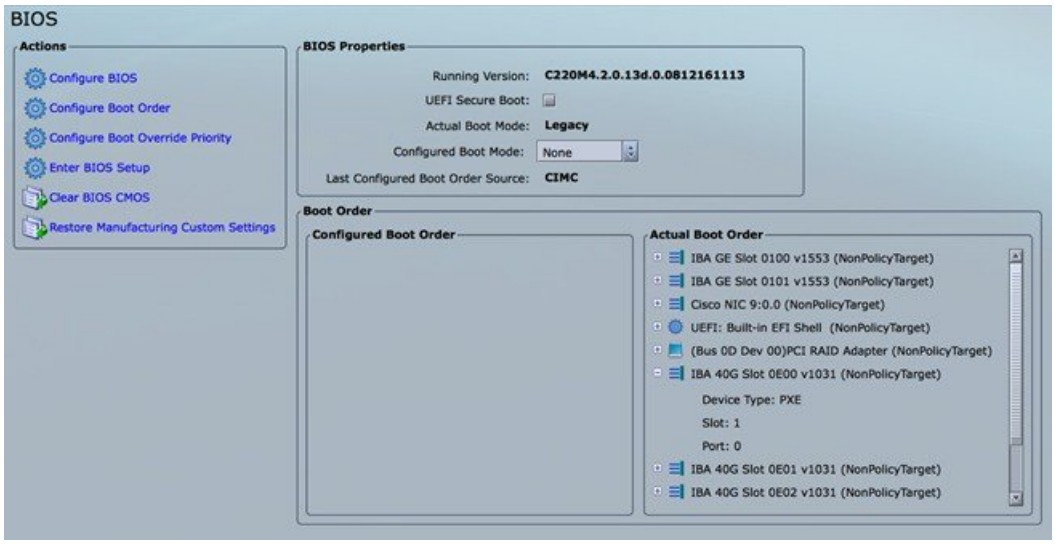
Setting Up the UCS C-Series Pod

After you install the RHEL OS on the management node, perform the following steps to set up the Cisco UCS C-Series servers:

Step 1 Follow steps in Configuring the Server Boot Order to set the boot order to boot from Local HDD.

Step 2 Follow steps in Configure BIOS Parameters to set the LOM, HBA, and PCIe slots to the following settings:

- CDN Support for VIC—Disabled
- PCI ROM CLP—Disabled
- PCH SATA Mode—AHCI
- All Onboard LOM Ports—Enabled
- LOM Port 1 OptionROM—Disabled
- LOM Port 2 OptionROM—Disabled
- All PCIe Slots OptionROM—Enabled
- PCIe Slot:1 OptionROM—Enabled
- PCIe Slot:2 OptionROM—Enabled
- PCIe Slot: MLOM OptionROM—Enabled
- PCIe Slot:HBA OptionROM—Enabled
- PCIe Slot:N1 OptionROM—Enabled
- PCIe Slot:N2 OptionROM—Enabled
- PCIe Slot:HBA Link Speed—GEN3
- Additional steps need to be taken to setup C-series pod with Intel NIC. In the Intel NIC testbed, each C-series server has 2, 4-port Intel 710 NIC cards. Ports A, B and C for each Intel NIC card should be connected to the respective TOR. Also, ensure that the PCI slot in which the Intel NIC cards are inserted are enabled in the BIOS setting (BIOS > Configure BIOS >Advanced > LOM and PCI Slot Configuration -> All PCIe Slots OptionROM-Enabled and enable respective slots). To identify the slots, check the slot-id information under the Network-Adapter tab listed under the Inventory link on the CIMC pane. All the Intel NIC ports should be displayed in the BIOS summary page under the Actual Boot Order pane, as IBA 40G Slot xyza with Device Type is set to PXE.



In case, the boot-order for the Intel NICs are not listed as above, the following one-time manual step needs to be executed to flash the Intel NIC x710 to enable PXE.

1. Boot each server with a CentOS image.
2. Download Intel Ethernet Flash Firmware Utility (Preboot.tar.gz) for X710 from the above link for Linux platform: https://www.intel.com/content/www/us/en/support/software/manageability-products/000005790.html.
3. Copy downloaded PREBOOT.tar to UCS server having X710 card.

```
mkdir -p /tmp/Intel/
tar xvf  PREBOOT.tar -C /tmp/Intel/
cd /tmp/Intel/
cd APPS/BootUtil/Linux_x64
chmod a+x bootutili64e
./bootutili64e -h # help
./bootutili64e # list out the current settings for NIC
./bootutili64e -bootenable=pxe -all
shutdown -r now
# now go with PXE
# Check result of the flash utility  (watch out for PXE Enabled on 40GbE interface)

#./bootutil64e

Intel(R) Ethernet Flash Firmware Utility
BootUtil version 1.6.20.1
Copyright (C) 2003-2016 Intel Corporation

Type BootUtil -? for help

Port Network Address Location Series  WOL Flash Firmware                Version
==== =============== ======== ======= === ============================ =======
  1   006BF10829A8    18:00.0 Gigabit YES UEFI,CLP,PXE Enabled,iSCSI    1.5.53
  2   006BF10829A8    18:00.1 Gigabit YES UEFI,CLP,PXE Enabled,iSCSI    1.5.53
  3   3CFDFEA471F0    10:00.0 40GbE   N/A UEFI,CLP,PXE Enabled,iSCSI    1.0.31
  4   3CFDFEA471F1    10:00.1 40GbE   N/A UEFI,CLP,PXE Enabled,iSCSI    1.0.31
  5   3CFDFEA471F2    10:00.2 40GbE   N/A UEFI,CLP,PXE,iSCSI            -------
  6   3CFDFEA471F3    10:00.3 40GbE   N/A UEFI,CLP,PXE,iSCSI            -------
  7   3CFDFEA47130    14:00.0 40GbE   N/A UEFI,CLP,PXE Enabled,iSCSI    1.0.31
  8   3CFDFEA47131    14:00.1 40GbE   N/A UEFI,CLP,PXE Enabled,iSCSI    1.0.31
  9   3CFDFEA47132    14:00.2 40GbE   N/A UEFI,CLP,PXE,iSCSI            -------
10   3CFDFEA47133    14:00.3 40GbE   N/A UEFI,CLP,PXE,iSCSI           -------
#
```

Setting Up the UCS B-Series Pod

After you install the RHEL OS on the management node, complete the following steps to configure a Cisco NFVI B-Series pod:

Step 1 Log in to Cisco UCS Manager, connect to the console of both fabrics and execute the following commands:

Step 2

```
# connect local-mgmt
# erase config
All UCS configurations will be erased and system will reboot. Are you sure? (yes/no): yes
Removing all the configuration. Please wait….
```

Step 3 Go through the management connection and clustering wizards to configure Fabric A and Fabric B:

Fabric Interconnect A

```
# connect local-mgmt
# erase config
Enter the configuration method. (console/gui) console
Enter the setup mode; setup newly or restore from backup. (setup/restore) ? setup
You have chosen to setup a new Fabric interconnect. Continue? (y/n): y
Enforce strong password? (y/n) [y]: n
Enter the password for "admin":
Confirm the password for "admin":
Is this Fabric interconnect part of a cluster(select 'no' for standalone)? (yes/no) [n]: yes
Enter the switch fabric (A/B) []: A
Enter the system name: skull-fabric
Physical Switch Mgmt0 IPv4 address : 10.30.119.58
Physical Switch Mgmt0 IPv4 netmask : 255.255.255.0
IPv4 address of the default gateway : 10.30.119.1
Cluster IPv4 address : 10.30.119.60
Configure the DNS Server IPv4 address? (yes/no) [n]: y
DNS IPv4 address : 172.29.74.154
Configure the default domain name? (yes/no) [n]: y
Default domain name : ctocllab.cisco.com

Join centralized management environment (UCS Central)? (yes/no) [n]: n

Following configurations will be applied:
Switch Fabric=A
System Name=skull-fabric
Enforced Strong Password=no
Physical Switch Mgmt0 IP Address=10.30.119.58
Physical Switch Mgmt0 IP Netmask=255.255.255.0
Default Gateway=10.30.119.1
DNS Server=172.29.74.154
Domain Name=ctocllab.cisco.com
Cluster Enabled=yes
Cluster IP Address=10.30.119.60
NOTE: Cluster IP will be configured only after both Fabric Interconnects are initialized

Apply and save the configuration (select 'no' if you want to re-enter)? (yes/no): yes
Applying configuration. Please wait..
```

Fabric Interconnect B

```
Enter the configuration method. (console/gui) ? console

Installer has detected the presence of a peer Fabric interconnect. This Fabric interconnect will be
 added to the cluster. Continue (y/n) ? y

Enter the admin password of the peer Fabric interconnect:
Connecting to peer Fabric interconnect... done
Retrieving config from peer Fabric interconnect... done
Peer Fabric interconnect Mgmt0 IP Address: 10.30.119.58
Peer Fabric interconnect Mgmt0 IP Netmask: 255.255.255.0
Cluster IP address : 10.30.119.60
Physical Switch Mgmt0 IPv4 address : 10.30.119.59
Apply and save the configuration (select 'no' if you want to re-enter)? (yes/no): yes
Applying configuration. Please wait.
```

Step 4 Configure the NTP:

a) In UCS Manager navigation area, click the **Admin** tab.
b) In the Filter drop-down list, choose **Time Zone Management**.
c) In the main window under Actions, click **Add NTP Server**.

d) In the Add NTP Server dialog box, enter the NTP hostname or IP address, then click **OK**.

Step 5 Following instructions in Cisco UCS Manager GUI Configuration Guide, Release 2.0, "Configuring Server Ports with the Internal Fabric Manager" section, configure the Fabric Interconnect A and Fabric Interconnect B uplinks to the Cisco NFVI top of rack (ToR) switches as **Uplink Ports**, **Server Ports**, and **Port Channels**.

Step 6 Configure the downlinks to the B-Series server chassis as **Server Ports**.

Step 7 Acknowledge all chassis.

Configuring the Out-of-Band Management Switch

The Cisco VIM installer API and SSH bonded interface occurs on 1 GB Intel NICs that connect the Cisco NFVI management node and the Cisco Catalyst switch. Following is a sample configuration for creating a port channel on a Catalyst switch. Modify the configuration for your environment:

```
interface GigabitEthernet0/39
 channel-group 2 mode active
 speed 1000

interface GigabitEthernet0/40
 channel-group 2 mode active
 speed 1000

interface Port-channel2
 switchport access vlan 165
 switchport mode access
```

Cisco VIM Configurations for ML2/VPP Installation

If you are installing Cisco VIM with ML2/VPP, the mechanism driver in the setup_yaml file should reflect the same.

Cisco ML2/VPP Mechanism Driver Configuration

```
MECHANISM_DRIVERS: vpp
TENANT_NETWORK_TYPES: "VLAN"
TENANT_VLAN_RANGES: <START>:<END>      # arbitrary VLAN range***
NFV_HOSTS: ALL
```

Cisco VIM Configurations for Cisco VTS Installation

If you are installing Cisco VIM with Cisco Virtual Topology Systems, you must enter the Cisco VTS parameters in Cisco VIM the setup_yaml file.

Cisco VTS Mechanism Driver Configuration

```
MECHANISM_DRIVERS: vts
TENANT_NETWORK_TYPES: "VLAN"
TENANT_VLAN_RANGES: <START>:<END>      # arbitrary VLAN range***
ENABLE_JUMBO_FRAMES: True
```

Note VLAN range overlap on the physical network could occur if a hardware VTEP is configured on a top of rack (ToR) switch. (VTEPs are Virtual Extensible Local Area Network (VXLAN) tunnel end points.)

NFV Parameters

```
NFV_HOSTS: ALL
```

Networking Parameters

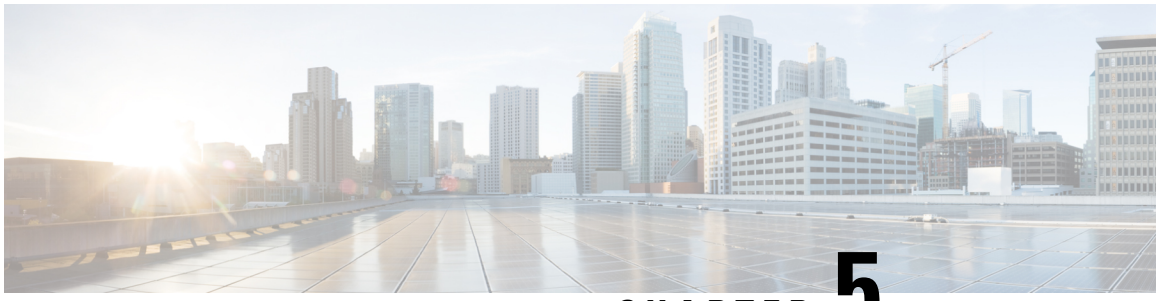
```
NETWORKING:
      ...
networks:
...       -
vlan_id: <VLAN to carry VTS tenant traffic>    # required for VTS
subnet: <subnet IP cidr>
gateway: <tenant GW IP>
pool:
- "<begin tenant IP> to <end tenant IP>"     # ***
segments:
- tenant
```

Note The tenant network pool size needs to take into account the IP addresses that are statically assigned through the VTS XRNC VM bootstrap configuration. For more information , see the Installing Cisco VTS, on page 57

Cisco VTS Parameters

```
VTS_PARAMETERS:
 VTS_USERNAME: 'admin'              # Required to be 'admin'
 VTS_PASSWORD: <VTC UI password>
 VTS_NCS_IP:   <VTC mx-net IP>      # VTC mx-net VIP for VTC HA (cannot be in mx-net pool
range)
 VTC_SSH_USERNAME: '<vtc_ssh_username>'   # Required parameter when VTS enabled and running
 NFVbench and/or VMTP
 VTC_SSH_PASSWORD: '<vtc_ssh_password>'   # Required parameter when VTS enabled and running
 NFVbench and/or VMTP
```

Note The mx-net IP pool configuration must take into account the IP addresses that are allocated to the VTC (VTS_NCS_IP). For more information, see the Installing Cisco VTS, on page 57



CHAPTER 5

Installing Cisco VTS

If your Cisco NFVI package includes Cisco Virtual Topology System, the following topics tell you how to install Cisco VTS for use with Cisco NFVI. The Cisco VTS installation procedures are customized for Cisco NFVI from the standard Cisco VTS 2.3 installation procedures located on the Cisco VTS product site. You must install Cisco VTS before you install Cisco VIM.

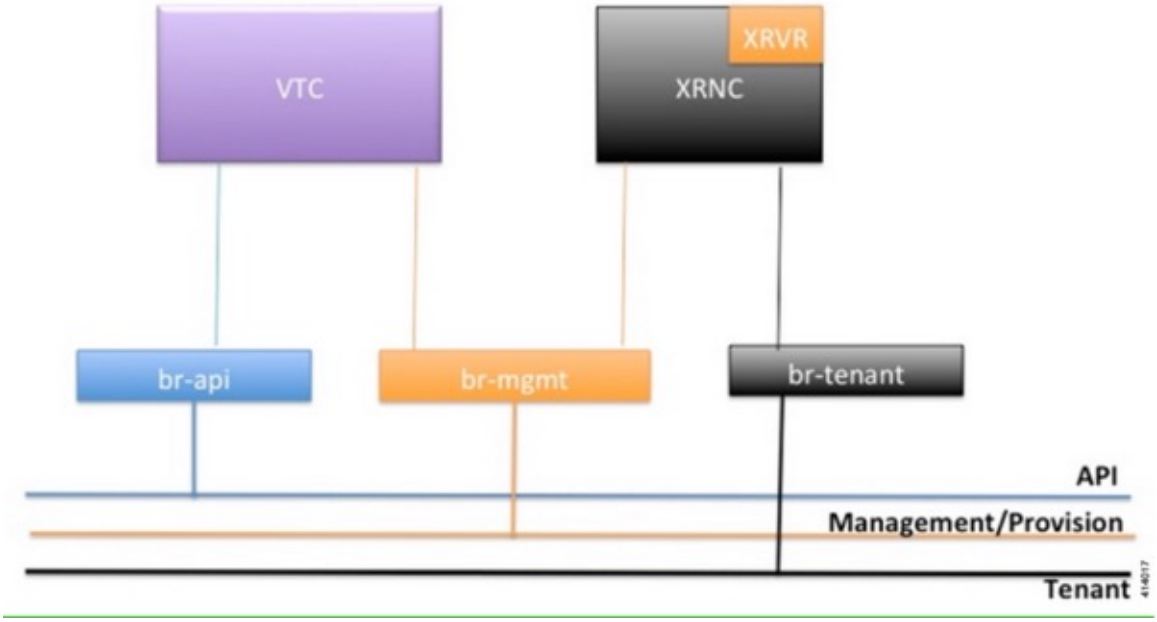
Overview to Cisco VTS Installation in Cisco NFVI

The Cisco Virtual Topology System (VTS) is an overlay management and provisioning system for data center networks. It automates data center overlay fabric provisioning for both physical and virtual workloads. It provides a policy-based approach for overlay provisioning, and can be used for multitenant data centers for cloud services, including Cisco NFVI.

To install Cisco VTS with Cisco NFVI, you must manually install the Cisco VTS Virtual Topology Controller (VTC) and its XRNC and XRVR VMs before you start the Cisco VIM installation. The VTC and XRNC VMs must be run on an independent pair of servers, that is, not on a Cisco NFVI control, compute, storage, or management node. You set up the networking on those servers as described below and outlined in the installation procedures. When you run the Cisco VIM installer, you will provide the VTC VIP and appropriate VTS credentials.

The following figure shows how Cisco VTS Virtual Topology Controller (VTC) and the IOS XRv (XRNC and XRVR) virtual machines (VMs) connect to the Cisco NFVI networks.

Figure 28: Cisco VTS Connectivity to Cisco NFVI



The following table maps Cisco VTS network names to Cisco VIM network names.

Table 6: Cisco VTS to Cisco VIM Network Name Mapping

Cisco VTS VM	Cisco VTS Network Name	Cisco VIM Network Name
VTC	Management Network	API (a)
VTC	Underlay Network	Management/Provision (mx)
XRNC/XRVR	Management Network	Management/Provision (mx)
XRNC/XRVR	Underlay Network	Tenant (t)

The following table describes the required IP address allocations for VTS components.

Table 7: Cisco VTS IP Address Allocations

Cisco VIM Network	Required Cisco VTS IP Addresses	Description
API (a)	3 total (1 VIP + 1 IP per VTC VM)	Set up in the VTC config.iso and cluster.conf

Cisco VIM Network	Required Cisco VTS IP Addresses	Description
Management/Provisioning (mx)	• 7 total—Three for VTC (one VTC VIP and one IP per VTC VM) • Four for XRNC: one IP address pair per XRNC/XRVR VM, one IP address for XRVR and the other to XRNC	Set up in XRNC config.iso and XRNC_HA.sh **Note**: VTS component IP addresses cannot overlap with the pool ranges configured in the Cisco VIM setup_data.yaml.
Tenant (t)	4 total—(one IP address pair per XRNC/XRVR VM, one IP address goes to the XRVR tenant interface and other to XRNC tenant interface	Set up in XRNC config.iso **Note**: The VTS component IPs cannot overlap with pool ranges configured in the Cisco VIM setup_data.yaml.

The VTS IP distribution and setup mechanism are listed below.

VIM API network

- VTC1—api (a) network IP1 (associated through the VTC1 config ISO)
- VTC2—api (a) network IP2 (associated through the VTC2 config ISO)
- VTC VIP—api (a) network IP3 (associated through the HA step cluster.conf)

VIM Management/Provisioning network

- VTC1—management/provisioning (mx) network IP1 (associated through the VTC1 config ISO)
- VTC2—management/provisioning (mx) network IP2 (associated through the VTC2 config ISO)
- VTC VIP—management/provisioning (mx) network IP3 (associated through the HA step cluster.conf)
- XRNC/XRv 1—management/provisioning (mx) network IP4 (associated through the XRNC-1 config ISO)
- XRNC/XRv 2—management/provisioning (mx) network IP5 (associated through the XRNC-2 config ISO)
- XRNC/XRv VIP—management/provisioning (mx) network IP6 (associated through the XRNC-1 & 2 config ISOs)

VIM Tenant network:

- XRNC/XRv 1—tenant (t) network IP1 (associated through the XRNC-1 config ISO)
- XRNC/XRv 2—tenant (t) network IP2 (associated through the XRNC-2 config ISO)
- XRNC/XRv VIP—tenant (t) network IP3 (associated through the XRNC-1 & 2 config ISOs)

Cisco VTS Usernames and Passwords in Cisco NFVI

The following table lists the Cisco VTS usernames and passwords that are employed after you install Cisco VTS in Cisco NFVI.

Table 8: Cisco VTS Usernames and Passwords in Cisco NFVI

Configuration Location	Value Requirements	Description/Comments
mercury: openstack-configs/setup_data.yaml VTS_PARAMETERS: VTS_USERNAME VTS_PASSWORD	VTS_USERNAME must be admin VTS_PASSWORD must match VTC UI login password for the admin user. Password must have a minimum of 8 characters and at least one uppercase letter, one digit, and one special character.	Used by VTF to register with the VTC / XRNC.
VTC ISO config.txt : vts-adminPassword	Must match the Cisco VIM setup_data.yaml VTS_PASSWORD parameter.	Configures VTC admin user initial password.
VTC ISO config.txt : AdministrativeUser AdministrativePassword	SSH username/password for VTC VM	SSH username/password for VTC VM
XRNC ISO: USERNAME PASSWORD_HASH	username cannot match XRVR_USERNAME PASSWORD_HASH must be generated from: openssl passwd -1 -salt xxx <password>	XRNC VM ssh username/password
XRNC ISO: XRVR_USERNAME XRVR_PASSWORD_HASH	username cannot match USERNAME	XRVR VM SSH username/password The XRVR adds this in VTS Inventory > Authorization Group > vtsgroup3 Device User Name associated with VTC admin user

System Requirements for VTC VM

The following table provides information about the minimum system requirements for the VTC virtual machine:

Requirement	Details
Disk space	48 GB
CPU	8
Memory	16 GB

Requirement	Details
Computing Host	Certified with Cisco UCS B-series, Cisco UCS C-series Rack Servers
Hypervisor	• VMware ESXi 5.5 • VMware ESXi 6.0U1 or later • Red Hat Enterprise Linux 7.1 with KVM

System Requirements for IOS XRv VM

The following table gives details about the minimum system requirements for the IOS XRv virtual machine:

Note The IOS XRv VM serves two purposes. It is required to enable VTS High Availability. It also acts as the control plane for the VTF. You need to install IOS XRv only if you consider enabling High Availability or if you plan to have a VTF in your set up.

Requirement	Details
Disk Space	Primary disk must be 2 GB.
CPUs	6
Memory	32 GB RAM
Computing Host	Certified with Cisco UCS B-series, Cisco UCS C-series Rack Servers
Hypervisor	• VMware ESXi 5.5 or VMware ESXi 6.0 • Red Hat Enterprise Linux 7.1 with KVM

System Requirements for VTF

The following table gives details about the minimum system requirements for the VTF virtual machine:

Note This section is applicable only if you have VTFs in your setup.

Requirement	Details
Disk Space	8 GB

CPU Cores	2
Memory	16 GB RAM
Hypervisor	• VMware ESXi 5.5 or VMware ESXi 6.0 • Red Hat Enterprise Linux 7.1 with KVM
Server network interface card (NIC)	Intel DPDK-supported NIC

For details about the requirements to install VTF in vhost mode, you must have Red Hat Enterprise Linux 7.2 running on the host machine. Additional requirements are: VIC Details-Cisco UCS VIC 1225,1227, and 1385.

Supported Virtual Machine Managers

Cisco VTS can be installed on the following supported versions of VMMs:

- OpenStack
- VMware vCenter

Supported Platforms

The following tables provide information about the platforms that Cisco VTS support, and their roles.

Note VTS supports VXLAN overlays using the BGP EVPN control plane.

Role	Platform Supported
Top-of-rack (ToR) leaf switch	• Cisco Nexus 9300TX and 9300PX platform switches • Cisco Nexus 9332PQ and 93128TX switches • Cisco Nexus 9200 platform switches • Cisco Nexus 5600 platform switches • Cisco Nexus 9500 platform switches • Cisco Nexus 7x00 platform switches

Data center spine	• Cisco Nexus 9300TX and 9300PX platform switches • Cisco Nexus 9500 platform switches • Cisco Nexus 9200 platform switches • Cisco Nexus 7x00 Series switches • Cisco Nexus 5600 platform switches
Border leaf	• Cisco Nexus 9300TX and 9300PX platform switches • Cisco Nexus 9500 platform switches • Cisco Nexus 9200 platform switches • Cisco Nexus 5600 platform switches • Cisco Nexus 7x00 platform switches
Data center interconnect (DCI)	• Cisco ASR 9000 Series Aggregation Services routers • Cisco Nexus 7x00 Series switches • Cisco Nexus 9300 platform switches
Fabric Extenders (FEX)	• Cisco Nexus C2248TP-E9500 • Cisco Nexus C2232PP FEX support is available for Cisco Nexus 9300, Cisco Nexus 5600, Cisco Nexus 9500 and Cisco Nexus 7x00 switches.
Hypervisor	• VMware ESXi 5.5; VMware ESXi 6.0 • Red Hat Enterprise Linux 7.1 with KVM

Note Cisco Nexus 5672 does not interoperate with Cisco Nexus 93xx or 95xx.

The following table lists the software images supported for the different devices.

Table 9: Software Images Supported

Cisco Nexus 93xx	NX OS Release 7.0(3)I2(2a) or 7.0(3)I2(2c)
Cisco Nexus 95xx	NX OS Release 7.0(3)I1(1b).

Cisco Nexus 7x00	• Data center spine —For Cisco Nexus 7000—7.3(0)D1(1); For Cisco Nexus 7700—7.3(0)DX(1)
	• Data center interconnect (DCI):
	  • VRF Peering mode—NX OS Release 7.3.1 and later.
	  • Integrated DCI mode—NX OS Release 7.3.1 and later.

Cisco Nexus 5600	NX OS Release 7.3(0)N1(1) and later.
Cisco ASR 9000	Cisco IOS XR Software Release 5.3.2 and later.

The following table lists the VPC modes supported for the different devices.

Note If Cisco Nexus 9000 series ToR is not configured with vPC related configuration, including peer-link, also known as a multichassis etherChannel trunk (MCT), you must not configure feature vpc on the ToR. This may bring loopback interface used for NVE to admin down state.

Table 10: VPC Modes Supported

Cisco Nexus 93xx	Server VPC
Cisco Nexus 95xx	Server VPC
Cisco Nexus 5600	Server VPC, FEX VPC, Enhanced VPC
Cisco Nexus 7000	Host VPC and single-homed host in port channel mode.

Installing Cisco VTS in a Cisco NFVI Environment

Installing Cisco VTS inside Cisco NFVI involves installing the Virtual Topology Controller (VTC) VM. You can install the VTC VM using either the automatic or manual configuration options.

- To install the VTC VM using an ISO file (auto configuration), see Installing VTC VM - Automatic Configuration Using ISO File, on page 64.
- To install the VTC VM using the virt-manager application (manual configuration), see Installing VTC VM - Manual Configuration Using virt-manager, on page 66.
- To install the VTC VM using VNC (manual configuration), see Installing VTC VM - Manual Configuration using VNC, on page 67

Installing VTC VM - Automatic Configuration Using ISO File

To install a VTC VM and enable configuration using an ISO file, create a text file with the VM settings, wrap the text file in an ISO file, and then attach the ISO file to the VM CD drive.

Step 1 Connect to the controller node via SSH, and copy the vtc.qcow2 file to /var/lib/libvirt/images/ folder.

Step 2 Copy the vtc.sample.xml file to your controller. The Sample Cisco VTS Configurations for Cisco NFVI, on page 79 topic provides the file contents.

Step 3 Create a **config.txt** file containing the following parameters:

```
    Hostname=vtc
ManagementIPv4Method=Static
ManagementIPv4Address= <VM's a-net IP address in a.b.c.d form>
ManagementIPv4Netmask= <a-net IP mask in a.b.c.d form>
ManagementIPv4Gateway= <a-net gateway IP address in a.b.c.d form>
UnderlayIPv4Method=Static
UnderlayIPv4Address= <VM's mx-net IP address in a.b.c.d form>
UnderlayIPv4Netmask=<mx-net IP mask in a.b.c.d form>
DNSv4=<DNS server--ie. setup_data.yaml::NETWORKING['domain_name_servers'][0]>
Domain=<domain name--ie. setup_data.yaml::NETWORKING['domain_name']>
NTPv4=<NTP server--ie. setup_data.yaml::NETWORKING['ntp_servers'][0]>
vts-adminPassword=<password for user 'admin'--setup_data.yaml::VTS_PARAMETERS['VTS_PASSWORD']>
AdministrativeUser=<VM ssh login user--can be setup_data.yaml::VTS_PARAMETERS['VTS_USERNAME']>
AdministrativePassword=<VM ssh login user--can be setup_data.yaml::VTS_PARAMETERS['VTS_PASSWORD']>
```

Note The *config.txt file* must have a blank line at the end.

Note Before entering the VTS_PASSWORD, review Cisco VTS Usernames and Passwords in Cisco NFVI, on page 60.

Parameter descriptions:

- Hostname—The VM hostname.
- ManagementPv4Method—Whether to use DHCP or static addressing for the Cisco NFVI API network (a-net) interface (eth0).
- ManagementIPv4Address—The api (a) network IPv4 address of the VM (required only for static addressing).
- ManagementIPv4Netmask—The a network IPv4 netmask of the VM (required only for static addressing).
- ManagementIPv4Gateway—The a network API IPv4 gateway of the VM (required only for static addressing).
- UnderlayIPv4Method—Whether to use DHCP or static addressing for the Cisco NFVI management/provisioning (mx) network interface (eth1).
- UnderlayIPv4Address—The mx network IPv4 address of the VM (required only for static addressing).
- UnderlayIPv4Netmask—The mx network IPv4 netmask of the VM (required only for static addressing).
- DNSv4—DNS IPv4 address (required only for static addressing).
- Domain—DNS search domain (required only for static addressing).
- NTPv4—NTP IPv4 address or FQDN (required only for static addressing).
- vts-adminPassword—Password for the vts-admin user. This should match the value in setup_data.yaml::VTS_PARAMETERS['VTS_PASSWORD'] or subsequently changed through the VTC UI to match the value in setup_data.yaml::VTS_PARAMETERS['VTS_PASSWORD']
- AdministrativeUser—New administrative user for login using SSH.
- AdministrativePassword—Password for the new administrative user.

Step 4 Use mkisofs to create an ISO file, for example:

```
mkisofs -o config.iso config.txt
```

Step 5 Create the VTC VM using following command:

```
virsh create vtc.sample.xml
```

Installing VTC VM - Manual Configuration Using virt-manager

To install the VTC VM configuring it manually using the virt-manager application:

Step 1 Connect to the controller node via SSH, and copy the vtc.qcow2 file to /var/lib/libvirt/images/ folder.

Step 2 Copy the Cisco NFVI vtc.sample.xml file to your controller. Modify it as per your setup. See Sample Cisco VTS Configurations for Cisco NFVI, on page 79 for examples.

Step 3 Create the VTC VM using following command:

```
virsh create vtc.sample.xml
```

Step 4 Run the command:

```
virsh list --all
```

It should display:

```
Id     Name     State
----------------------------------------------------
2 VTC running
```

Step 5 Start virt-manager. Run:

```
virt-manager
```

Step 6 After the virt-manager window opens, click the VTC VM to open up the VTC VM console.

The console displays an installation wizard that takes you through the initial VTC VM configuration.

Step 7 Enter the following:

Note For items that take multiple values, such as DNS and NTP, each value must be separated by a space.

- VTS Hostname
- DHCP / Static IP configuration for static IP
- Management IP address for VTC—This is the Cisco NFVI api (a) network IP address.
- Management IP Netmask (api network)
- Management Gateway address (api network)
- DNS Address—One of the DNS servers in setup_data.yaml::NETWORKING['domain_name_servers'
- DNS Search domain—-- setup_data.yaml::NETWORKING['domain_name']
- Underlay IP address—This is the IP address for Cisco NFVI management/provisioning (mx) network.
- Underlay IP Netmask (mx network)
- NTP address—One of the setup_data.yaml::NETWORKING['ntp_servers'] addresses

- Password change for user vts-admin—Enter the default user vts-admin password. The vts-admin user is used for password recovery and to revisit a configuration screen if you make a mistake or need to change the information. If you log in to the VTC VM using vts-admin username and password again, you will get the same dialog to go through the VTC VM setup again. The password must match the value in setup_data.yaml::VTS_PARAMETERS['VTS_PASSWORD'] or subsequently changed through the VTC UI to match the value in setup_data.yaml::VTS_PARAMETERS['VTS_PASSWORD']

  Before entering the VTS_PASSWORD, reviewing Cisco VTS Usernames and Passwords in Cisco NFVI, on page 60 is recommended.

- Administrator User—Enter administrative username and password. This username and password are used to login to the VM via SSH.

- Password for administrator user

VTC VM reboots at this time. Wait for two minutes for the VTC VM to be up. You can ping the IP address given for VTC VM in the setup process to verify whether the VTC VM is up.

Step 8 SSH into VTC VM using the IP address, administrative username/password given in the setup process (not vts-admin user).

Installing VTC VM - Manual Configuration using VNC

If the server where you will install VTC is in a remote location with network latency or low bandwidth, you can use VNC to access the VTC VM and manually configure it using the CTC VM graphic console. To do this:

Step 1 Connect to the controller node via SSH, and copy the vtc.qcow2 file to /var/lib/libvirt/images/ folder.

Step 2 Copy the vtc.sample.xml file to your controller. Modify it as per your setup. The sample VTC XML file output is provided in Sample Cisco VTS Configurations for Cisco NFVI, on page 79.

Step 3 Replace the following sections of the vtc.sample.xml file:

```
 <graphics type='spice' port='5900' autoport='yes' listen='127.0.0.1'>
      <listen type='address' address='127.0.0.1'/>
    </graphics>
```

with the following:

```
<graphics type='vnc' port='5900' autoport='yes' listen='0.0.0.0'>
      <listen type='address' address='0.0.0.0'/>
    </graphics>
```

Note Setting the listen address to 0.0.0.0 allows external clients to connect to the VNC port (5900). You will also need to make sure that iptables configuration (if any) allows inbound TCP port 5900 connections.

Step 4 Create the VTC VM using following command:

```
virsh create vtc.sample.xml
```

You should now be able to use a VNC client to connect to the VTC VM graphic console and continue the setup.

Step 5 Enter the following:

Note For items that take multiple values, such as DNS and NTP, use a space to separate each value.

- VTS Hostname
- DHCP/Static IP configuration for static IP
- Management IP address for VTC—This is the Cisco NFVI api (a) network IP address.
- Management IP Netmask (api network)
- Management Gateway address (api network)
- DNS Address—One of the DNS servers in setup_data.yaml::NETWORKING['domain_name_servers'
- DNS Search domain—-- setup_data.yaml::NETWORKING['domain_name']
- Underlay IP address—This is the IP address for Cisco NFVI management/provisioning (mx) network.
- Underlay IP Netmask (mx network)
- NTP address—One of the setup_data.yaml::NETWORKING['ntp_servers'] addresses
- Password change for user vts-admin—Enter the default user vts-admin password. The vts-admin user is used for password recovery and to revisit a configuration screen if you make a mistake or need to change the information. If you log into the VTC VM using vts-admin username and password again, you will get the same dialog to go through the VTC VM setup again. This should match the value in setup_data.yaml::VTS_PARAMETERS['VTS_PASSWORD'] or subsequently changed through the VTC UI to match the value in setup_data.yaml::VTS_PARAMETERS['VTS_PASSWORD']
- Administrator User—Enter administrative username and password. This username and password are used to login to the VM via SSH.
- Password for administrator user.

VTC VM reboots at this time. Wait for two minutes for the VTC VM to come up. You can ping the IP address given for VTC VM in the setup process to verify whether the VTC VM is up.

Step 6 SSH into VTC VM using the IP address, administrative username/password given in the setup process (not vts-admin user).

Installing the XRNC and XRv VMs

Before you can install Cisco VTS for Cisco NFVI, you must install the IOS XRv VM and register it to VTS. IOS XRv VM is the control plane VM. Installing and registering the IOS XRv VM requires you to complete the following procedures:

- Creating an IOS XRv VM , on page 68
- Creating an ISO for IOS XRv, on page 70

Creating an IOS XRv VM

The IOS XRv VM is essential to the Virtual VTEP topology. The IOS XRv VM contains a nested VM so IOS XRv must enable nesting.

Before you begin

You must complete a VTS VM installation, and the VTC UI initial password must be changed to the password that you will enter for Cisco VIM when you install Cisco VIM. This password is set in setup_data.yaml or the Cisco VIM Insight.

Setting up Nested VM in RedHat

This has been verified with RedHat 7.1 OSP.

Step 1 Run **cat /sys/module/kvm_intel/parameters/nested**.

Step 2 If the output is N, shut down all active VMs, then enable the nested KVM feature:

```
echo "options kvm-intel nested=1" | sudo tee /etc/modprobe.d/kvm-intel.conf
    rmmod kvm_intel
    modprobe kvm_intel
```

Step 3 Run **cat /sys/module/kvm_intel/parameters/nested** and verify that it gives Y.

Bringing up the KVM-based IOS XRv VM

Step 1 Create the IOS XRv VM XML referring the Cisco NFVI sample (XRNC.XML).

Step 2 Generate an ISO file for the IOS XRv. See Creating an ISO for IOS XRv, on page 70.

Step 3 Create the VM using the XML.

```
virsh create XRNC.xml
```

Deploying the vCenter-based IOS XRv VM

Step 1 Generate an ISO file for the IOS XRv VM. See Creating an ISO for IOS XRv, on page 70.

Step 2 In the vSphere Client, select **File** > **Deploy OVF Template**. The Deploy OVF Template wizard appears.

Step 3 Select XRNC.ova from the source location, and click **Next**. The OVF template details are displayed.

Step 4 Click **Next** to specify the destination. Enter the following details:

- Name for the VM.
- Folder or datacenter where the VM will reside.

Step 5 Click **Next** to select the storage location to store the template files. You do not need to change the default values for virtual disk format and VM Storage Policy.

Step 6 Click **Next** to set up the networks. Specify the first network as the Underlay (Cisco NFVI t-net) Network and the second network as the Management (Cisco NFVI mx-net) Network.

Step 7 Click **Next**. Review the settings selections.

Step 8 Click **Finish** to start the deployment.

Step 9 After the deployment is complete, edit the VM settings. Add a CD/DVD Drive selecting Datastore ISO file and point to the XRNC.iso file that was generated and uploaded to the host.

Step 10 Power on the VM.

Running the Setup Script

Run the setup script on the IOS XRv to complete the configuration:

Before you begin

Ensure the tenant network (t) gateway and management network (mx) gateway are reachable from the XRNC server.

SSH into your IOS XRv.

- If you do not want to run in High Availability mode, run the setup script as in the below example:

```
cisco@XRVR-DL1:~$ sudo /opt/cisco/package/sr/bin/setupXRNC_HA.sh 0.0.0.0
```

- If you do want to run in HA mode, see the Installing VTS in an HA Configuration, on page 75 procedure.

Creating an ISO for IOS XRv

To create an ISO file for IOS XRv:

Step 1 Create the system.cfg file based on the sample below.

Note Verify that the configuration files has no spaces or extra characters.

Note Before you enter the VTS_USERNAME and VTS_PASSWORD, review Cisco VTS Usernames and Passwords in Cisco NFVI, on page 60.

```
# This is a sample day0 configuration file
# Copyright (c) 2015 cisco Systems

# VTS Information
VTS_ADDRESS=" <VTC's mx-net VIP address in a.b.c.d form>"
VTS_REGISTRATION_USERNAME=" < must match VTS_PARAMETERS.VTS_USERNAME >"
VTS_REGISTRATION_PASSWORD=" <must match VTS_PARAMETERS.VTS_PASSWORD >!"

# VTC/VTF Network Configuration
HOSTNAME="DL-XRVR6"
NTP_SERVER=" <NTP server--ie. setup_data.yaml::NETWORKING['ntp_servers'][0]>"
NETWORK_CONFIG_METHOD="static"
NETWORK_NAMESERVER_IP=" <DNS server--ie. setup_data.yaml::NETWORKING['domain_name_servers'][0]>"
UNDERLAY_NETWORK_CONFIG_METHOD="static"
UNDERLAY_NETWORK_IP_ADDRESS=" <VM's t-net IP address in a.b.c.d form>"
UNDERLAY_NETWORK_IP_NETMASK=" <t-net IP mask in a.b.c.d form>"
#NETWORK_IP_NETMASK=24
UNDERLAY_NETWORK_IP_GATEWAY=" t-net gateway IP address in a.b.c.d form>"

MGMT_NETWORK_CONFIG_METHOD="static"
```

```
MGMT_NETWORK_IP_ADDRESS=" <VM's mx-net IP address in a.b.c.d form>"
MGMT_NETWORK_IP_NETMASK=" <mx-net IP mask in a.b.c.d form>"
MGMT_NETWORK_IP_GATEWAY=" <mx-net gateway IP address in a.b.c.d form>"

ALL_VTFS_MODE="vhost"

# VTC/VTF Admin user/password hash
# Generate with openssl passwd -1 -salt <salt> <password>
# cisco/cisco123 PASSWORD_HASH='$1$xxx$J3aa90XAPYg6HSNUUUD2o1'
USERNAME='cisco'
PASSWORD_HASH='$1$xxx$J3aa90XAPYg6HSNUUUD2o1'


# XRVR Specific Settings (VTC only)
XRVR_USERNAME="admin"
XRVR_PASSWORD="cisco123"
XRVR_STATIC_MGMT_IP=" <XRVR's mx-net VIP address in a.b.c.d/prefixlen form>"
XRVR_STATIC_UNDERLAY_IP=" <XRVR's t-net VIP address in a.b.c.d/prefixlen form>"
XRVR_NAME=" <XRVR VM instance's hostname>"
XRVR_BGP_COMMUNITY=" <VNI range for VTS to use>"
```

Note The IOS XRv login/password is hard coded to admin/cisco123.

Step 2 Copy your IOS XRv system.cfg files to the same path where the script resides. For example:

```
admin:/opt/cisco/package/vts/bin$ ls -l
total 1432
-rwxr-xr-x 1 vts-admin vts-admin   4767 Sep 29 16:40 build_vts_config_iso.sh
-rw-r--r-- 1 root      root        1242 Sep 29 23:54 system.cfg
```

Step 3 Create the ISO file as shown below (you need to log in as root):

```
root:/opt/cisco/package/vts/bin# ./build_vts_config_iso.sh xrnc system.cfg
Validating input.
Generating ISO File.
Done!
```

Step 4 Spawn the IOS XRv VM with the ISO connected to it.

Step 5 Power on the VM.

In case you spawn a new IOS XRv VM later, it will come up with IOS XRv Day Zero configuration and get reregistered with the VTC. Use the **sync-to** option available in the Config Sync feature to synchronize the configuration with the latest VTC configuration. See the *Synchronizing Configuration* section in the *Cisco VTS User Guide* for more information on this feature.

Verifying Cisco VTS Installation in Cisco NFVI

The following procedures provide information about how to verify the Cisco VTS installation in Cisco NFVI.

Verifying VTC VM Installation

To verify VTC VM installation:

Step 1 Log into the VTC VM just created using the VTC VM console.

- If you installed the VTC VM in a VMware environment, use the VM console.
- If you installed the VTC VM in an RedHat KVM based-OpenStack environment, - telnet 0 <*console-port*> (The console port is the Telnet port in the VTC.xml file.)

Step 2 Ping the Cisco NFVI api network gateway.

If ping fails, verify the VM networking to the Cisco NFVI api network.

Step 3 For the VTC VM CLI, ping the Cisco NFVI management/provisioning (mx) network gateway.

If ping fails, verify VM networking to the mx network.

Note Underlay network gateway is the switched virtual interface (SVI) created for IOSXRv and VTF on the leaf where the controller is connected.

Step 4 After a few minutes, verify whether the VTS UI is reachable by typing in the VTS api network IP in the browser.

Verifying IOS XRv VM Installation

To verify ISO XRv VM installation:

Before you begin

Ensure the tenant network (t) gateway and management network (mx) gateway are reachable from the XRNC server.

Step 1 Log into the IOS XRv VM using the VTC VM console.

- If you installed the VTC VM in a VMware environment, use the VM console.
- If you installed the VTC VM in an RedHat KVM based-OpenStack environment, use virt-manager or VNC console to log into the VM. See Installing VTC VM - Manual Configuration using VNC, on page 67

Step 2 Ping the Cisco NFVI tenant (t) network gateway IP address.

In case ping fails, verify Cisco NFVI tenant network.

Step 3 Ping the VTC Cisco NFVI management/provisioning (mx) network IP address.

In case ping fails, verify the mx network.

Note You should be able to ping the gateway IP address for both Cisco NFVI mx and t networks, as XRv registers to the VTC using the VTC mx network IP address.

Step 4 Run **virsh list** to make sure the nested VM is running.

Step 5 Verify whether the nested IOS XRv is booting up. To do this, run:

```
telnet 0 5087
```

If the o/p command fails, verify whether nested virtualization on the host where IOSXRv is booted is turned on.

Also, verify that another Telnet session is not using this session.

Step 6 Verify whether the Virtual Forwarding Group (VFG) group is created on the VTS GUI and IOSXRv is part of the VFG group.

Step 7 On the XRv shell, run the setup command:

```
sudo /opt/cisco/package/sr/bin/setupXRNC_HA.sh 0.0.0.0
```

For HA installations, replace 0.0.0.0 with the underlay IP address of the second IOSXRv.

Troubleshooting VTF Registration

If VTF registration issues arise, you can use the following commands to find the VTF registration logs on each Cisco NFVI compute node:

```
[root@devstack-71 neutron]# docker exec -it neutron_vtf_4269 bash
[root@devstack-71 /]# cd /var/log/vpfa
[root@devstack-71 vpfa]# ls
vpfa_err.log   vpfa_med.log  vpfa_server.log        vpfa_server_frequent.log  vpfa_stdout.log

vpfa_freq.log  vpfa_reg.log  vpfa_server_errors.log  vpfa_server_slow.log
[root@devstack-71 vpfa]# tail vpfa_reg.log
2016-06-23 02:47:22,860:INFO:VTF-REG: Sent PATCH {"vtf": {"username": "admin",
"vpp-client-name": "devstack-71", "ip": "34.34.34.5", "binding-host-name": "devstack-71",
"gateway-ip": "34.34.34.1", "local-mac": "00:3a:7d:6a:13:c9"}} to
https://172.18.96.15:8888/api/running/cisco-vts/vtfs/vtf
2016-06-23 02:47:23,050:INFO:VTF-REG-ERR: Failure:400!!!
```

A successful log example is shown below:

```
[root@devstack-71 vpfa]# tail vpfa_reg.log
2016-06-23 15:27:57,338:INFO:AUTH: Successful Login - User: admin
URI:/yang-api/datastore/interfaces Host:IPv4Address(TCP, '34.34.34.5', 21345) Method:GET
2016-06-23 15:28:07,340:INFO:AUTH: Successful Login - User: admin
URI:/yang-api/datastore/interfaces Host:IPv4Address(TCP, '34.34.34.5', 21345) Method:GET
```

If a VTF registration fails, check the following:

- IP network connectivity between the compute nodes and the VTC and XRNC/XRVR VMs (Cisco NFVI tenant and management/provisioning networks)
- VTS_PARAMETERS—The VTS_USERNAME must be admin.
- The VTC and XRNC/XRVR must be up and the VTS configurations (described in Configuring Cisco VTS and XRVR After Installation, on page 73) must be applied. The XRVR must be registered with VTC.
- Check that the VTS UI shows "vtsgroup3" in Inventory->Authorization Groups.
- Check that the VTC Admin Username is admin and Device Username is what was set for XRVR_USERNAME in the XRNC config ISO.

Configuring Cisco VTS and XRVR After Installation

The following steps cover the Cisco VTS configurations you need to provision after installation.

Step 1 If you changed the Cisco VTS username/password when you configured the VTS HA configuration, continue with Step 3. If not, log into the Cisco VTS GUI using the default username/password admin/admin.

Step 2 Change the Cisco VTS password using the UI Change Password tab.

Note Before you enter the Cisco VTS password, review Cisco VTS Usernames and Passwords in Cisco NFVI, on page 60.

Step 3 Log into the Linux CLI using SSH then use the ncs_cli to set the following parameters:

```
configure
set resource-pools vni-pool vnipool range 4096 65535
set devices device <XRVR-NAME> asr9k-extension:device-info device-use leaf
set devices device <XRVR-NAME> asr9k-extension:device-info bgp-peering-info bgp-asn 23
set devices device <XRVR-NAME> asr9k-extension:device-info bgp-peering-info loopback-if-num 0
```

Step 4 After the VTF registers, add the following configurations:

```
set cisco-vts infra-policy admin-domains admin-domain D1 l2-gateway-groups l2-gateway-group L2GW-0
devices
    device <XRVR-NAME>
set cisco-vts infra-policy admin-domains admin-domain D1 l2-gateway-groups l2-gateway-group L2GW-0
policy-parameters
    distribution-mode decentralized-l2
set cisco-vts infra-policy admin-domains admin-domain D1 l2-gateway-groups l2-gateway-group L2GW-0
policy-parameters
    control-plane-protocol bgp-evpn
set cisco-vts infra-policy admin-domains admin-domain D1 l2-gateway-groups l2-gateway-group L2GW-0
policy-parameters
    arp-suppression
set cisco-vts infra-policy admin-domains admin-domain D1 l2-gateway-groups l2-gateway-group L2GW-0
policy-parameters
    packet-replication ingress-replication
set cisco-vts infra-policy admin-domains admin-domain D1 l3-gateway-groups l3-gateway-group L3GW-0
policy-parameters
    distribution-mode decentralized-l3
set cisco-vts infra-policy admin-domains admin-domain D1 l3-gateway-groups l3-gateway-group L3GW-0
policy-parameters
    control-plane-protocol bgp-evpn
set cisco-vts infra-policy admin-domains admin-domain D1 l3-gateway-groups l3-gateway-group L3GW-0
policy-parameters
    arp-suppression
set cisco-vts infra-policy admin-domains admin-domain D1 l3-gateway-groups l3-gateway-group L3GW-0
policy-parameters
    packet-replication ingress-replication
set cisco-vts infra-policy admin-domains admin-domain D1 l2-gateway-groups l2-gateway-group L2GW-0
ad-l3-gw-parent L3GW-0
```

Step 5 Enter the BGP configuration for XRVI:

```
some IGP
outer ospf 100
router-id 18.18.18.18
address-family ipv4 unicast
area 0.0.0.0
  default-cost 10
  interface Loopback0
  !
  interface GigabitEthernet0/0/0/0
  !
```

```
!
!
interface Loopback0
ipv4 address 8.8.8.8 255.255.255.255
!

router bgp 23
bgp router-id 8.8.8.8
address-family ipv4 unicast
!
address-family l2vpn evpn
  retain route-target all
!
 After you add this BGP info in the XRVR you will need to sync the devices via the ncs_cli

ncs_cli > request devices device <XRVR-NAME> sync-from
```

Installing VTS in an HA Configuration

Complete the following steps to install Cisco VTS in a Layer 2 HA configuration.

Step 1 Create two VTC VMs. (In the following steps, these will be referred to as VTC1 and VTC2.) When you create the VMs, reserve three IP addresses for each Cisco VIM network to which the VTC VM will be connected as described in Overview to Cisco VTS Installation in Cisco NFVI, on page 57.

Step 2 If you changed the initial VTC password in a previous installation step, proceed to Step 4. If not, log into the VTC GUI using the default username/password admin/admin.

Step 3 Change the VTC password using the UI Change Password tab. See Cisco VTS Usernames and Passwords in Cisco NFVI, on page 60 for information about Cisco VTS usernames and passwords.

Step 4 Edit the cluster.conf file on VTC1 and VTC2 located in /opt/cisco/package/vtc/bin/. Both VTCs must have identical information in the cluster.conf file. Parameters you will enter include:

- vip_public—VIP address used for the Cisco VIM API (a) network.
- vip_private—VIP address used for VTS on the Cisco VIM management/provisioning (mx) network. Cisco VIM uses VTFs, so this field must be entered. The vip_private field is the VIP for the VTS master private interface
- private_network_interface—The VIP interface name used for the Cisco NFVI management/provisioning network. It is the VTC1 and VTC2 secondary interface names on the same private network as XRVR. This must be completed.
- master_name—Enter the name of the VTC you want to be the primary one in the HA configuration.
- master_ip—The master VTC IP address used for the Cisco NFVI API network.
- master_network_interface—The master VTC interface name used for the Cisco NFVI API network. The master_network_interface and slave_network_interface are the interface names of VTC1 and VTC2 where the real IP addresses reside. The interface names must be identical.
- slave_name—Enter the name of the VTC you want to be the secondary one in the HA configuration.
- slave_ip—The secondary VTC IP address used for the Cisco NFVI API network.

- slave_network_interface—The secondary VTC interface name used for the Cisco NFVI API network. The master_network_interface and slave_network_interface are the interface names of VTC1 and VTC2 where the real IP addresses reside. The interface names must be identical.
- private_gateway—The Cisco VIM management/provisioning gateway IP address from setup.yaml. This will come from the Cisco VIM setup_data.yaml file after you complete the Cisco VIM installation and the Cisco VIM Configurations for Cisco VTS Installation , on page 55procedure.
- external_ip—The external IP address. This will come from the Cisco VIM setup_data.yaml file after you complete the Cisco VIM installation and the Cisco VIM Configurations for Cisco VTS Installation , on page 55 procedure.

```
###Virtual IP of VTC Master on the public interface.
# In case of Cisco VIM this is the VTC VIP on "api" network
vip_public=<VIP on a-net>

vip_private=<VIP on mx-net>
private_network_interface=eth1  # fixed value

master_name=vtc1
master_ip=<IP on a-net>
master_network_interface=eth0   # fixed value

slave_name=vtc2
slave_ip=<IP on a-net>
slave_network_interface=eth0    # fixed value


#Note this should be reachable all the time as this is used for management network VIP monitoring
private_gateway=<mx-net gateway IP from setup_data.yaml>

###In the event that a network failure occurs evenly between the two routers, the cluster needs an
outside ip to determine where the failure lies
###This can be any external ip such as your vmm ip or a dns but it is recommended to be a stable ip
 within your environment
external_ip=<external_lb_vip_address from setup_data.yaml>


#-----------------------------------------------------------
# For Cisco VIM the below values should be left blank
#-----------------------------------------------------------

###If you have your vtc's in different subnets, xrvr will need to be configured to route traffic and
 the below section needs to be filled in
###If you have your vtc's on the same subnet, the below section can be skipped

###Name of your vrf. Example: VTS_VIP
vrf_name=

###Ip of your first Xrvr. Example: 11.1.1.5
xrvr1_mgmt_ip=

###List of neighbors for xrvr1, separated by comma. Example: 11.1.1.1,11.1.1.2
xrvr1_bgp_neighbors=

###Ip of your second Xrvr. Example: 12.1.1.5
xrvr2_mgmt_ip=

###List of neighbors for xrvr2, separated by comma. Example: 12.1.1.1,12.1.1.2
xrvr2_bgp_neighbors=

###Credentials for Xrvr
xrvr_user=
```

```
xrvr_pass=

###Xrvr ASN information
remote_ASN=
local_ASN=

###Xrvr BGP information
bgp_keepalive=
bgp_hold=
```

Step 5 After modifying the cluster.conf files on VTC1 and VTC2 execute the 'modify_host_vtc.sh script located in /opt/cisco/package/vtc/bin'. The script will execute the following:

On VTC1

```
127.0.0.1       localhost
127.0.1.1       vtc1
11.1.1.4        vtc1
11.1.1.14       vtc2
```

On VTC2

```
127.0.0.1       localhost
127.0.1.1       vtc1
11.1.1.4        vtc1
11.1.1.14       vtc2
```

11.1.1.4 is the VTC1 real IP address, and 11.1.1.14 if the VTC2 real IP address. You might see the hostname in the prompt fail to change after running the script. The prompt will change to the hostname that is defined in cluster.conf after you log out or reboot.

Step 6 Execute the cluster installer script, cluster_install.sh, located in /opt/cisco/package/vtc/bin/ on VTC1 and VTC2. Do not run the script until have completed Steps 1-5.

```
admin@vtc1:/opt/cisco/package/vtc/bin$ sudo ./cluster_install.sh
[sudo] password for admin:
Change made to ncs.conf file. Need to restart ncs
ncs stop/waiting
ncs start/running
corosync stop/waiting
corosync start/running, process 5220
HA cluster is installed
```

Step 7 Execute the master_node_install.sh script located in /opt/cisco/package/vtc/bin/, on the VTC that you want to be the master. Run this script only on the master VTC. Do not run it on the slave VTS.

```
admin@vtc1:/opt/cisco/package/vtc/bin$ sudo ./master_node_install.sh
Master node install finished
```

When the master_node_install script finishes, you can use the **ip addr** command to see the public and private VIPs. If you use VTF, with the VIP up, both XRVRs automatically complete their auto-registration.

Step 8 Verify the HA Status:

```
admin@vtc1:/opt/cisco/package/vtc/bin$ sudo crm status
Last updated: Wed May  4 00:00:28 2016
Last change: Wed May  4 00:00:10 2016 via crm_attribute on vtc2
Stack: corosync
Current DC: vtc2 (739533872) - partition with quorum
Version: 1.1.10-42f2063
2 Nodes configured
4 Resources configured
```

```
Online: [ vtc1 vtc2 ]

ClusterIP      (ocf::heartbeat:IPaddr2):       Started vtc1
Master/Slave Set: ms_vtc_ha [vtc_ha]
     Masters: [ vtc1 ]
     Slaves: [ vtc2 ]
ClusterIP2     (ocf::heartbeat:IPaddr2):       Started vtc1

admin@vtc1:/opt/cisco/package/vtc/bin$ sudo ip addr
1: lo: <LOOPBACK,UP,LOWER_UP> mtu 65536 qdisc noqueue state UNKNOWN group default
    link/loopback 00:00:00:00:00:00 brd 00:00:00:00:00:00
    inet 127.0.0.1/8 scope host lo
       valid_lft forever preferred_lft forever
    inet6 ::1/128 scope host
       valid_lft forever preferred_lft forever
2: eth0: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000

    link/ether 52:54:00:00:bd:0f brd ff:ff:ff:ff:ff:ff
    inet 11.1.1.4/24 brd 11.1.1.255 scope global eth0
       valid_lft forever preferred_lft forever
  inet 11.1.1.2/32 brd 11.1.1.2 scope global eth0
       valid_lft forever preferred_lft forever
    inet6 2001:420:10e:2010:5054:ff:fe00:bd0f/64 scope global dynamic
       valid_lft 2591955sec preferred_lft 604755sec
    inet6 fe80::5054:ff:fe00:bd0f/64 scope link
       valid_lft forever preferred_lft forever
3: eth1: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc pfifo_fast state UP group default qlen 1000

    link/ether 52:54:00:4c:11:13 brd ff:ff:ff:ff:ff:ff
    inet 15.15.15.4/24 brd 11.1.1.255 scope global eth1
       valid_lft forever preferred_lft forever
    inet 15.15.15.20/32 brd 11.1.1.20 scope global eth1
```

Completing the XRNC HA Configuration

Complete the following steps to set up the XRNC HA configuration:

Before you begin

Ensure the tenant network (t) gateway and management network (mx) gateway are reachable from the XRNC server.

Step 1 log into each DL and navigate to /opt/cisco/package/sr/bin, using SSH.

Step 2 Edit the DL hostnames as XRDL1 and XRDL2.

Step 3 Run the following commands to set up the XRNC HA:

On the active XRNC:

```
sudo /opt/cisco/package/sr/bin/setupXRNC_HA.sh < IP address of br-underlay XRNC2>
```

On the standby XRNC:

```
sudo /opt/cisco/package/sr/bin/setupXRNC_HA.sh -s < IP address of br-underlay XRNC1>
```

Uninstalling VTC HA

To move VTC back to it's original pre-HA state, run the following script on both the active and standby nodes.

```
sudo /opt/cisco/package/vtc/bin/uninstallHA.sh
```

Sample Cisco VTS Configurations for Cisco NFVI

Sample VTC VM libvert Domain Configuration

```
<domain type='kvm' id='254'>
  <name>VTC</name>
  <uuid>5789b2c3-df39-4154-a1d3-e38cefc856a3</uuid>
  <memory unit='KiB'>8388608</memory>
  <currentMemory unit='KiB'>8388608</currentMemory>
  <vcpu placement='static'>8</vcpu>
  <resource>
    <partition>/machine</partition>
  </resource>
  <os>
    <type arch='x86_64' machine='pc-i440fx-rhel7.0.0'>hvm</type>
    <boot dev='hd'/>
  </os>
  <features>
    <acpi/>
    <apic/>
    <pae/>
  </features>
  <cpu mode='custom' match='exact'>
    <model fallback='allow'>Westmere</model>
    <feature policy='require' name='vmx'/>
  </cpu>
  <clock offset='utc'/>
  <on_poweroff>destroy</on_poweroff>
  <on_reboot>restart</on_reboot>
  <on_crash>restart</on_crash>
  <devices>
    <emulator>/usr/libexec/qemu-kvm</emulator>
    <disk type='file' device='disk'>
      <driver name='qemu' type='qcow2' cache='none'/>
      <source file='/opt/neutron-vts/vtc/vtc.qcow2'/>
      <backingStore/>
      <target dev='vda' bus='virtio'/>
      <alias name='virtio-disk0'/>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x06' function='0x0'/>
    </disk>
    <disk type='file' device='cdrom'>
      <driver name='qemu' type='raw'/>
      <source file='/opt/neutron-vts/config.iso'/>
      <backingStore/>
      <target dev='hdc' bus='ide'/>
      <readonly/>
      <alias name='ide0-1-0'/>
      <address type='drive' controller='0' bus='1' target='0' unit='0'/>
    </disk>
    <controller type='usb' index='0'>
      <alias name='usb'/>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x01' function='0x2'/>
    </controller>
    <controller type='pci' index='0' model='pci-root'>
      <alias name='pci.0'/>
```

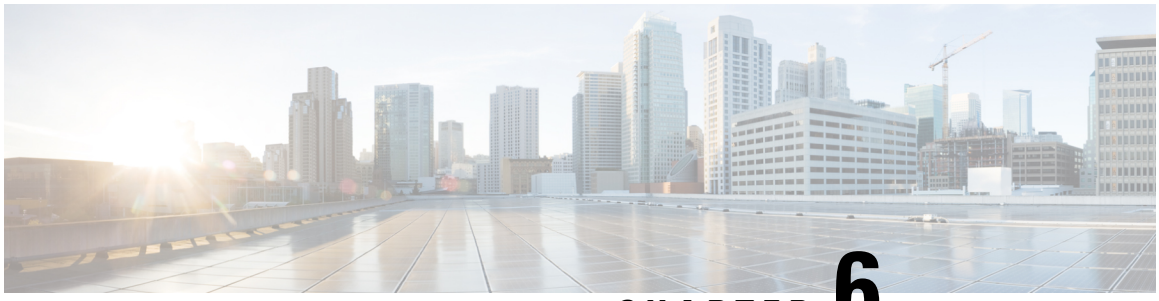
```
    </controller>
    <controller type='virtio-serial' index='0'>
      <alias name='virtio-serial0'/>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x05' function='0x0'/>
    </controller>
    <controller type='ide' index='0'>
      <alias name='ide'/>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x01' function='0x1'/>
    </controller>
    <interface type='bridge'>
      <source bridge='br_api'/>
      <model type='virtio'/>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x03' function='0x0'/>
    </interface>
    <interface type='bridge'>
      <source bridge='br_mgmt'/>
      <model type='virtio'/>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x0b' function='0x0'/>
    </interface>
    <serial type='tcp'>
      <source mode='bind' host='127.0.0.1' service='4799'/>
      <protocol type='telnet'/>
      <target port='0'/>
      <alias name='serial0'/>
    </serial>
    <console type='tcp'>
      <source mode='bind' host='127.0.0.1' service='4799'/>
      <protocol type='telnet'/>
      <target type='serial' port='0'/>
      <alias name='serial0'/>
    </console>
    <channel type='spicevmc'>
      <target type='virtio' name='com.redhat.spice.0' state='disconnected'/>
      <alias name='channel0'/>
      <address type='virtio-serial' controller='0' bus='0' port='1'/>
    </channel>
    <input type='mouse' bus='ps2'/>
    <input type='keyboard' bus='ps2'/>
    <graphics type='vnc' port='5900' autoport='yes' listen='0.0.0.0'>
      <listen type='address' address='0.0.0.0'/>
    </graphics>
    <sound model='ich6'>
      <alias name='sound0'/>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x04' function='0x0'/>
    </sound>
    <video>
      <model type='qxl' ram='65536' vram='65536' vgamem='16384' heads='1'/>
      <alias name='video0'/>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x02' function='0x0'/>
    </video>
    <memballoon model='virtio'>
      <alias name='balloon0'/>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x07' function='0x0'/>
    </memballoon>
  </devices>
</domain>
```

Sample XRNC VM libvirt Domain Configuration

```
<domain type='kvm'>
  <name>XRVR</name>
  <uuid>0b84e257-61bc-4e6e-8721-8528487e4d69</uuid>
  <memory unit='KiB'>32389120</memory>
  <currentMemory unit='KiB'>32388608</currentMemory>
```

```
<vcpu placement='static'>6</vcpu>
<resource>
  <partition>/machine</partition>
</resource>
<os>
  <type arch='x86_64' machine='pc-i440fx-rhel7.0.0'>hvm</type>
  <boot dev='hd'/>
</os>
<features>
  <acpi/>
  <apic/>
  <pae/>
</features>
<cpu mode='custom' match='exact'>
  <model fallback='allow'>Westmere</model>
  <feature policy='require' name='vmx'/>
</cpu>
<clock offset='utc'/>
<on_poweroff>destroy</on_poweroff>
<on_reboot>restart</on_reboot>
<on_crash>restart</on_crash>
<devices>
  <emulator>/usr/libexec/qemu-kvm</emulator>
  <disk type='file' device='disk'>
    <driver name='qemu' type='qcow2' cache='none'/>
    <source file='/opt/neutron-vts/xrnc/xrnc.qcow2'/>
    <target dev='vda' bus='virtio'/>
    <address type='pci' domain='0x0000' bus='0x00' slot='0x06' function='0x0'/>
  </disk>
  <disk type='file' device='cdrom'>
    <driver name='qemu' type='raw'/>
    <source file='/opt/neutron-vts/xrnc_cfg.iso'/>
    <target dev='hdc' bus='ide'/>
    <readonly/>
    <address type='drive' controller='0' bus='1' target='0' unit='0'/>
  </disk>
  <controller type='usb' index='0'>
    <address type='pci' domain='0x0000' bus='0x00' slot='0x01' function='0x2'/>
  </controller>
  <controller type='pci' index='0' model='pci-root'/>
  <controller type='virtio-serial' index='0'>
    <address type='pci' domain='0x0000' bus='0x00' slot='0x05' function='0x0'/>
  </controller>
  <controller type='ide' index='0'>
    <address type='pci' domain='0x0000' bus='0x00' slot='0x01' function='0x1'/>
  </controller>
  <interface type='bridge'>
    <source bridge='br_mgmt'/>
    <model type='virtio'/>
    <address type='pci' domain='0x0000' bus='0x00' slot='0x0c' function='0x0'/>
  </interface>
  <interface type='bridge'>
    <source bridge='br_tenant'/>
    <model type='virtio'/>
    <address type='pci' domain='0x0000' bus='0x00' slot='0x03' function='0x0'/>
  </interface>
  <serial type='tcp'>
    <source mode='bind' host='127.0.0.1' service='9099'/>
    <protocol type='telnet'/>
    <target port='0'/>
  </serial>
  <console type='tcp'>
    <source mode='bind' host='127.0.0.1' service='9099'/>
    <protocol type='telnet'/>
```

```
      <target type='serial' port='0'/>
    </console>
    <graphics type='vnc' port='5901' autoport='yes' listen='0.0.0.0'>
     <listen type='address' address='0.0.0.0'/>
    </graphics>
    <input type='mouse' bus='ps2'/>
    <input type='keyboard' bus='ps2'/>
    <sound model='ich6'>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x04' function='0x0'/>
    </sound>
    <video>
      <model type='vga' vram='16384' heads='1'/>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x02' function='0x0'/>
    </video>
    <memballoon model='virtio'>
      <address type='pci' domain='0x0000' bus='0x00' slot='0x07' function='0x0'/>
    </memballoon>
  </devices>
</domain>
```



CHAPTER 6

Installing Cisco VIM

The following topics tell you how to configure and install Cisco VIM:

Cisco VIM Installation Overview

Before you can install Cisco Virtual Infrastructure Manager, complete the procedures in Preparing for Cisco NFVI Installation, on page 41. If your management node does not have Internet access, complete the Preparing to Install Cisco NFVI on Management Nodes Without Internet Access, on page 37procedure. The Cisco VIM installation procedure provides two methods for downloading and installing the Cisco VIM installation files, from USB stick prepared for installation, or from the Internet.

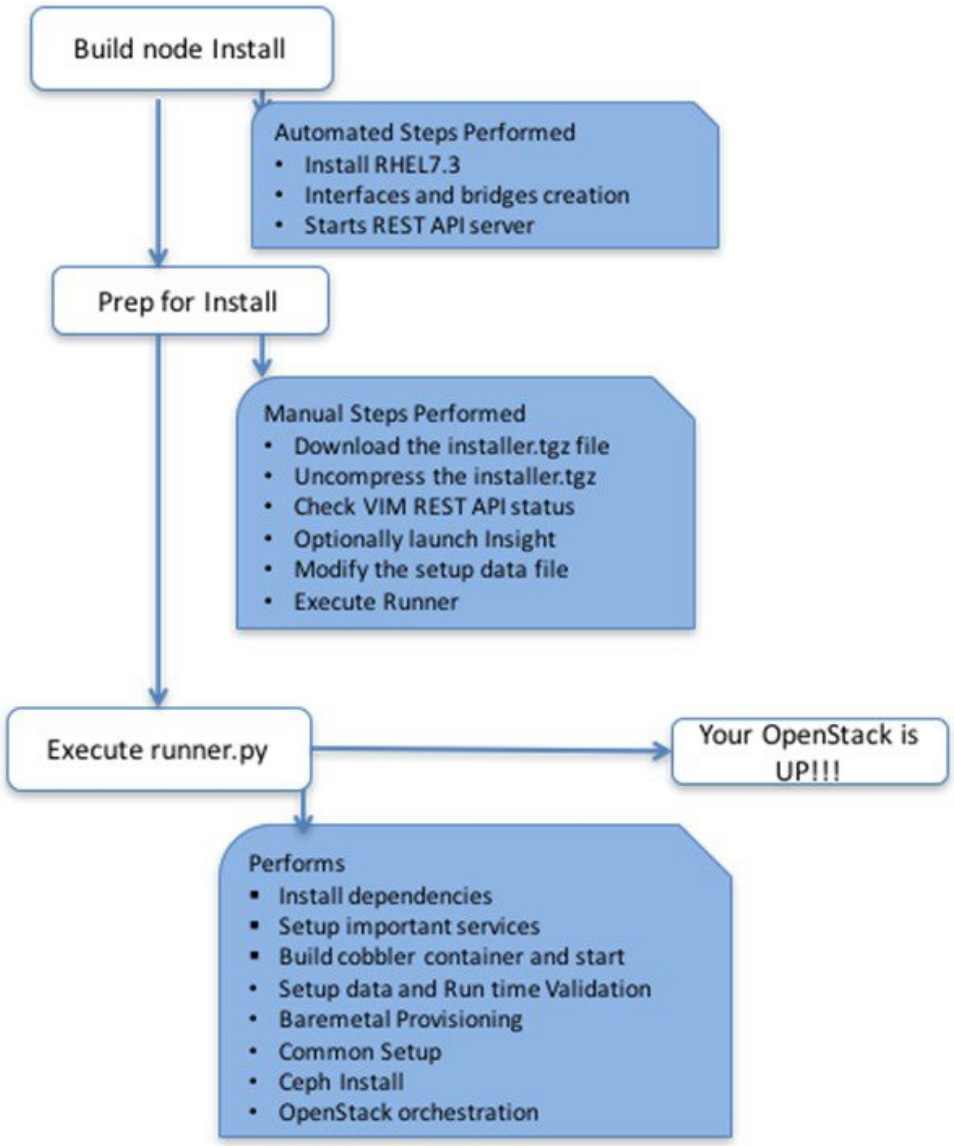
Completing these procedures ensures the Cisco NFVI network infrastructure is set up before the Cisco VIM installation. The bootstrap script is then kicked off, which downloads installer repository, installs Docker and dependencies and starts installer web service,

The Cisco VIM installer can then be launched. It validates the testbed configuration file (setup_data.yaml), creates new vNICs on the controller, compute, and dedicated storage nodes based on the configuration provided in the setup_data.yaml file. This is followed by the Preboot Execution Environment (PXE) boot of RHEL7.2 onto the target nodes (control, compute and storage) through the Cobbler server set up on the management node. After the installation, the Cisco VIM installer performs common steps across all the Cisco NFVI nodes.

Next, Ceph related packages required for managing the cluster and creating OSD and monitor nodes are installed on the control and storage nodes. By default, the minimum three Ceph monitor nodes are installed at the host level on the control nodes. These serve as management nodes and have the administration keyring. Ceph configurations, such as ceph.conf and Ceph client keyrings files, are stored under /etc/ceph on each controller. Each Ceph storage node associates an Object Storage Daemon (OSD) to a physical hard drive with a write journal on a separate SSD to support small block random I/O.

The following illustration provides an overview to the Cisco VIM installation.

Figure 29: Cisco VIM Installation Flow



If you have Cisco Insight, you will complete only part of the Cisco VIM installation procedure and proceed to the Installing Cisco VIM Insight (Tech Preview) on page procedure followed by Installing Cisco VIM through Cisco VIM Insight (Tech Preview) , on page 125 to complete the configuration and setup of Cisco VIM using the Cisco VIM Insight. If you do not have Cisco VIM Insight, you will configure Cisco VIM by editing the data_setup.yaml as described in the Cisco VIM installation.

Installing Cisco VIM

This procedure allows you to install Cisco VIM on a Cisco NFVI management node:

Before you begin

- You need Cisco NFVI installation files download site credentials from your Cisco account representative.
- For Management nodes with NO Internet access, you need USB stick containing the Cisco NFVI installation files. To prepare the USB stick, see the Preparing to Install Cisco NFVI on Management Nodes Without Internet Access, on page 37.

Step 1 If your management node does not have Internet access and you prepared a USB stick in Preparing to Install Cisco NFVI on Management Nodes Without Internet Access, on page 37, complete the following steps:

a) Insert the USB stick into the management node drive.

b) Run the import_artifacts.sh script to copy all artifacts onto the management node, for example:

cd ~/installer-<tag_id>/tools

./import_artifacts.sh

All the installation artifacts are copied to /var/cisco/artifacts/ on the management node

Step 2 If you are installing Cisco VIM Insight, navigate to Installing Cisco VIM Insight (Tech Preview) , on page 113 and complete the Cisco VIM Insight installation.

If you are not installing Cisco VIM Insight, complete the following steps.

Step 3 Change to the installer directory by running the following command:

```
cd ~/installer-<tag_id>
```

Step 4 Create a dir (for example, ~/Save/) to contain a copy of the setup_data.yaml file, the file that will configure Cisco NFVI for your particular implementation.

Step 5 Change to the openstack-configs directory and copy the example Cisco VIM setup_data.yaml file into the directory you just created:

```
cd openstack-configs/
cp setup_data.yaml.<C_or_B>_Series_EXAMPLE setup_data.yaml
~/Save/setup_data.yaml
```

Step 6 With a yaml editor, modify the copied example setup_data.yaml file as the data setup file for your implementation. This includes both Cisco NFVI data and OpenStack parameters. For details, see Cisco VIM Configuration Overview, on page 89.

Step 7 Run the installation:

```
./ciscovimclient/ciscovim --setupfile ~/Save/setup_data.yaml run
```

After the installation is complete, you can view the installation logs at /var/log/mercury.

Cisco VIM Client Details

Cisco VIM combines the CLI and API so that you can use the CLI or API installer transparently.

Note For a complete list of Cisco VIM REST API commands, see the *Cisco NFVI Administrator Guide*.

Before you use the Cisco VIM CLI, check that the API server is up and pointing to the right installer directory. You can execute the following command to validate the state of the API server and the installer directory it is referencing:

```
# cd installer-<tagid>/tools
#./restapi.py -a status
Status of the REST API Server:  active (running) since Thu 2016-08-18 09:15:39 UTC; 9h ago
REST API launch directory: /root/installer-<tagid>/
```

Verify the server status is active and the restapi launch directory is the same the directory from where the installation is launched. If the installer directory, or the REST API state is not correct, go to the target installer directory and execute the following:

```
# cd new-installer-<tagid>/tools
#./restapi.py -a setup

Check if the REST API server is running from the correct target directory
#./restapi.py -a status
Status of the REST API Server:  active (running) since Thu 2016-08-18 09:15:39 UTC; 9h ago
REST API launch directory: /root/new-installer-<tagid>/
```

The REST API tool also provides the options to restart, tear down and reset password for the REST API server as listed:

```
# ./restapi.py -h
usage: restapi.py [-h] --action ACTION [--yes] [--verbose]

REST API setup helper

optional arguments:
  -h, --help            show this help message and exit
  --action ACTION, -a ACTION
                        setup - Install and Start the REST API server.
                        teardown - Stop and Uninstall the REST API
       server.
                        restart - Restart the REST API server.
                        regenerate-password - Regenerate the password for
       REST API server.
                        reset-password - Reset the REST API password with
      user given password.
                        status - Check the status of the REST API server
  --yes, -y             Skip the dialog. Yes to the action.
  --verbose, -v         Perform the action in verbose mode.
```

If the REST API server is not running, executing **./ciscovimclinet/ciscovim** will show the following error message:

```
#./ciscovimclient/ciscovim –setupfile ~/Save/<setup_data.yaml> run
ERROR: Error communicating with https://<api_ip:8445> [Errno 111] Connection refused
```

If the installer directory, or the REST API state is not correct or it is pointing to an incorrect REST API launch directory, go to the installer-<tagid>/tools dir and execute:

```
# ./restapi.py --action setup
```

To confirm that the Rest API server state and launch directory is correct, execute:

```
# ./restapi.py --action status
```

If you ran the REST API recovery step on an existing pod, run the following command to ensure that the REST API server continues to manage the existing pod:

```
# cd installer-<tagid>/
#./ciscovimclient/ciscovim --setup_file <setup_data_file_path> --perform 7 -y
```

For an overview to the commands you can execute from the CLI, enter the following command:

```
./ciscovimclient/ciscovim --help
usage: ciscovim [--setupfile <setupdata_file>] <subcommand> ...

Command-line interface to the Cisco Virtualized manager

Positional arguments:
  <subcommand>
    add-computes        Add Computes to the OpenStack cloud; to add multiple compute nodes,
 enter
                         # cd installer-<tagid>/ #./ciscovimclient/ciscovim --setup_file
                        <setup_data_file_path> --perform 7 -y
    add-storage         Add storage to the system
    check-fernet-keys   Check whether the fernet keys are successfully
                        synchronized across keystone nodes
    commit              Commit an update
    install-status      Install status of the OpenStack cloud
    list-nodes          List of nodes in the OpenStack cloud
    list-steps          List steps
    partition-recovery  Control nodes recovery after network partition have
                        been resolved
    period-rotate-fernet-keys
                        Set the frequency of fernet keys rotation on Keystone
    reconfigure         Reconfigure your OpenStack cloud
    remove-computes     Remove Computes to the system
    remove-storage      Remove storage to the system
    replace-controller  Replace Controller from the system
    resync-fernet-keys  Resynchronize the fernet keys across all the keystone
                        nodes if needed
    rollback            Rollback an update
    rotate-fernet-keys  Trigger rotation of the fernet keys on Keystone
    run                 Perform a install operation
    update              Do an update on the system
    update-status       See the status of an update Operation
    upgrade             Upgrade your OpenStack cloud
    help                Display help about this program or one of its
                        subcommands.

Optional arguments:
  --setupfile <setupdata_file>

See "ciscovim help COMMAND" for help on a specific command.

To look at the help for a sub-command (e.g. run) execute the following:
./ciscovimclient/ciscovim help run
usage: ciscovim run [--join] [--perform <perform>] [--skip <skip>] [-y]

Perform a install operation

Optional arguments:
  --join               Join the installation process
  --perform <perform>  Perform the following steps.
```

```
  --skip <skip>        Skip the following steps.
  -y, --yes            Yes option to skip steps without prompt
[root@MercRegTB1 installer]#
```

You can also run the installer in multiple smaller steps. To understand the steps involved during installation execute the following command:

```
# ./ciscovimclient/ciscovim list-steps
Virtualized Infrastructure Manager:
===================================
+--------------------------+--------------+
| Operations               | Operation ID |
+--------------------------+--------------+
| INPUT_VALIDATION         |      1       |
| BUILDNODE_ORCHESTRATION  |      2       |
| VALIDATION               |      3       |
| BAREMETAL                |      4       |
| COMMONSETUP              |      5       |
| CEPH                     |      6       |
| ORCHESTRATION            |      7       |
| VMTP                     |      8       |
+--------------------------+--------------+
```

To execute the installer in steps, include specific steps from above. For example:

```
$ ./ciscovimclient/ciscovim run --perform 1,3 -y
```

Similarly, you can execute the installation using the skip option, where you explicitly indicate which options to skip. For example

```
$ ./ciscovimclient/ciscovim run --skip 1,3 -y
```

Note When using the step-by-step installation, keep a track of what steps are already completed, or unpredictable results might occur.

While the install time varies from pod to pod, typical installation times through the Internet for a UCS C-series with three controller, nine compute, and three storage are listed in the following table.

Table 11:

Operation ID	Operation	Estimated Time
1	Input validation	6 minutes
2	Management node orchestration	40 minutes
3	Validation (software and hardware)	30 seconds
4	Bare metal install	60 minutes
5	Common setup	10 minutes
6	Ceph	5 minutes
7	Orchestration	25 minutes
8	VMTP (external and provider networks)	14 minutes

Cisco VIM Configuration Overview

The following topics provide a list of Cisco NFVI configurations you must enter in setup_data.yaml with a yaml editor. These configurations must be performed prior to running the Cisco VIM installation. If you are installing Cisco Insight, you will complete the Cisco VIM data and OpenStack configurations using VIM Insight as described in Installing Cisco VIM through Cisco VIM Insight (Tech Preview) , on page 125 .

Configuring ToR Automatically

Cisco VIM 2.0, provides a complete automation of the cloud deployment. Cisco VIM, of this feature is to automate day-0 configuration of N9xxx series Top of Rack(ToR) switches. The purpose is to automate Power-On Auto Provisioning (post-POAP) configuration on ToR offering of Cisco VIM, which constitutes of one or more pair of identical Cisco N9300 series switches. The day-0 ToR automation configures the interfaces connected to the management (br_mgmt), control, compute, and storage nodes of the pod. In addition, it configures the VPC peer link interfaces for ToR pairs. The automation handles both B and C-series pods. The automation includes configuration of the edge ports in the leaf switches off which the hosts hang-out and the VPC peer link between the switches. The Auto-Configuration feature does not include the configuration of the spine switches, and the connectivity between the leaf and the spine; that is the upstream link of the spine switches that carry the external VLAN connectivity.

As the feature is a post-POAP automation provisioning, the management interface, vrf, and admin user needs to be pre-provisioned on each of the ToR switch. Also, ssh needs to be enabled in each ToRs. The recommended N9K switch software version for OVS/VLAN, LB/VXLAN and ML2/VPP based setup are 7.0(3)I4(6) and 7.0(3)I6(1). The recommended N9K switch software version for VTS based installation are 7.0(3)I2(2a) and 7.0(3)I2(2c) has to be running on the ToRs. Bootstraping the ToR image is still a manual process. The installer API interface (br_api) on the management node needs to be up and running, and the ssh to the management node through SSH must be working. You should be able to access each of the ToRs through its management interface from the Cisco VIM management node using SSH.

Setting Up the Cisco VIM Data Configurations

The Cisco VIM configuration file, setup_data.yaml, installs and configures the VIM deployment. When creating this file, take extreme care. Any change to this configuration after deployment, with the exception (example: NFVIMON, of adding and removing nodes etc) will cause a stack redeployment. Pay particular attention to the pod networking layout plan configured in setup_data.yaml because any future changes to it will require the pod to be reinstalled.

If your configurations are correct, the installation will go smoothly. Cisco recommends using a YAML editor on Linux (PyCharm, Komodo or vi/vim with YAML plugin) to edit this file. Items shown in brown must be changed to your specific testbed. Do not copy the examples shown below into your YAML file, because your browser might render the characters differently. If you are using the Cisco VIM installer, you will not be able to update the OpenStack config files (for example, ml2_conf.ini, and other files) directly. All OpenStack configurations must be in the setup_data.yaml file. This ensures that the installer has a view of the OpenStack deployment, so that it can reliably perform later software updates and upgrades. This ensures a consistent and repeatable installation, which is important. Key setup file parts are shown in the following sections.

Setting Up the ToR Configurations for B-series and C-series

The ToR configuration is driven through the mercury setup_data.yaml configuration. The information for automated TOR configuration is provided in two parts in the setup_data.yaml file. The common information

is in the TORSWITCHINFO section, whereas the information on individual switch ports connected to specific nodes are under SERVERS section for C-seires, and UCSM-COMMON section for B-series., if the entire TORSWITCHINFO section is not provided or CONFIGURE_TORS attribute under TORSWITCHINFO then all the ToR provisioning related steps will be skipped. The general ToR section contains attributes related to ToR connection, configuration for the management interface for the management node, and vPC peer details in case of ToR pairs.

Note The port-channel number for the vPC peer link interfaces, is derived from the Vpc domain. The ToRs are paired with each other based on their corresponding vpc_peer_link addresses.

```
TORSWITCHINFO:
      CONFIGURE_TORS: True
         SWITCHDETAILS:
      -
    hostname: K09-n9k-a # mandatory for NFVbench
    username: admin  # mandatory for NFVbench
    password: <redacted> # mandatory for NFVbench
    ssh_ip: <a.b.c.d>  # mandatory for NFVbench
    ssn_num: <xyz>
    vpc_peer_keepalive: <f.g.h.i>
    vpc_domain: <int>
    vpc_peer_port_info: <'eth1/45,eth1/46,eth1/47'>
    vpc_peer_vlan_info: <'NNNN,NNNN-NNNN'>
    br_mgmt_port_info: 'eth1/19'
    br_mgmt_po_info: <'NN'>
    br_mgmt_vlan_info: <'NNNN'>

  -
    hostname: K09-n9k-b # mandatory for NFVbench
    username: admin  # mandatory for NFVbench
    password: <redacted> # mandatory for NFVbench
    ssh_ip: <f.g.h.i>  # mandatory for NFVbench
    ssn_num: < xyz>
    vpc_peer_keepalive: < a.b.c.d>
    vpc_domain: <int>
    vpc_peer_port_info: <'eth1/45,eth1/46,eth1/47'>
    vpc_peer_vlan_info: <'NNNN,NNNN-NNNN'>
    br_mgmt_port_info: 'eth1/19'
    br_mgmt_po_info: <'NN'>
    br_mgmt_vlan_info: <'NNNN'>
```

The attributes for vpc_peer_vlan_info, vpc_domain, br_mgmt_po_info, and br_mgmt_vlan_info have to match across the ToRs, and should only be defined in only two of the TORs, where the management node is hanging off. The attribute for vpc_peer_vlan_info is optional. If it is not specified, it will derive a list of VLAN ids from the host/FI facing interfaces and br_mgmt interface. Also, the attribute for ssn_num which represents the chassis serial number is optional.

The chassis serial number can be obtained by executing the following command on each of the ToRs:

```
show license host-id
```

In the case of B-series, Cisco VIM configures the UCSMCOMMON section to declare the interface configuration under **tor_info_fi** and **tor_info_fi_redundant** for the FI.

Note ToR names need to match with names provided in the TORSWITCHINFO section.

```
UCSMCOMMON:
    ENABLE_QOS_FOR_PORT_PROFILE: true,
    ENABLE_QOS_POLICY: true,
    ENABLE_UCSM_PLUGIN: true,
     ucsm_ip: <p.q.r.s>,
     ucsm_password: <redacted>,
     ucsm_resource_prefix: c43b,
     ucsm_username: admin,
           tor_info_fi: {po: 18,  K09-n9k-a: eth1/17, K09-n9k-b: eth1/17}
           tor_info_fi_redundant: {po: 19,  K09-n9k-a: eth1/19, K09-n9k-b: eth1/19}
```

In this example of B-Series, tor_info is not declared in the SERVERES section as all connectivity is through the FI (controller, compute, and storage) declared in the UCSCOMMON section. VLANs for the FI facing interfaces are derived from the NETWORK segment ROLES for controller, compute, and storage nodes.

The SERVERS section declares the interface configurations for each of the controller, compute, and storage nodes under **tor_info.**

```
SERVERS:
  controller-1:
    rack_info: {rack_id: rack43X}
    cimc_info: {cimc_ip: <ip_addr>}
    tor_info: {po: 5, B9-TOR-9K-1: eth1/5, B9-TOR-9K-2: eth1/5}
controller-2:
    rack_info: {rack_id: rack43Y}
    cimc_info: {cimc_ip: <ip_addr>}
    tor_info: {po: 7, B9-TOR-9K-1: eth1/7, B9-TOR-9K-2: eth1/7}
  controller-3:
    rack_info: {rack_id: rack43Z}
    cimc_info: {cimc_ip: <ip_addr>}
    tor_info: {po: 9, B9-TOR-9K-1: eth1/9, B9-TOR-9K-2: eth1/9}
  compute-1:
    rack_info: {rack_id: rack43}
    cimc_info: {cimc_ip: <ip_addr>}
    tor_info: {po: 11, B9-TOR-9K-1: eth1/11, B9-TOR-9K-2: eth1/11}
  compute-2:
    rack_info: {rack_id: rack43}
    cimc_info: {cimc_ip: <ip_addr>}
    tor_info: {po: 13, B9-TOR-9K-1: eth1/13, B9-TOR-9K-2: eth1/13}
storage-1:
    rack_info: {rack_id: rack43}
    cimc_info: {cimc_ip: <ip_addr>}
    tor_info: {po: 14, B9-TOR-9K-1: eth1/14, B9-TOR-9K-2: eth1/14}
storage-2:
    rack_info: {rack_id: rack43}
    cimc_info: {cimc_ip: <ip_addr>}
    tor_info: {po: 15, B9-TOR-9K-1: eth1/15, B9-TOR-9K-2: eth1/15}
storage-3:
    rack_info: {rack_id: rack43}
    cimc_info: {cimc_ip: <ip_addr>}
    tor_info: {po: 16, B9-TOR-9K-1: eth1/16, B9-TOR-9K-2: eth1/16}
```

VLANS for host facing interfaces are derived from NETWORK section based on the server ROLES definition of each of the servers and their corresponding network profile roles assigned for each of the segments.

Setting Up Server Level information for C-series with Intel NIC

When the C-series pod is configured to run in a complete Intel NIC environment, the ToR configurations have an additional configuration ,that is, dp_tor_info section. Control plane and data plane traffic are broken out into two separate interfaces with VLAN limiting applied on each of the control and data interfaces facing each for the controller and compute nodes.

```
    c43b-control-1:
       rack_info: {rack_id: rack43}
     cimc_info: {cimc_ip: <ip_addr>}
       tor_info: {po: 9, K09-n9k-a: 'eth1/9, eth1/12'}
       dp_tor_info: {po: 12, K09-n9k-a: 'eth1/12, eth1/12'}
    c43b-compute-1:
       rack_info: {rack_id: rack43}
     cimc_info: {cimc_ip: <ip_addr>}
     tor_info: {po: 10, K09-n9k-a: 'eth1/10, eth1/13'}
       dp_tor_info: {po: 13, K09-n9k-a: 'eth1/13, eth1/13'}
```

Server Level Setup_data info for C-series with Intel NIC with SRIOV

When the C-series pod is configured to support SRIOV with Intel NIC, a third interface is configured to allow SRIOV traffic for the compute nodes. Switchports configured for SRIOV are not placed in a port-channel. VLAN limiting is applied to this interface for all the data plane related VLAN IDs.

```
c43b-compute-1:
       rack_info: {rack_id: rack43}
     cimc_info: {cimc_ip: <ip_addr>}
                 tor_info: {po: 10, K09-n9k-a: 'eth1/10, eth1/13'}
       dp_tor_info: {po: 13, K09-n9k-a: 'eth1/13, eth1/13'}
                 sriov_tor_info: { K09-n9k-a: eth1/33, K09-n9k-b: eth1/33}
```

Support for Custom Configuration

Custom Configuration is an optional procedure. The setup_data.yaml file has a section called CUSTOM_CONFIG to support custom configuration. Under the CUSTOM_CONFIG section, raw CLI commands can be provided at the global, port channel, and switchport level. CUSTOM_CONFIG is applied at the time of bootstrap and add-interfaces workflow steps.

For example: setup_data.yaml

```
TORSWITCHINFO:
  CONFIGURE_TORS: true
  CUSTOM_CONFIG:
    GLOBAL:
      [<'cli line 1'>,
       <'cli line 2'>,]
    PORTCHANNEL:
      [<'cli line 1'>]
    SWITCHPORT:
      [<'cli line 1'>,
       <'cli line 2'>,]
```

Intel NIC Support

Cisco VIM supports C-series pod running with either all Intel 710X NICs or Cisco VICs. In the case of Intel NIC, each server needs to have 2 of 4 port 710X cards. The orchestrator identifies the NIC support based on the following INTEL_NIC_SUPPORT values:

- False-This is the default value. The orchestrator assumes that all the servers have Cisco VIC
- True-The orchestrator assumes that all the servers have Intel NIC.

To define the value, run the following command

```
# INTEL_NIC_SUPPORT: <True or False>
```

A C-series pod, running Intel NIC, also supports SRIOV. By Default, SRIOV is not supported. To enable, define a value in the range 1-32 (32 is maximum) # INTEL_SRIOV_VFS: <integer>

Remote Registry Credentials

```
REGISTRY_USERNAME: '<username>'
REGISTRY_PASSWORD: '<password>'
REGISTRY_EMAIL: '<email@address.com>'
```

Common CIMC Access Information for C-series POD

```
CIMC-COMMON:
cimc_username: "admin"
cimc_password: <"cisco123">
```

UCSM Common Access Information for B-series POD

```
UCSMCOMMON:
ucsm_username: "admin"
ucsm_password: <"cisco123">
ucsm_ip: <"a.b.c.d">
ucsm_resource_prefix: <"skull"> # max of 6 chars
ENABLE_UCSM_PLUGIN: <True> #optional; if True, Cisco-UCSM will be used, if not defined,
default is False
MRAID_CARD: <True or False>
ENABLE_QOS_POLICY: True or False # only allowed if ENABLE_UCSM_PLUGIN is True
ENABLE_QOS_FOR_PORT_PROFILE: <True or False>
```

Note When you use Cisco UCS Manager to enable QOS Policy, remember that in certain NFV solutions guest VM (SRIOV) traffic must have heartbeat messages moving across the VMs at a higher priority. In this case the UCS Manager plugin uses a predefined QOS policy name, created by the installer, to attach to the port profile. Cisco VIM does not change the QOS flags that UCS Manager provides by default. You can configure two types of QOS profiles: nfvi (default) or media. For NFV, VM heartbeat messages will have a higher priority. For media, multicast traffic is prioritized on the tenant/provider network over other types of traffic such as SSH and HTTP. The QOS policy with UCS Manager is an optional feature. By default this feature is not enabled.

Configure Cobbler

```
## Cobbler specific information.
## kickstart:    static values as listed below
## cobbler_username: cobbler  #username to access cobbler server; static value of Cobbler;
 not user configurable
## admin_username: root # static value of root; not user configurable
## admin_ssh_keys: This is a generated key which will be put on the hosts.
##                  This is needed for the next install step, using Ansible.
COBBLER:
  pxe_timeout: 45                              # Optional parameter (in minutes); min of 30
 and max of 120, defaults to 45 mins
  cobbler_username: cobbler   # cobbler UI user; currently statically mapped to cobbler;
not user configurable
  admin_username: root        # cobbler admin user; currently statically mapped to root;
not user configurable
  #admin_password_hash should be the output from:
  #  python -c "import crypt; print crypt.crypt('<plaintext password>')"
  admin_password_hash: <Please generate the admin pwd hash using the step above; verify the
 output starts with $6>
  admin_ssh_keys:                              # Optional parameter
    - ssh-rsa
AAAAB3NzaC1yc2EAAAADAQABAAACAQDHaQJDE5tJWdrj5FuEZcJdaWlewDfsaxdEasxyj8Rr1dYS5DydQ36l1z/7tUN4PjA25/563xfQIZZxYJqbxdPWXXdJJVGg9UeK
 cisco@cisco-server
  kickstart:               # not user configurable
```

```
    control: ucs-b-and-c-series.ks
    compute: ucs-b-and-c-series.ks
    block_storage: ucs-b-and-c-series.ks
```

Configure Network

```
NETWORKING:
  domain_name: domain.example.com
#max of 4 NTP servers
  ntp_servers:
   - <1.ntp.example.com>
   - <2.ntp.example2.com >
#max of 3 DNS servers
  domain_name_servers:
    - <a.b.c.d>
  http_proxy_server: <a.b.c.d:port> # optional, needed if install is through internet, and
 the pod is behind a proxy
  https_proxy_server: <a.b.c.d:port> # optional, needed if install is through internet, and
 the pod is behind a proxy
  admin_source_networks: # optional, host based firewall to white list admin's source IP
    - 10.0.0.0/8
    - 172.16.0.0/12
```

Note External access to the management node is made through the IP address configured on the br_api interface. To provide additional security for this connection, the optional **admin_source_networks** parameter is provided. When specified, access to administrator services is only allowed from the IP addresses specified on this list. Use this setting with care, since a misconfiguration can lock out an administrator from accessing the management node through the network. Recovery can be made by logging in through the console and reconfiguring this setting.

Define Network Segments

```
networks:
- # CIMC network section is applicable only for B-series
   vlan_id: <107>
   subnet: <10.30.115.192/28> # true routable network
   gateway: <10.30.115.193>
   pool:
       - 10.30.115.194 to 10.30.115.206
   segments:
       - cimc
vlan_id: <108>
   subnet: <10.30.116.192/28> # true routable network
   gateway: <10.30.116.193>
   segments:
       - api
-
   vlan_id: 3000
   subnet: 13.13.1.0/24
   gateway: 13.13.1.1
   pool:
    # specify the pool range in form of <start_ip> to <end_ip>, IPs without the "to"
    # will be treated as an individual IP and will be used for configuring
       - 13.13.1.11 to 13.13.1.200
   segments: #management and provisioning will always be the same
      - management
      - provision

# OVS-VLAN requires VLAN-id as "None"
# LinuxBridge-VXLAN requires valid VLAN-id
```

```
-
   vlan_id: <vlan_id or None>
   subnet: 14.13.1.0/24
   gateway: 14.13.1.1
   pool:
     - 14.13.1.11 to 14.13.1.254
   segments:
    - tenant
-
   vlan_id: 3005
   subnet: 15.13.1.0/24
   gateway: 15.13.1.1
   pool:
     - 15.13.1.11 to 15.13.1.254
   segments:
     - storage

# optional network "external"
-
vlan_id: <108>
   segments:
     - external

# optional network "provider"; None for C-series, vlan range for B-series
-
vlan_id: "<None or 3200-3210>"
   segments:
    - provider
```

Define Server Roles

In the Roles section, add the hostname of the servers and their corresponding roles. In the case of micro-pod, specify the same server names under control, compute, and ceph. Also, the number of servers under each role has to be three for micro-pod.

```
ROLES:    -□ for PODTYPE: fullon
 control:
   - Your_Controller_Server-1_HostName
   - Your_Controller_Server-2_HostName
   - Your_Controller_Server-3_HostName
 compute:
   - Your_Compute_Server-1_HostName
   - Your_Compute_Server-2_HostName
   - ……
   - Your_Compute_Server-n_HostName
 block_storage:
   - Your_Ceph_Server-1_HostName
   - Your_Ceph_Server-2_HostName
   - Your_Ceph_Server-3_HostName
object_storage:
networker:
ROLES:    -□ for PODTYPE: micro
 control:
   - Your_Server-1_HostName
   - Your_Server-2_HostName
   - Your_Server-3_HostName
 compute:
   - Your_Server-1_HostName
   - Your_Server-2_HostName
   - Your_Server-3_HostName
 block_storage:
   - Your_Server-1_HostName
   - Your_Server-2_HostName
```

```
   - Your_Server-3_HostName
object_storage:
networker:

# Server common
# Provide the username (default: root)
SERVER_COMMON:
   server_username: root
```

Note The maximum length of non-FQDN hostname is 32 characters. In this example, the length of Your_Controller_Server-1_HostName hostname is 33 characters. So, change the hostname length to 32 or less characters in both the ROLES and SERVERS section.

Cisco VIM introduces a new topology type called micro-pod to address solutions that have requirements of high availability, but with limited compute and storage needs. In this deployment model, the control, compute, and storage services reside on each of the three nodes that constitute the pod. Cisco VIM does not support the expansion of the micro-pod to accommodate larger storage or compute node. Each cloud application can decide the type of pod needed based on their resource (mem, storage consumption) requirements. In CiscoVIM Release 2.0, the micro-pod option supports only OVS/VLAN with Cisco-VIC on a specific BOM.

To enable the micro-pod option, update the setup_data as follows:

```
POD_TYPE: micro
```

Define Servers - C-Series Pod Example

Note The UCS C-Series maximum host name length is 32 characters.

```
SERVERS:
Your_Controller_Server-1_HostName:
cimc_info: {'cimc_ip': '172.22.191.36'}
rack_info: {'rack_id': 'RackA'}
#hardware_info: {'VIC_slot': '7'} # optional; only needed if vNICs need to be created on a
 specific slot, e.g. slot 7
#management_ip: <static_ip from management pool> #optional, if defined for one server, has
 to be defined for all nodes
#cimc username, password at a server level is only needed if it is different from the one
defined in the CIMC-COMMON section
Your_Controller_Server-2_HostName:
cimc_info: {'cimc_ip': '172.22.191.37', 'cimc_username': 'admin','cimc_password': 'abc123'}
rack_info: {'rack_id': 'RackB'}

Your_Controller_Server-3_HostName:
cimc_info: {'cimc_ip': '172.22.191.38'}
rack_info: {'rack_id': 'RackC'}
hardware_info: {'VIC_slot': '7'} # optional only if the user wants a specific VNIC to be
chosen

Your_Storage_or_Compute-1_HostName:
cimc_info: {'cimc_ip': '172.22.191.40'}
rack_info: {'rack_id': 'RackA'}
hardware_info: {'VIC_slot': '3'} # optional only if the user wants a specific VNIC to be
chosen

.. .. similarly add more computes and 3 storage info
```

Note Cisco VIM installation requires that controller node Rack IDs be unique. The intent it to indicates the physical rack location so physical redundancy is provided within the controllers. If controller nodes are installed all in the same rack, you must assign a unique rack ID to prepare for future Cisco NFVI releases that include rack redundancy. However, compute and storage nodes to not have rack ID restrictions.

Define Servers - B-Series Pod Example

Note For UCS B-Series servers, the maximum host name length is 16 characters.

```
SERVERS:
Your_Controller_Server-1_HostName:
rack_info: {'rack_id': 'rack2'}
ucsm_info: {'server_type': 'blade',
'chassis_id': 1,
'blade_id' : 1}
Your_Controller_Server-2_HostName:
rack_info: {'rack_id': 'rack3'}
ucsm_info: {'server_type': 'blade',
'chassis_id': 2,
'blade_id' : 1}
Your_Controller_Server-3_HostName:
rack_info: {'rack_id': 'rack4'}
ucsm_info: {'server_type': 'blade',
'chassis_id': 2,
'blade_id' : 4}
#management_ip: <static_ip from management pool> #optional, if defined for one server,
has to be defined for all nodes
Your_Compute-1_HostName:
rack_info: {'rack_id': 'rack2'}
ucsm_info: {'server_type': 'blade',
'chassis_id': 2,
'blade_id' : 2}
.. add more computes as needed

Your_Storage-1_HostName:
rack_info: {'rack_id': 'rack2'}
ucsm_info: {'server_type': 'rack',
'rack-unit_id': 1}
Your_Storage-2_HostName:
rack_info: {'rack_id': 'rack3'}
ucsm_info: {'server_type': 'rack',
'rack-unit_id': 2}
Your_Storage-3_HostName:
rack_info: {'rack_id': 'rack4'}
ucsm_info: {'server_type': 'rack',
'rack-unit_id': 3}

# max # of chassis id: 24
# max # of blade id: 8
#max # of rack-unit_id: 96
```

Note Cisco VIM requires that controller Rack IDs be unique to indicate the physical rack location and provide physical redundancy for controllers. If your controllers are all in the same rack, you must still assign a unique rack ID to controllers to provide for future rack redundancy. Compute and storage nodes have no Rack ID restrictions.

Multiple VLAN Trunking with SRIOV using UCSM for UCS B-Series Pods

Some NFV solutions require the guest VM single root I/O virtualization (SRIOV) to send and receive VLAN tagged packets. Because the UCSM plugin in Cisco VIM creates the SR-IOV ports and attaches them to the guest VM, the port must be brought up in trunk mode. To support this, special network names are provided to the UCSM plugin at initialization. Each network supports a different set of application VLANs, which are included in the Cisco VIM configuration. When the port profile is created in UCSM, it checks to see if the port is created on one of the special neutron networks. If so, it adds the VLANs provided in the setup_data.yaml to the UCSM port profile. In effect, this allows the VM-FEX port to trunk all of the VLANs. A typical configuration example in setup_data is shown below. This is an optional feature which, by default, is not enabled. If it is not enabled, the section shown below is absent. SRIOV with Multi-VLAN trunking is only available in the UCS B-Series pod enabled with UCSM plugin.

```
SRIOV_MULTIVLAN_TRUNK:
     - network_name1: 124, 2:3,9:13
     - network_name2: 4, 5:7, 8
#all the vlans listed are unique in the entire setup_data.yaml
```

Setting Up the Cisco VIM OpenStack Configurations

The following sections provide examples of Cisco VIM OpenStack configurations in the setup_data.yaml file. **OpenStack Admin Credentials**

```
ADMIN_USER: <admin>
ADMIN_TENANT_NAME: <admin tenant>
```

OpenStack HAProxy and Virtual Router Redundancy Protocol Configuration

```
external_lb_vip_address: An externally routable ip address in API nework
VIRTUAL_ROUTER_ID: vrrp_router_id #eg: 49 (range of 1-255)
internal_lb_vip_address: <Internal IP address on mgmt network>
```

OpenStack DNS Name Configuration

For web and REST interfaces, names are commonly used instead of IP addresses. You can set the optional external_lb_vip_fqdn parameter to assign a name that resolves to the external_lb_vip_address. You must configure the services to ensure the name and address match. Resolution can be made through DNS and the Linux /etc/hosts files, or through other options supported on your hosts. The Cisco VIM installer adds an entry to /etc/hosts on the management and other Cisco NFVI nodes to ensure that this resolution can be made from within the pod. You must ensure the resolution can be made from any desired host outside the pod.

```
external_lb_vip_fqdn: host or DNS name matching external_lb_vip_address
```

OpenStack TLS and HTTPS Configuration

Enabling TLS is important to ensure the Cisco VIM network is secure. TLS encrypts and authenticates communication to the cloud endpoints. When TLS is enabled, two additional pieces of information must be provided to the installer: haproxy.pem and haproxy-ca-crt. These must be placed in the ~/installer-xxxx/openstack-configs directory.

haproxy.pem is the server side certificate file in PEM format. It must include the server certificate, any intermediate certificates, and the private key for the server. The common name of the certificate must match the external_lb_vip_address and/or the external_lb_vip_fqdn as configured in the setup_data.yaml file. haproxy-ca.crt is the certificate of the trusted certificate authority that signed the server side.

For production clouds, these certificates should be provided by a trusted third party CA according to your company IT policy. For test or evaluation clouds, self-signed certificates can be used quickly enable TLS. For convenience, the installer includes a script that will create and install self-signed certificates

Note Do not use the certificates generated by this tool for production. They are for test purposes only.

To use this tool, make the following changes to the setup data file, then run the tool:

```
external_lb_vip_address: <IP address on external network>
external_lb_vip_tls: True
external_lb_vip_fqdn: host or DNS name matching external_lb_vip_address (if FQDN is needed)
```

To run the tool, from the /working_dir/ directory, execute **./tools/tls_cert_gen.sh -f openstack-configs/setup_data.yaml.**

OpenStack Glance Configuration with Dedicated Ceph

For OpenStack Glance, the OpenStack image service, the dedicated Ceph object storage configuration is show below. Do not change it. The Ceph and Glance keys are generated during the Ceph installation step, so you do not need to specify the keys in the setup_data.yaml file.

```
STORE_BACKEND: ceph #supported as 'ceph' for ceph backend store; don't change
```

OpenStack Glance Configuration

```
STORE_BACKEND: <set to 'file' for local filesystem store>
```

OpenStack Cinder Configuration with Dedicated Ceph

For OpenStack Cinder, the OpenStack storage service, the dedicated Ceph object storage configuration is show below. Do not change it. The Ceph and Cinder keys are generated during the Ceph installation step, so you do not need to specify the keys in setup_data.yaml file. Use the **vgs** command to check your volume groups available on your controller nodes. The controller nodes run the Cinder volume containers and hold the volume groups for use by Cinder. If you have available disks and want to create a new volume group for Cinder use the **vgcreate** command.

```
VOLUME_DRIVER: ceph
```

OpenStack Nova Configuration

To reduce the boot time, the NOVA_BOOT_FROM parameter is set to local for Cisco VIM in the OpenStack Newton release. While this reduces the boot time, it does not provide Ceph back end redundancy. To overwrite it, you can set NOVA_BOOT_FROM to **ceph**.

```
# Nova boot from CEPH
NOVA_BOOT_FROM: <ceph> #optional
```

OpenStack Neutron Configuration

OpenStack Neutron configuration is shown below.

```
# ML2 Conf - choose from either option 1 or option 2
# option 1: LinuxBridge-VXLAN
MECHANISM_DRIVERS: linuxbridge
```

```
TENANT_NETWORK_TYPES: "VXLAN"
Or
## option 2: OVS VLAN
MECHANISM_DRIVERS: openvswitch
TENANT_NETWORK_TYPES: "VLAN"
# VLAN ranges can be one continuous range or comma separated discontinuous ranges
TENANT_VLAN_RANGES: 3001:3100,3350:3400
# Jumbo MTU functionality. Only in B series, OVS-VLAN
# more info here [Mercury] Jumbo MTU feature in Mercury (B Series)
# ENABLE_JUMBO_FRAMES: True

# for Provider networks, just specifying the provider in the segments under
# the NETWORKING section is enough.
# Note : use phys_prov as physical_network name when creating a provider network
```

Note When creating an external or provider network, use physical_network=phys_ext (need to be specified) or physical_network=phys_prov (need to be specified), respectively.

The JUMBO_MTU functionality is available only for OVS over VLAN in a UCS B-Series pod. In a VLAN setup, by default the MTU size is set to 1500 (1450 for VXLAN) and 8972 bytes. When JUMBO_MTU is enabled (with 28 bytes left for the header), the VLAN MTU will be 9000 and VXLAN will be 8950.

Cisco VIM also supports the installation of a handful of optional services, namely, Keystone v3 and Heat. OpenStack Heat is an orchestration service that allows you to spin up multiple instances, logical networks, and other cloud services in an automated fashion. To enable Heat, add the following Optional Services section in the setup_data.yaml file:

```
# Optional Services:
OPTIONAL_SERVICE_LIST:
- heat
```

To disable Heat, remove the Optional Services section from the setup_data.yaml file. The Optional Services support provides an infrastructure to support additional services in the future.

Note Auto-scaling is not supported in Cisco VIM, release 2.0.

To enhance the security portfolio and multi-tenancy with the use of domains, the Keystone v3 support is added in Cisco VIM release 2.0 from an authentication end-point. Keystone v2 and Keystone v3 are mutually exclusive; an administrator has to decide the authentication end-point during installation. By default, the VIM orchestrator picks keystone v2 as the authentication end-point.

To enable Keystone v3, add the following line under the optional services section.

```
# Optional Services:
OPTIONAL_SERVICE_LIST:
- keystonev3
```

LDAP support with Keystone v3

With the introduction of Keystone v3, the OpenStack service authentication can now be delegated to an external LDAP server. In Cisco VIM 2.0, this feature has been introduced optionally if the authorization is done by Keystone v3.

The pre-requisite for enabling LDAP integration is that the LDAP endpoint should be reachable from all the Controller nodes that run OpenStack Keystone Identity Service.

To avail the LDAP support with Keystone v3 feature, add the following section to the setup_data during the installation of the pod:

```
LDAP:
  domain: <Domain specific name>
  user_objectclass: <objectClass for Users> # e.g organizationalPerson
  group_objectclass: <objectClass for Groups> # e.g. groupOfNames
  user_tree_dn: '<DN tree for Users>' # e.g. 'ou=Users,dc=cisco,dc=com'
  group_tree_dn: '<DN tree for Groups>' # e.g. 'ou=Groups,dc=cisco,dc=com'
  suffix: '<suffix for DN>' # e.g. 'dc=cisco,dc=com'
  url: '<ldap:// host:port>' # e.g. 'ldap://172.26.233.104:389'
  user: '<DN of bind user>' # e.g. 'dc=admin,dc=cisco,dc=com'
  password: <password> # e.g. password of bind user
```

Note The parameter values differ based on the Directory Service provider. For Example, OpenLDAP or Microsoft Active Directory.

Integrating identity with LDAP over TLS: The automation supports keystone integration with LDAP over TLS. In order to enable TLS, the CA root certificate must be presented as part of the /root/openstack-configs/haproxy-ca.crt file. The url parameter within the LDAP stanza must be set to *ldaps*.

The url parameter supports the following format:

```
url:  '<ldaps | ldap>://<FQDN | IP-Address>:[port]'
```

The protocol can be one of the following: ldap for non-ssl and ldaps when TLS has to be enabled.

The ldap host can be a fully-qualified domain name (FQDN) or an IP Address depending on how the SSL certificates are generated.

The port number is optional. If the port number is not provided, the ldap services are assumed to be running on the default ports. For example, 389 for non-ssl and 636 for ssl. However, if these ports are not the default ports, then the non-standard port numbers must be provided.

OpenStack Object Storage integration with Cisco VIM

Cisco VIM supports automated integration with a customer-managed object storage solution. The integration points reside primarily in the OpenStack Identity (Keystone) component of Cisco VIM. In the Cisco VIM 2.0, this integration is restricted to Keystone v2 only. It currently integrates with SwiftStack as the choice of object storage solution. The deployment assumes a customer-managed SwiftStack solution. Installation of the SwiftStack Controller/PACO cluster is out of scope of this document and customer should reach out to the SwiftStack team for license and installation details. While OpenStack can support multiple endpoints for a given object-store service, the current setup in the context of automation supports a single Keystone object-store service per SwiftStack PACO cluster endpoint.

The current automation uses the admin role for authentication and authorization of SwiftStack users between the Keystone SwiftStack tenant and SwiftStack account.

Pre-requisites

For a customer-managed deployment model, the minimum pre-requisites are:

- You must have a SwiftStack controller, Cluster deployed with appropriate PAC (Proxy/Account/Container) and Object configured ahead of time.
- You must know the Swift endpoint of the PAC outward facing IP address, the corresponding admin user, password and service tenant information at the time of configuring Keystone integration.

- The networking should be configured in such a way that the PAC outward facing IP address and the pod API network can talk to each other.The Keystone Auth and Keystone Auth Token middleware must be pre-configured in SwiftStack (see Keystone Configuration Requirements in SwiftStack, on page 102)

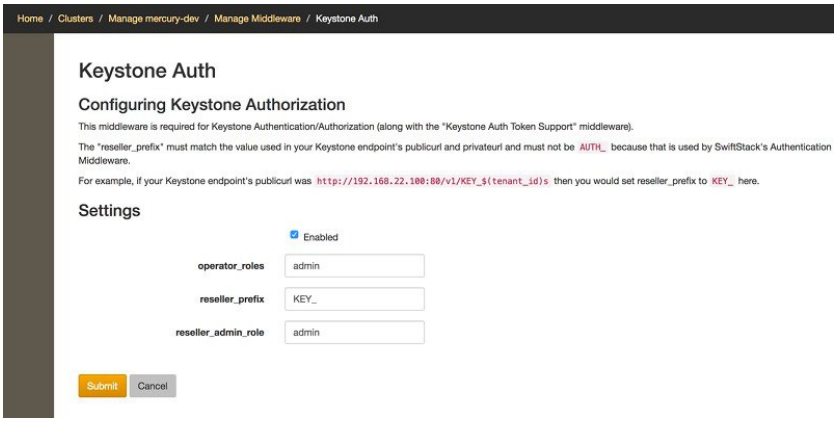
The OpenStack controllers must have network reachability to the SwiftStack API endpoints, so that the Horizon and Cinder Backup service can talk to the SwiftStack endpoints.

Keystone Configuration Requirements in SwiftStack

To configure Keystone authorization, from the SwiftStack controller, choose the **Cluster** > **Manage** > **Middleware** > **Keystone Auth** option.

Note The reseller_prefix setting enables the Keystone Auth middleware invocation at the time of authentication.

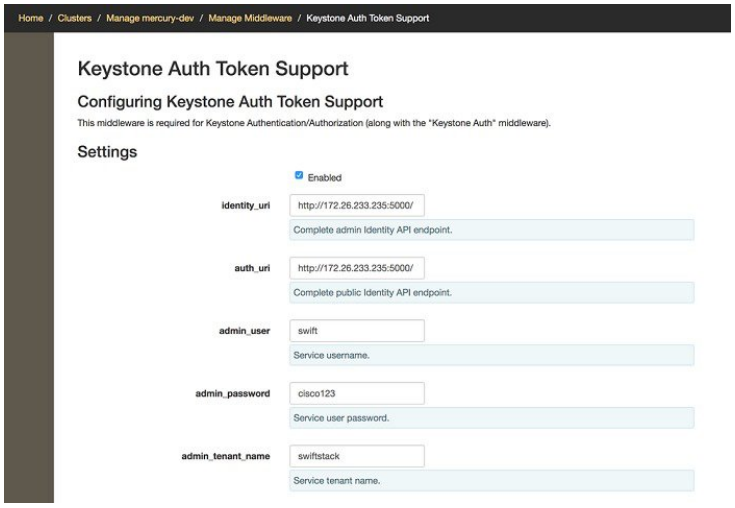
Figure 30: Configuring Keystone



To configure Keystone Auth Token Support, from the SwiftStack controller, choose the **Cluster** > **Manage** > **Middleware** > **Keystone Auth Token Support** option.

Note auth_uri is deprecated.

Figure 31: Keystone Auth



Usage in Cisco VIM

In order to support SwiftStack endpoint configuration, the following section needs to be configured in the setup_data.yaml file.

```
########################################
# Optional Swift configuration section
########################################
# SWIFTSTACK: # Identifies the objectstore provider by name
#   cluster_api_endpoint: <IP address of PAC (proxy-account-container) endpoint>
#   reseller_prefix: <Reseller_prefix configured in Swiftstack Keystone middleware E.g KEY_>
#   admin_user: <admin user for swift to authenticate in keystone>
#   admin_password: <swiftstack_admin_password>
#   admin_tenant: <The service tenant corresponding to the Account-Container used by
Swiftstack>
#   protocol: <http or https> # protocol that swiftstack is running on top
```

The automation supports two modes of Integration with SwiftStack- Integration during fresh installation of the pod and a reconfigure option to add a SwiftStack endpoint to an existing pod running Cisco VIM 2.0.

In the fresh installation mode, the addition of the Optional Swift configuration section in the setup_data.yaml file will automatically provision the following in Keystone:

- Keystone service for Object Store.
- Keystone endpoints for the Object Store service.
- A SwiftStack admin user with admin role in a SwiftStack tenant.

Integration Testing: In order to test if the Keystone integration has been successful, request a token for the configured swift user and tenant.

The output must contain a properly generated endpoint for the object-store service that points to the SwiftStack PAC cluster endpoint with the expected "reseller_prefix".

For example:

KEY_curl -d '{"auth":{"passwordCredentials":{"username": "<username>", "password": "<password>"},"tenantName":"<swift-tenant>"}}' -H "Content-type: application/json" < OS_AUTH_URL >/tokens

The output should list endpoints generated by Keystone for the object-store cluster endpoint of SwiftStack for the user tenant (SwiftStack account).

A sample output snippet (all IP and Keys are just examples, they will vary from pod to pod):

```
  {
      "access": {
          "metadata": {
              "is_admin": 0,
              "roles": [
                  "33f4479e42eb43529ec14d3d744159e7"
              ]
          },
          "serviceCatalog": [
          {
                          "endpoints": [
                              {
                                  "adminURL": "http://10.30.116.252/v1",
                                  "id": "3ca0f1fee75d4e2091c5a8e15138f78a",
                                  "internalURL":
"http://10.30.116.252/v1/KEY_8cc56cbe99ae40b7b1eaeabb7984c77d",
                                  "publicURL":
"http://10.30.116.252/v1/KEY_8cc56cbe99ae40b7b1eaeabb7984c77d",
                                  "region": "RegionOne"
                              }
                          ],
                          "endpoints_links": [],
                          "name": "object-store",
                          "type": "object-store"
                      },
          ......
```

Verify that the Keystone user has access to the SwiftStack cluster. Using the token generated preceding for the swiftstack user and tenant, make a request to the SwiftStack cluster:

```
curl -v -H  "x-auth-token: <auth-token>"
http://10.30.116.252/v1/KEY_8cc56cbe99ae40b7b1eaeabb7984c77d
```

This command displays all the containers (if present) for the SwiftStack tenant (account).

Integrating SwiftStack over TLS

Integrating SwiftStack over TLS: The automation supports SwiftStack integration over TLS. To enable TLS, the CA root certificate must be presented as part of the /root/openstack-configs/haproxy-ca.crt file. The **protocol** parameter within the SWIFTSTACK stanza must be set to **https.** As a pre-requisite, the SwiftStack cluster has to be configured to enable HTTPS connections for the SwiftStack APIs with termination at the proxy servers.

Cinder Volume Backup on SwiftStack

Cisco VIM, enables cinder service to be configured to backup its block storage volumes to the SwiftStack object store. This feature is automatically configured if the SWIFTSTACK stanza is present in the setup_data.yaml file. The mechanism to authenticate against SwiftStack during volume backups leverages the same keystone SwiftStack endpoint configured for use to manage objects. The default SwiftStack container to manage cinder volumes within the Account (Keystone Tenant as specified by "admin_tenant") is currently defaulted to **volumebackups**

Once configured, cinder backup service is enabled automatically as follows:

```
cinder service-list
+-----------------+---------------+------+---------+-------+----------------------------+----------------+
| Binary          | Host          | Zone | Status  | State | Updated_at
| Disabled Reason     |
+-----------------+---------------+------+---------+-------+----------------------------+----------------+
| cinder-backup    | c43b-control-1 | nova | enabled | up    | 2017-03-27T18:42:29.000000
| -               |
| cinder-backup    | c43b-control-2 | nova | enabled | up    | 2017-03-27T18:42:35.000000
| -               |
| cinder-backup    | c43b-control-3 | nova | enabled | up    | 2017-03-27T18:42:33.000000
| -               |
| cinder-scheduler | c43b-control-1 | nova | enabled | up    | 2017-03-27T18:42:32.000000
| -               |
| cinder-scheduler | c43b-control-2 | nova | enabled | up    | 2017-03-27T18:42:32.000000
| -               |
| cinder-scheduler | c43b-control-3 | nova | enabled | up    | 2017-03-27T18:42:31.000000
| -               |
| cinder-volume    | c43b-control-1 | nova | enabled | up    | 2017-03-27T18:42:35.000000
| -               |
| cinder-volume    | c43b-control-2 | nova | enabled | up    | 2017-03-27T18:42:30.000000
| -               |
| cinder-volume    | c43b-control-3 | nova | enabled | up    | 2017-03-27T18:42:32.000000
| -               |
+-----------------+---------------+------+---------+-------+----------------------------+----------------+
```

Backing up of an existing cinder volume.

```
openstack volume list
+--------------------------------------+--------------+-----------+------+-------------+
| ID                                   | Display Name | Status    | Size | Attached to |
+--------------------------------------+--------------+-----------+------+-------------+
| f046ed43-7f5e-49df-bc5d-66de6822d48d | ss-vol-1     | available |    1 |             |
+--------------------------------------+--------------+-----------+------+-------------+

openstack volume backup create f046ed43-7f5e-49df-bc5d-66de6822d48d
+-------+--------------------------------------+
| Field | Value                                |
+-------+--------------------------------------+
| id    | 42a20bd1-4019-4571-a2c0-06b0cd6a56fc |
| name  | None                                 |
+-------+--------------------------------------+

openstack container show volumebackups
+--------------+--------------------------------------+
| Field        | Value                                |
+--------------+--------------------------------------+
| account      | KEY_9d00fa19a8864db1a5e609772a008e94 |
| bytes_used   | 3443944                              |
| container    | volumebackups                        |
| object_count | 23                                   |
+--------------+--------------------------------------+

swift list volumebackups

volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00001
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00002
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00003
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00004
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00005
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00006
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00007
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00008
```

```
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00009
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00010
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00011
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00012
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00013
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00014
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00015
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00016
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00017
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00018
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00019
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00020
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc-00021
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc_metadata
volume_f046ed43-7f5e-49df-bc5d-66de6822d48d/20170327185518/az_nova_backup_42a20bd1-4019-4571-a2c0-06b0cd6a56fc_sha256file
```

Enabling NFVBench on Cisco VIM

This section describes how to setup and use NFVBench with Cisco VIM.

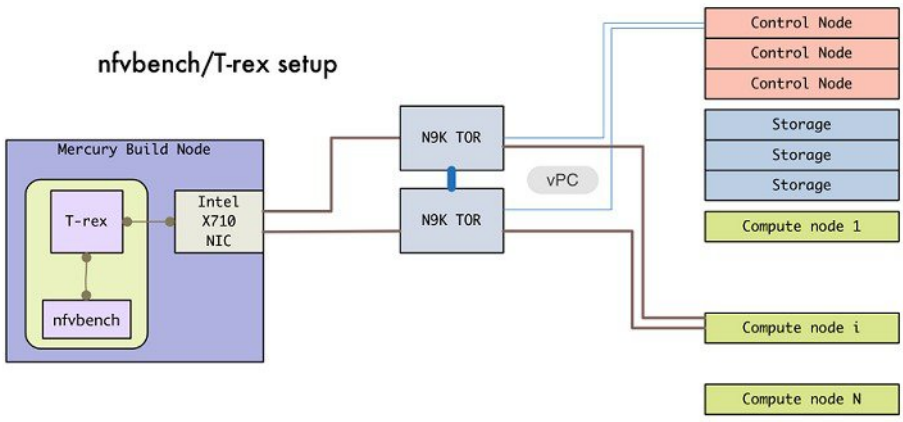
Once the pre-requisites for the management node hardware (Intel NIC) are met, add the NFVBench configurations in the setup_data.yaml. By default, NFVBench configuration is not enabled in Cisco VIM 2.0.

Before you begin

- NFVBench offering in Cisco VIM, requires a 10GE Intel NIC (Intel X710 NIC (4 x 10G) or Intel-520 (2x10G)) to be installed on the management node.
- To interact with Intel NIC, TRex traffic generator uses DPDK interface, and makes use of hardware instead of just software to generate packets. This approach is more scalable and enables NFVBench to perform tests without software limitations.

If your NIC has more than two ports, use the first two ports only. Connect the first port to the first ToR switch (order is given by setup_data.yaml) and the second port to the second TOR switch. In case of only one ToR switch connect the first two ports to it as shown in the NFVBench Topology figure.

Figure 32: NFVBench topology setup



Step 1 To enable the NFVBench, set the following command:

```
NFVBENCH:
   enabled: True    # True or False
   tor_info: {switch_a_hostname: ethx/y, switch_b_hostname: ethx/y} # mandatory
#  tor_info: {switch_c_hostname: 'etha/b,ethx/y'} # use if there is only one TOR switch
   vtep_vlans: vlan_id1,vlan_id2 # mandatory only when mechanism driver is VTS, or tenant type is
VXLAN
#  nic_ports: int1,int2             # Optional input, indicates which 2 of the 4 ports in the 10 G
intel NIC ports on the on the management node is the    NFVBENCH tool using to send and receive
traffic. If nothing is specified, the tool assumes its Port 1,2 i.e. the first 2 ports that will be
 us
# Please refer to the VTS_PARAMETERS and TORSWITCHINFO if NFVbench is enabled
# Required when mechanism driver is VTS
VTS_PARAMETERS:
   …
   VTS_NCS_IP: '<vtc_ssh_username>'   # Required parameter when VTS enabled
   VTC_SSH_USERNAME: '<vtc_ssh_username>'   # mandatory for NFVbench
   VTC_SSH_PASSWORD: '<vtc_ssh_password>'   # mandatory for NFVbench
# Minimal settings always required with NFVbench
TORSWITCHINFO:
   CONFIGURE_TORS: True
   …
   SWITCHDETAILS:
   - hostname: <switch_a_hostname>
     username: admin
     password: <password>
     ssh_ip: <ssh access to the switch a

   - hostname: <switch_b_hostname>
     username: admin
     password: <password>
     ssh_ip: <ssh access to the switch b
```

The tor_info provides the information to configure the TOR switches. Two ports specified by interfaces will be configured in trunk mode in the same port-channel **po**. NFVBench needs the login details to access ToR details and retrieve TX/RX counters. Manual configuration is required if the 'CONFIGURE_TORS' is set to 'True'.

With VTS as mechanism driver additional settings are needed. NFVBench needs access to VTS NCS to perform cleanup after it detaches traffic generator port from VTS. Also a pair of VTEP VLANs is required for VLAN to VxLAN mapping. Value can be any random VLAN ID. Note that vtep_vlans field is required if VxLAN is used as encapsulation without VTS.

Step 2 To do manual configuration on the ToRs, we recommend you to perform the following configurations:

```
interface <port-channela>
  switchport mode trunk
  switchport trunk allowed vlan <3000-3049>
interface Ethernetx/y
  switchport mode trunk
  switchport trunk allowed vlan <3000-3049>
  channel-group <a>
```

NFV Host Configuration

NFV Host configuration describes how to configure NFV hosts and Cisco VIM monitoring.

Cisco VIM supports CPU pinning and huge page on the compute nodes. To enable non-uniform memory access (NUMA), you can use ALL (case insensitive) to configure all compute nodes. For VTS and ML2/VPP, only the value of ALL is allowed. For OVS/VLAN, alternatively, you can list the compute nodes where NUMA must be enabled.

```
# For VPP and VTS, only NFV_HOSTS: ALL is allowed
NFV_HOSTS: ALL
or
NFV_HOSTS: ['compute-server-1']
```

Cisco VIM allows you to collect host monitoring information by enabling collectd, a daemon that collects system performance statistics periodically and provides mechanisms to store the values in different ways. For information about enabling collectd, see Enabling collectd for Performance Monitoring, on page 110

By default, hyper-threading is enabled across compute nodes in Cisco VIM. Based on certain VNF characteristics, Cisco VIM offers user the capability to disable hyper-threading across the pod on day-0. You can also disable it on a single compute node on day-n, updating the setup_data and doing remove or add of compute nodes (see Utilizing NUMA features in Cisco NFV Infrastructure section in the Cisco VIM 2.0 Admin Guide for details on day-n operation). To disable hyper-threading, update the setup_data with the following name or value pair before starting the installation.

```
DISABLE_HYPERTHREADING: True or False; this is optional and default value is false.
```

Note NFV Host configuration does not support micro-pod.

Install Mode

Cisco VIM can be deployed on the setup in one of the following install modes:

1. Connected-In this mode, the setup must be connected to Internet to fetch artifacts and docker images.
2. Dis-connected: In this mode, Cisco VIM is not connected to Internet. The artifacts and docker images are loaded from USB device.

Based on the deployment type, select the install mode as connected or disconnected.

```
# Install Mode: connected/disconnected
INSTALL_MODE: connected
```

Enabling NFVIMON on Cisco VIM

The Cisco VIM solution uses Cisco NFVI Monitor (NFVIMON) to monitor the health and performance of the NFVI. This includes monitoring both the physical and logical components of one or multiple NFVI pods. The NFVIMON feature enables extensive monitoring and collection of performance data for various components of the cloud infrastructure including Cisco UCS blade and rack servers, service profiles, Nexus top of rack switches, fabric connections, and also the OpenStack instances. The monitoring system is designed such that it can monitor single or multiple pods from a single management system. NFVIMON is enabled by extending the setup_data.yaml file with relevant information. Also, NFVIMON can be enabled on an existing pod, through the reconfigure option. Then, the pod is added as a VIM resource to be monitored in a Control Center.

NFVIMON consists of four components: dispatcher, collector, resource manager (RM), and control-center with Cisco Zenpacks (CZ). Integration of NFVIMON into VIM is loosely coupled and the VIM automation only deals with installing the minimal software piece (dispatcher) needed to monitor the pod. The installing of the other NFVIMON components (collector, resource manager (RM) and control-center with Cisco Zenpacks (CZ), are outside the scope of the current install guide.

Before you Begin

Ensure that you have engaged with the account team for services engagement on the planning and installation of the NFVIMON accessories along with its network requirements. The image information of collector, Resource Manager (RM) and control-center with Cisco Zenpacks (CZ) is available only through Cisco Advance Services. At a high level, have a node designated to host a pair of collector VM for each pod, and a common node to host CC and RM VMs, which can aggregate and display monitoring information from multiple pods.

In terms of networking, the collectors VMs need to have two interfaces: an interface in br_mgmt of the VIM, and another interface that is routable, which can reach the VIM Installer REST API and the RM VMs. As the collector VM is in an independent node, four IPs from the management network of the pod should be pre-planned and reserved. Install steps of the collector, resource manager (RM) and control-center with Cisco Zenpacks (CZ) are Cisco advance services activities.

Installation of NFVIMON Dispatcher

The dispatcher is the only component in NFVIMON that is managed by VIM orchestrator. While the dispatcher acts as a conduit to pass OpenStack information of the pod to the collectors, it is the Cisco Zenpack sitting in the controller node, that gathers the node level information.

To enable dispatcher as part of the VIM Install, update the setup_data with the following information:

```
#Define the PODNAME
PODNAME: <PODNAME with no space>; ensure that this is unique across all the pods
NFVIMON:
  MASTER:                  # Master Section
    admin_ip: <IP address of Control Centre VM>
  COLLECTOR:               # Collector Section
    management_vip: <VIP for ceilometer/dispatcher to use> #Should be unique across the VIM
 Pod; Should be part of br_mgmt network
    Collector_VM_Info:
      -
        hostname: <hostname of Collector VM 1>
        password: <password_for_collector_vm1>  # max length of 32
       ccuser_password: <password from master for 'ccuser' (to be used for self monitoring)>
  # max length of 32
        admin_ip: <ssh_ip_collector_vm1> # Should be part of br_api network
        management_ip: <mgmt_ip_collector_vm1> # Should be part of br_mgmt network
      -
        hostname: <hostname of Collector VM 2>
        password: <password_for_collector_vm2>  # max length of 32
       ccuser_password: <password from master for 'ccuser' (to be used for self monitoring)>
  # max length of 32
        admin_ip: <ssh_ip_collector_vm2> # Should be part of br_api network
        management_ip: <mgmt_ip_collector_vm2> # Should be part of br_mgmt network
  DISPATCHER:
    rabbitmq_username: admin  # Pod specific user for dispatcher module in
ceilometer-collector
```

To monitor ToR, ensure that the following **TORSWITCHINFO** sections are defined in the setup_data.yaml file.

```
TORSWITHCINFO:
  SWITCHDETAILS:
 -
      hostname: <switch_a_hostname>:     # Mandatory for NFVIMON if switch monitoring is
needed
      username: <TOR switch username>    # Mandatory for NFVIMON if switch monitoring is
needed
      password: <TOR switch password>    # Mandatory for NFVBENCH; Mandatory for NFVIMON
if switch monitoring is needed
      ssh_ip: <TOR switch ssh ip>        # Mandatory for NFVIMON if switch monitoring is
needed
```

```
      ....
  -
      hostname: <switch_b_hostname>:     # Mandatory for NFVIMON if switch monitoring is
needed
      username: <TOR switch username>    # Mandatory for NFVIMON if switch monitoring is
needed
      password: <TOR switch password>    # Mandatory for NFVIMON if switch monitoring is
needed
      ssh_ip: <TOR switch ssh ip>        # Mandatory for NFVIMON if switch monitoring is
needed
      ....
```

Enabling collectd for Performance Monitoring

Cisco VIM uses collectd to periodically collect system performance statistics from the management, controller, and compute nodes, the containers and VMs. By default, collectd is not enabled. To enable collectd, complete the following steps so that collectd will be enabled after installation is complete.

Step 1 Use a terminal client to log into to your management node using SSH. In the example below, the management node has an IP address of 10.10.10.2.

```
# ssh root@10.10.10.2
root@10.10.10.2 password
```

Step 2 Edit mercury/installer/openstack-configs/setup_data.yaml.

```
[root@build1 ~]# vi mercury/installer/openstack-configs/setup_data.yaml
```

Step 3 Make the following changes to cnable collectd:

```
###################################
## Collectd
###################################
COLLECTD:
  enabled: True   # True or False (case-sensitive)
```

With this configuration, you should now be able to use collectd to gather system performance metrics. By default, the collectd data collection frequency is every 30 secs. You can change the frequency of collecting system performance data post-install. See the “Reconfiguring Passwords, Debugs, TLS, ELK and collectd” section of the Cisco NFVI Administrator Guide for information on how to change the collectd “interval” under the COLLECTD_RECONFIGURE entry in the openstack_config.yaml file after Cisco VIM is installed.

Enabling or Disabling Autobackup of Management Node

Cisco VIM 2.0 introduces the backup and recovery of the management node. By default, the feature is enabled. Auto-snapshots of the management node happens during pod management operation. You can disable the autobackup of the management node.

To enable or disable the management node, update the setup_data.yaml file as follows:

```
# AutoBackup Configuration
# Default is True
#autobackup: <True or False>
```

Forwarding ELK logs to External Syslog Server

Cisco VIM supports backup and recovery of the management node, to keep the process predictable and avoid loss of logs. The software supports the capability of forwarding the ELK logs to an external syslog server.

Before launching the installation, update the setup_data.yaml file with the following information:

```
 ###################################
## SYSLOG EXPORT SETTINGS
###################################
SYSLOG_EXPORT_SETTINGS:
  remote_host: <Syslog_ip_addr>   # required
  protocol: udp   # optional; defaults to udp
  facility: <string>  # optional; defaults to local5
  severity: <string; suggested value: debug>
  port: <int>; # defaults to 514 (optional)
  clients: 'ELK'   # defaults to ELK; optional
# Please note other than the remote host info, most of the other info is not needed; Also
the client list in 2.0 is restricted to ELK only.
```

With this configuration, the ELK logs are exported to an external syslog server. You can add this configuration to a pod that is already up and running. For more details, refer to Forwarding ELK logs to External Syslog Server section in the admin guide.

Updating Cisco NFVI Software

The Cisco VIM installer provides a mechanism to update all OpenStack services and some infrastructure services such as RabbitMQ, MariaDB, HAProxy, and VMTP. Updating host-level packages and management node ELK and Cobbler containers are not supported. Updating Cisco NFVI software has minimal service impact because the update runs serially, component-by-component, one node at a time. If errors occur during an update, an automatic rollback will bring the cloud back to its previous state. After an update is completed, check for any functional cloud impacts. If everything is fine, you can then commit the update which clears the old containers from the system. Cisco recommends that you commit the update before you perform any other pod management functions. Skipping the commit option might lead to double faults. If you see any functional impact on the cloud, perform a manual rollback to start the old containers again.

Note Cisco NFVI software updates are not supported for registry related containers and authorized_keys. Also, after the management node repo containers are updated, they cannot be rolled back to the older versions because this requires node packages to be deleted, which might destabilize the cloud.

To prevent double faults, a cloud sanity check is done before the update is started, and another cloud sanity check is performed at the end of the update.

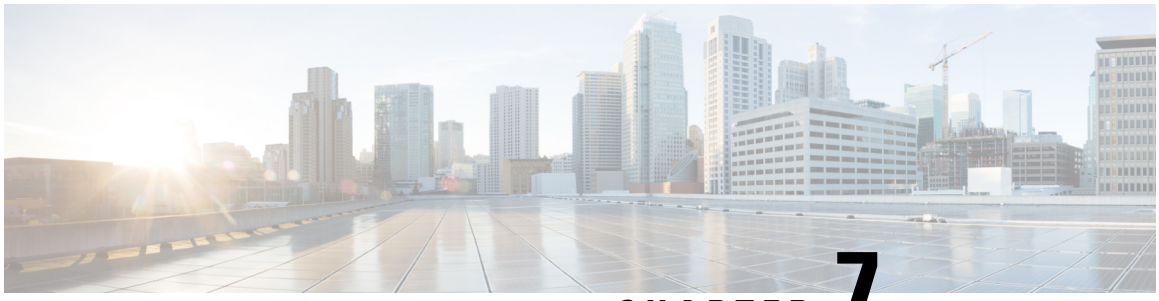
To complete the software update, perform the Installing Cisco VIM. If your management node does not have Internet, complete the Preparing to Install Cisco NFVI on Management Nodes Without Internet Access, on page 37 procedure first, then follow the Cisco VIM installation instructions. Differences between a software update and regular Cisco VIM installation:

- You do not need to modify setup_data.yaml like you did during the first installation. In most cases, no modifications are needed.
- You do not need to repeat the Cisco VIM Insight installation.

- Minor differences between NFVI software installation and updates are listed in the installation procedure.

Note After you complete the software update, you must commit it before you can perform any pod management operations. During software updates the following operations are locked: add/remove compute/storage node, replace controllers, and rotate fernet key. Before you commit, you can roll back the update to return the node to its previous software version.

For information about updating the Cisco NFVI software, see the "Managing Cisco NFVI" chapter in the Cisco NFV Infrastructure Administrator Guide, Release 2.0



CHAPTER 7

Installing Cisco VIM Insight (Tech Preview)

Cisco VIM 2.0 offers a unified management solution which will be available in the subsequent releases.

Cisco VIM Insight can be installed on two modes:

- Standalone/non-HA mode
- HA mode (in future release)

You can start installing in a Standalone/non-HA mode initially (on the management node of the pod) or a standalone (BOM) server and eventually move to a three-node system (BOM) that will provide a HA of the UI system in future release. Rendition and migration from one install mode to another is easy because the UI interacts to each pod through REST API and very little RBAC information of the admin and user is kept in the database.

Also, the UI has two types of Admin: UI Admin and Pod Admin. UI Admin is for the administrators who can add more folks as UI Admin or Pod admin. Pod Admin has privileges only at the pod level, where as an UI Admin has privileges both at UI and pod level.

Complete the following procedure to install Cisco VIM Insight on the Cisco NFVI management node.

Cisco VIM Insight with Internet Access

Complete the following steps to install Cisco VIM Insight on the Cisco NFVI management node.

Since security is paramount to pod management, the web-service hosting the single pane of glass is protected through TLS. Following are the steps to get the TLS certificate setup going.

You can select one of the following approaches for the TLS certificate configurations:

1. Providing your own certificate: You can bring in your certificate on the management node and provide the absolute path of .pem and cacert files in the insight_setup_data.yaml file. The path must be provided as a value for the key 'PEM_PATH' in the insight_setup_data.yaml file.
2. Generating a new certificate on the node:

You can create a new certificate on the node using following command:

```
#./tls_insight_cert_gen.py -f <path_to_insight_setup_data.yaml>/insight_setup_data.yaml
```

This script will search for the 'PEM_PATH' inside the insight_setup_data.yaml. As the path is not provided it will create a new certificate inside install-dir/openstack-configs.

Before you begin

You must complete all Cisco NFVI preparation tasks described in Preparing for Cisco NFVI Installation, on page 41 and also the management node has to be installed as described Cisco VIM Management Node Networking.

Step 1 Enter `ip a` to verify the `br_mgmt` and `br_api` interfaces are up and are bound to bond1 and bond0 respectively.

For example:

```
$  ip a
6: br_api: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP
     link/ether 00:42:68:6f:79:f2 brd ff:ff:ff:ff:ff:ff
     inet  nnn.nnn.nnn.nnn/25 brd  nnn.nnn.nnn.nnn  scope global br_api
        valid_lft forever preferred_lft forever
     inet6 fe80::3c67:7aff:fef9:6035/64 scope link
        valid_lft forever preferred_lft forever
7: bond1: <BROADCAST,MULTICAST,MASTER,UP,LOWER_UP> mtu 1500 qdisc noqueue master br_api state UP
     link/ether 00:42:68:6f:79:f2 brd ff:ff:ff:ff:ff:ff
8: br_mgmt: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP
     link/ether 00:78:88:46:ee:6e brd ff:ff:ff:ff:ff:ff
     inet  nnn.nnn.nnn.nnn/24 brd  nnn.nnn.nnn.nnn  scope global br_mgmt
        valid_lft forever preferred_lft forever
     inet6 fe80::278:88ff:fe46:ee6e/64 scope link
        valid_lft forever preferred_lft forever
9: bond0: <BROADCAST,MULTICAST,MASTER,UP,LOWER_UP> mtu 1500 qdisc noqueue master br_mgmt state UP
     link/ether 00:78:88:46:ee:6e brd ff:ff:ff:ff:ff:ff
```

Note The br_mgmt and br_api interfaces are created when you install RHEL on the management node in Installing the Management Node, on page 49

Step 2 Copy the Standalone insight_setup_data.yaml.Standalone_EXAMPLE file from the /root/installer-<tag_id>/openstack-configs to any other location on the management node or the BOM.

```
# cp /root/installer-<tag_id>/openstack-configs/insight_setup_data.yaml.Standalone_EXAMPLE
/root/insight_setup_data.yaml
```

Step 3 Modify the insight setup data according to your requirements.

```
## Configuration File:

########################################################
# User Defined Configuration File.
# Information in this file is specific to the user setup.
########################################################

# This file is used as an inventory file to setup Insight Container.


#########################################################
# Registry credentials
#########################################################
REGISTRY_USERNAME: '<username>'
REGISTRY_PASSWORD: '<password>'

# Install Mode: connected/disconnected, Optional parameter; default is connected
```

```
INSTALL_MODE: connected

# https_proxy: <Name of the proxy server without https://> ; Optional Parameter for INSTALL_MODE:
# Needed for connected install only and not required for disconnected mode.
https_proxy_server: <proxy.domain.com:port_no>

##################################################
# Super Admin Username Password
##################################################

# This User will be the default Super Admin of the System and can Grant Access to all other Users
getting registered to PODs.
# This is a mandatory field and is required to be filled every time.
UI_ADMIN_USERNAME: '<username>'
UI_ADMIN_EMAIL_ID: '<email_id@domain.com>'

# Please define the mail server off which the Insight email alias works;
# For example, outbound.cisco.com
# Mandatory: Valid SMTP Server is required for sending mails to the customers.
INSIGHT_SMTP_SERVER: <smtp.domain.com>

# for Insight UI, customer needs to create a mailer, so that automated mails come from that alias;
# For example, vim-insight-admin@cisco.com
# Mandatory: You need to create a valid email alias that would be responsible for sending email
notification for Users and UI Admin.
INSIGHT_EMAIL_ALIAS: <Email-Alias@domain.com>

#TLS certificate path;
#Absolute TLS certificate path, can also be generated using the script tls_insight_cert_gen.py located
 at
# installer-<tagid>/insight/; if generated by: tls_insight_cert_gen.py, then entry of the info is
optional;
# the script will copy the certs to installer-<tagid>/openstack-configs/ dir
PEM_PATH: <abs_location_for_cert_path>

#If using tls_insight_cert_gen.py to create the cert, please define the following:
CERT_IP_ADDR: <br_api of the insight node>

# Mandatory
CERT_HOSTNAME: <Domain name for Cert>

# Optional
```

Step 4 Save the edited insight_setup_data.yaml file.

Step 5 Start the insight Standalone installation process (multimode is not yet supported).

```
$ cd /root/installer-<tag_id>/insight/
$ ./bootstrap_insight.py --help
optional arguments:
  -h, --help            show this help message and exit
  --option OPTION, -o OPTION
                        standalone - Install Insight on Single Node.
                        multinode - Install Insight on a 3 node Cluster.
  --action ACTION, -a ACTION
                        install - Initiate Installation.
                        uninstall - Uninstall Insight.
  --file INSIGHTSETUPDATA, -f INSIGHTSETUPDATA

$  ./bootstrap_insight.py -a install -o standalone -f </root/insight_setup_data.yaml>
Insight Schema Validation would be initiated:

VIM Insight install logs are at: / var/log/insight/<Bootstrap_insight_<date>_<time>.log
```

```
  Management Node Validations!
+-------------------------------+--------+-------+
| Rule                          | Status | Error |
+-------------------------------+--------+-------+
| Check Kernel Version          |  PASS  | None  |
| Check Docker Version          |  PASS  | None  |
| Check Management Node Tag     |  PASS  | None  |
| Check Bond Intf. Settings     |  PASS  | None  |
| Root Password Check           |  PASS  | None  |
| Check Boot Partition Settings |  PASS  | None  |
| Check LV Swap Settings        |  PASS  | None  |
| Check Docker Pool Settings    |  PASS  | None  |
| Check Home Dir Partition      |  PASS  | None  |
| Check Root Dir Partition      |  PASS  | None  |
| Check /var Partition          |  PASS  | None  |
| Check LVM partition           |  PASS  | None  |
| Check RHEL Pkgs Install State |  PASS  | None  |
+-------------------------------+--------+-------+


  Insight standalone Input Validations!
+-------------------------------------+--------+-------+
| Rule                                | Status | Error |
+-------------------------------------+--------+-------+
| Insight standalone Schema Validation |  PASS  | None  |
| Check for Valid Keys                |  PASS  | None  |
| Check for duplicate keys            |  PASS  | None  |
+-------------------------------------+--------+-------+


Downloading VIM Insight Artifacts, will take time!!!



Cisco VIM Insight Installed successfully!
+----------------------+--------+-----------------------------------------------------+
| Description          | Status | Details                                             |
+----------------------+--------+-----------------------------------------------------+
| VIM Insight UI URL   | PASS   | https://ip_addr:9000                          |
| VIM UI Admin Email ID | PASS   | Check for info @: ../openstack-                     |
|                      |        | configs/insight_setup_data.yaml                     |
| VIM UI Admin Password | PASS   | Check for info @ /opt/cisco/insight/secrets.yaml    |
+----------------------+--------+-----------------------------------------------------+

Done with VIM Insight install!
VIM Insight install logs are at: "/var/log/insight/bootstrap_insight/"
```

Logs of Insight Bootstrap will be generated at : **/var/log/insight/bootstrap_insight/** on the management node. Log file name for Insight Bootstrap will be in the following format : Bootstrap_insight_<date>_<time>.log. Only ten bootstrap Insight log files are displayed at a time. Once the bootstrap process is completed a summary table preceding provides the information of the UI URL and the corresponding login credentials. After first login, for security reasons, we recommend you to change the Password.

To add a new UI Admin in a setup that just got created, login to VIM insight and add a new UI admin user from the Manage **UI Admin Users** menu. Without doing a fresh install (that is un-bootstrap, followed by bootstrap) of the insight application, the UI admin that was bootstrapped cannot be changed.

Refer Cisco VIM Insight Post Bootstrap Validation Checks , on page 119 to verify the bootstrap status of Cisco VIM Insight.

Installing Cisco VIM Insight without Internet Access

Complete the following steps to install Cisco VIM Insight on the Cisco NFVI management node.

Management Node setup (without Internet):

For many service providers, the infrastructure on which Management Node setup is run is air-gapped. This presents an additional dimension for the orchestrator to handle. To support install that is air-gapped, refer to the section Preparing for Installation on Servers Without Internet Access, on page 37 and follow the steps to prepare 64G USB 2.0.

Before you begin

You must complete all Cisco NFVI preparation tasks described in Preparing for Cisco NFVI Installation, on page 41 and the management node as described in Cisco VIM Management Node Networking, on page 19

Step 1 Enter `ip a` to verify the `br_mgmt` and `br_api` interfaces are up and are bound to bond1 and bond0.

For example:

```
$  ip a
6: br_api: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP
     link/ether 00:42:68:6f:79:f2 brd ff:ff:ff:ff:ff:ff
     inet  nnn.nnn.nnn.nnn/25 brd  nnn.nnn.nnn.nnn  scope global br_api
        valid_lft forever preferred_lft forever
     inet6 fe80::3c67:7aff:fef9:6035/64 scope link
        valid_lft forever preferred_lft forever
7: bond1: <BROADCAST,MULTICAST,MASTER,UP,LOWER_UP> mtu 1500 qdisc noqueue master br_api state UP
     link/ether 00:42:68:6f:79:f2 brd ff:ff:ff:ff:ff:ff
8: br_mgmt: <BROADCAST,MULTICAST,UP,LOWER_UP> mtu 1500 qdisc noqueue state UP
     link/ether 00:78:88:46:ee:6e brd ff:ff:ff:ff:ff:ff
     inet  nnn.nnn.nnn.nnn/24 brd  nnn.nnn.nnn.nnn  scope global br_mgmt
        valid_lft forever preferred_lft forever
     inet6 fe80::278:88ff:fe46:ee6e/64 scope link
        valid_lft forever preferred_lft forever
9: bond0: <BROADCAST,MULTICAST,MASTER,UP,LOWER_UP> mtu 1500 qdisc noqueue master br_mgmt state UP
     link/ether 00:78:88:46:ee:6e brd ff:ff:ff:ff:ff:ff
```

Note The `br_mgmt` and `br_api` interfaces are created when you install RHEL on the management node in Installing the Management Node, on page 49.

Step 2 Copy the Standalone insight_setup_data.yaml.Standalone_EXAMPLE file from /root/installer-<tag_id>/openstack-configs to any other location on the management node or the BOM.

```
# cp /root/installer-<tag_id>/openstack-configs/insight_setup_data.yaml.Standalone_EXAMPLE
/root/insight_setup_data.yaml
```

Step 3 Modify the insight setup data according to the requirements. Refer to the insight_setup_data.yaml as listed in step 5 of the preceding section).

Step 4 Save the edited insight_setup_data.yaml file.

Step 5 Run Import Artifacts :

$ cd /root/installer-<tag_id>/tools

./import_artifacts.sh

To verify that /var/cisco/artifcats on the management node has the following Insight artifacts, along with the other components 'insight-K9.tar', 'mariadb-app-K9.tar','haproxy-K9.tar'

Step 6 Start the insight Standalone installation process (multimode is not yet supported).

```
$ cd to /root/<Install-Dir>/insight/
$ ./bootstrap_insight.py --help

optional arguments:
  -h, --help            show this help message and exit
  --option OPTION, -o OPTION
                        standalone - Install Insight on Single Node.
                        multinode - Install Insight on a 3 node Cluster.
  --action ACTION, -a ACTION
                        install - Initiate Installation.
                        uninstall - Uninstall Insight.
  --file INSIGHTSETUPDATA, -f INSIGHTSETUPDATA

$  ./bootstrap_insight.py – a install –o standalone –f /root/insight_setup_data.yaml
Insight Schema Validation would be initiated:

VIM Insight install logs are at: /var/log/mercury/<Bootstrap_insight_<date>_<time>.log


  Management Node Validations!
+--------------------------------+--------+-------+
| Rule                           | Status | Error |
+--------------------------------+--------+-------+
| Check Kernel Version           |  PASS  | None  |
| Check Docker Version           |  PASS  | None  |
| Check Management Node Tag      |  PASS  | None  |
| Check Bond Intf. Settings      |  PASS  | None  |
| Root Password Check            |  PASS  | None  |
| Check Boot Partition Settings  |  PASS  | None  |
| Check LV Swap Settings         |  PASS  | None  |
| Check Docker Pool Settings     |  PASS  | None  |
| Check Home Dir Partition       |  PASS  | None  |
| Check Root Dir Partition       |  PASS  | None  |
| Check /var Partition           |  PASS  | None  |
| Check LVM partition            |  PASS  | None  |
| Check RHEL Pkgs Install State  |  PASS  | None  |
+--------------------------------+--------+-------+


  Insight standalone Input Validations!
+-------------------------------------+--------+-------+
| Rule                                | Status | Error |
+-------------------------------------+--------+-------+
| Insight standalone Schema Validation |  PASS  | None  |
| Check for Valid Keys                |  PASS  | None  |
| Check for duplicate keys            |  PASS  | None  |
+-------------------------------------+--------+-------+


Downloading VIM Insight Artifacts, will take time!!!



Cisco VIM Insight Installed successfully!
+----------------------+--------+-------------------------------------------------------+
```

```
| Description           | Status | Details                                                |
+-----------------------+--------+--------------------------------------------------------+
| VIM Insight UI URL    | PASS   | https://172.26.232.144:9000                            |
| VIM UI Admin Email ID | PASS   | Check for info @: ../openstack-                        |
|                       |        | configs/insight_setup_data.yaml                        |
| VIM UI Admin Password | PASS   | Check for info @ /opt/cisco/insight/secrets.yaml       |
+-----------------------+--------+--------------------------------------------------------+

Done with VIM Insight install!
VIM Insight install logs are at: /var/log/insight/bootstrap_insight/
```

Logs of Insight Bootstrap will be generated at : **/var/log/insight/bootstrap_insight/** on the management node. Log file name for Insight Bootstrap will be in the following format : Bootstrap_insight_<date>_<time>.log. Only ten bootstrap Insight log files are displayed at a time. Once the bootstrap process is completed a summary table preceding provides the information of the UI URL and the corresponding login credentials. After first login, for security reasons, we recommend you to change the Password.

To add a new UI Admin in a setup that just got created, login to VIM insight and add a new UI admin user from the Manage **UI Admin Users** menu. Without doing a fresh install (that is un-bootstrap, followed by bootstrap) of the insight application, the UI admin that was bootstrapped with cannot be changed.

Refer Cisco VIM Insight Post Bootstrap Validation Checks , on page 119 to verify the bootstrap status of Cisco VIM Insight.

Cisco VIM Insight Post Bootstrap Validation Checks

1. After the VIM Insight bootstrap, you can view if the Insight and Mysql containers are up or not by running the following command:

```
$ docker ps -a
CONTAINER ID        IMAGE
                                    COMMAND                  CREATED             STATUS
        NAMES
cbe582706e50        cvim-registry.com/mercury-rhel7-osp10/insight:7434
"/start.sh"                         10 hours ago        Up 10 hours    insight_7321
68e3c3a19339        cvim-registry.com/mercury-rhel7-osp10/mariadb-app:7434
"/usr/bin/my_init /ma"   10 hours ago
```

2. Check the status of Insight by running the following command :

```
$ systemctl status docker-insight
 docker-insight.service - Insight Docker Service
   Loaded: loaded (/usr/lib/systemd/system/docker-insight.service; enabled; vendor preset:
 disabled)
   Active: active (running) since Fri 2017-04-07 13:09:25 PDT; 36s ago
 Main PID: 30768 (docker-current)
   Memory: 15.2M
   CGroup: /system.slice/docker-insight.service
           └─30768 /usr/bin/docker-current start -a insight_7434

Apr 07 13:09:26 i11-tb2-ins-3 docker[30768]: Tables_in_rbac
Apr 07 13:09:26 i11-tb2-ins-3 docker[30768]: buildnode_master
Apr 07 13:09:26 i11-tb2-ins-3 docker[30768]: permission_master
Apr 07 13:09:26 i11-tb2-ins-3 docker[30768]: role_master
Apr 07 13:09:26 i11-tb2-ins-3 docker[30768]: role_permission
Apr 07 13:09:26 i11-tb2-ins-3 docker[30768]: user_master
Apr 07 13:09:26 i11-tb2-ins-3 docker[30768]: user_role
```

```
Apr 07 13:09:26 i11-tb2-ins-3 docker[30768]: user_session
Apr 07 13:09:26 i11-tb2-ins-3 docker[30768]: Starting the apache httpd
Apr 07 13:09:26 i11-tb2-ins-3 docker[30768]: AH00558: httpd: Could not reliably determine
 the server's fully qualified domain name, using 2.2.2.6. Set the 'ServerName' directive
 gl... this message
Hint: Some lines were ellipsized, use -l to show in full.
```

3. Check if the Insight is up by running the following command:

```
$curl https://br_api:9000 -k (or --insecure)
Your response of curl should show the DOCTYPE HTML:
<!DOCTYPE html>
<!--[if lt IE 7]>     <html lang="en" ng-app="myApp" class="no-js lt-ie9 lt-ie8 lt-ie7">
 <![endif]-->
<!--[if IE 7]>         <html lang="en" ng-app="myApp" class="no-js lt-ie9 lt-ie8">
<![endif]-->
<!--[if IE 8]>        <html lang="en" ng-app="myApp" class="no-js lt-ie9"> <![endif]-->
<!--[if gt IE 8]><!--> <html lang="en" ng-app="mercuryInstaller" class="no-js">
<!--<![endif]-->
    <head>
        <meta charset="utf-8">
        <meta http-equiv="X-UA-Compatible" content="IE=edge">
        <title>Cisco VIM Installer</title>
        <meta name="description" content="">
        <meta name="viewport" content="width=device-width, initial-scale=1,
maximum-scale=1, user-scalable=0"/>
        <link rel="stylesheet"
href="../static/lib/html5-boilerplate/dist/css/normalize.css">
       <link rel="stylesheet" href="../static/lib/html5-boilerplate/dist/css/main.css">

        <link rel="stylesheet" href="../static/lib/bootstrap/bootstrap.min.css">
        <link rel="stylesheet" href="../static/lib/font-awesome/font-awesome.min.css">
        <!--<link
href="http://maxcdn.bootstrapcdn.com/font-awesome/4.1.0/css/font-awesome.min.css"
rel="stylesheet">-->
        <link rel="stylesheet" href="../static/lib/bootstrap/bootstrap-theme.min.css">
        <link rel="stylesheet" href="../static/lib/uigrid/ui-grid.min.css">
        <link rel="stylesheet" href="../static/lib/chart/angular-chart.min.css">
        <script
src="../static/lib/html5-boilerplate/dist/js/vendor/modernizr-2.8.3.min.js"></script>
        <link rel="stylesheet" href="../static/css/app.css">
        <!--new dashboard css starts-->
        <link rel="stylesheet" href="../static/css/dashboard.css">
        <!--new dashboard css end-->
    </head>
    <body class="skin-blue sidebar-collapse" ng-controller="DashboardCtrl"
id="ToggleNavbar">
    <div class="wrapper" id="wrapper">



        <div class="content-wrapper" id="contentclass">
            <mi-header></mi-header>
            <mi-left-side-navbar></mi-left-side-navbar>
            <message-box> </message-box>
           <div class=" viewheight" ng-view autoscroll="true"></div>
        </div>

        <mi-footer></mi-footer>
    </div>
        <!--new dashboard js starts-->
        <script src="../static/lib/bootstrap/jquery.min.js"></script>
        <script src="../static/lib/jquery/jquery-ui.js"></script>
        <script src="../static/lib/bootstrap/progressbar.js"></script>
```

```
        <!--new dashboard js ends-->
        <script src="../static/lib/chart/Chart.min.js"></script>
        <script src="../static/lib/bootstrap/bootstrap.min.js"></script>
        <script src="../static/lib/angular/angular.js"></script>
        <script src="../static/lib/chart/angular-chart.min.js"></script>
        <script src="../static/lib/uigrid/angular-touch.js"></script>
        <script src="../static/lib/uigrid/angular-animate.js"></script>
        <script src="../static/lib/uigrid/csv.js"></script>
        <script src="../static/lib/uigrid/pdfmake.js"></script>
        <script src="../static/lib/uigrid/vfs_fonts.js"></script>
        <script src="../static/lib/uigrid/ui-grid.js"></script>
        <script src="../static/lib/angular/smart-table.min.js"></script>
        <script src="../static/lib/angular-route/angular-route.js"></script>
        <script src="../static/lib/angular-cookies/angular-cookies.js"></script>
        <script src="../static/lib/angular/angular-translate.js"></script>
        <script
src="../static/lib/angular/angular-translate-loader-static-files.min.js"></script>
        <script
src="../static/lib/angular/angular-translate-storage-cookie.min.js"></script>
        <script
src="../static/lib/angular/angular-translate-storage-local.min.js"></script>
        <script src="../static/lib/yamltojson/yaml.js"></script>
        <script src="../static/lib/yaml/js-yaml.min.js"></script>
        <script src="../static/lib/d3/d3min.js"></script>
        <script src="../static/utility/utility.js"></script>
        <script src="../static/widgets/widgets.js"></script>
        <script src="../static/app.js"></script>
        <script src="../static/layout/layout.js"></script>
        <script src="../static/login/login.js"></script>
        <script src="../static/globals/globals.js"></script>
        <script src="../static/dashboard/dashboard.js"></script>
        <script src="../static/cloudpulse/cloudpulse.js"></script>
       <script src="../static/blueprintsetup/physicalsetupwizard/ucsmcommon.js"></script>

       <script src="../static/blueprintsetup/physicalsetupwizard/cimccommon.js"></script>

        <script src="../static/vmtp/runvmtp.js"></script>

       <script src="../static/blueprintsetup/physicalsetupwizard/networking.js"></script>


        <script
src="../static/blueprintsetup/physicalsetupwizard/serverandroles.js"></script>
       <script src="../static/blueprintsetup/openstacksetupwizard/cephsetup.js"></script>

        <script
src="../static/blueprintsetup/openstacksetupwizard/cindersetup.js"></script>
        <script
src="../static/blueprintsetup/openstacksetupwizard/glancesetup.js"></script>
       <script src="../static/blueprintsetup/openstacksetupwizard/haproxy.js"></script>

        <script
src="../static/blueprintsetup/openstacksetupwizard/keystonesetup.js"></script>
        <script
src="../static/blueprintsetup/openstacksetupwizard/swiftstack.js"></script>
        <script
src="../static/blueprintsetup/openstacksetupwizard/neutronsetup.js"></script>
       <script src="../static/blueprintsetup/openstacksetupwizard/vmtpsetup.js"></script>

        <script
src="../static/blueprintsetup/physicalsetupwizard/physicalsetupwizard.js"></script>
       <script src="../static/blueprintsetup/servicesSetupWizard/systemlog.js"></script>

       <script src="../static/blueprintsetup/servicesSetupWizard/nfvbench.js"></script>
```

```
         <script
src="../static/blueprintsetup/servicesSetupWizard/servicesSetupWizard.js"></script>
        <script
src="../static/blueprintsetup/openstacksetupwizard/openstacksetupwizard.js"></script>
        <script src="../static/blueprintsetup/blueprintsetup.js"></script>
        <script src="../static/blueprintmanagement/blueprintmanagement.js"></script>
        <script src="../static/topology/topology.js"></script>
        <script src="../static/monitoring/monitoring.js"></script>
        <script src="../static/horizon/horizon.js"></script>
        <script src="../static/podmanagement/podmanagement.js"></script>
        <script
src="../static/blueprintsetup/openstacksetupwizard/tlssupport.js"></script>
       <script src="../static/blueprintsetup/openstacksetupwizard/elksetup.js"></script>

        <script src="../static/systemupdate/systemupdate.js"></script>
        <script
src="../static/blueprintsetup/physicalsetupwizard/registrysetup.js"></script>
        <script src="../static/registertestbed/registertestbed.js"></script>
        <script src="../static/registersaas/registersaas.js"></script>
        <script src="../static/useradministration/manageusers.js"></script>
        <script src="../static/useradministration/rolemanagement.js"></script>
        <script src="../static/saasadmindashboard/saasadmindashboard.js"></script>
        <script src="../static/saasadmindashboard/buildnodes.js"></script>
        <script src="../static/saasadmindashboard/buildnodeusers.js"></script>
        <script src="../static/saasadmindashboard/managesaasuser.js"></script>
        <script src="../static/saasadminusermanagement/saasadminusermgmt.js"></script>
       <script src="../static/blueprintsetup/physicalsetupwizard/nfvisetup.js"></script>

       <script src="../static/blueprintsetup/physicalsetupwizard/torswitch.js"></script>

       <script src="../static/blueprintsetup/openstacksetupwizard/vtssetup.js"></script>

        <script src="../static/rbacutilities/rbacutility.js"></script>
        <script src="../static/forgotpassword/forgotpassword.js"></script>
      <script src="../static/changepassword/changepassword.js"></script>
        <script src="../static/passwordreconfigure/passwordreconfigure.js"></script>
        <script
src="../static/openstackconfigreconfigure/openstackconfigreconfigure.js"></script>
        <script
src="../static/reconfigureoptionalservices/reconfigureoptionalservices.js"></script>
</body>
```

VIM Insight UI Admin Login for Standalone Setup

For security reasons, the UI Admin need to login to the UI with which Insight has been bootstrapped, and add other users as UI Admin. UI Admin needs to add new users as Pod Admin.

Registration of UI Admin to Insight

Step 1 Enter the following address on the browser: https://<br_api>:9000.

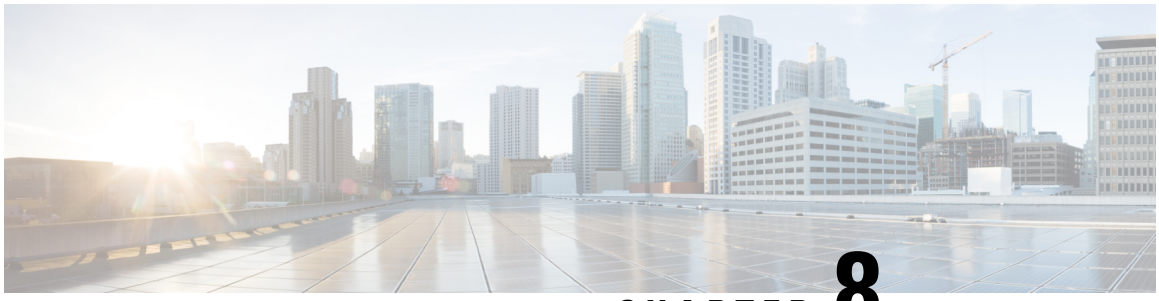
Step 2 Enter the Email ID and the Password. Email ID should be the one specified as 'UI_ADMIN_EMAIL_ID in insight_setup_data.yaml during bootstrap. Password for UI Admin is generated at : /opt/cisco/insight/secrets.yaml and key is 'UI_ADMIN_PASSWORD.

Step 3 Click **Login as UI Admin User**. You will be redirected to Insight UI Admin Dashboard.

VIM Insight Pod Admin Login for Standalone Setup

Registration of Pod Admin to Insight:

Step 1 Login as Insight UI Admin.
Step 2 Navigate to **Manage Pod Admin.**
Step 3 Click **Add Pod Admin**.
Step 4 Enter a new Email ID in **Add Pod Admin** pop-up.
Step 5 Enter the username of the Pod Admin which is registered.
Step 6 Click **Save**.User Registration Mail would be sent to newly added Pod Admin with a token.
Step 7 Click the URL with token and if token is valid then Pod Admin will be redirected to Insight-Update Password Page.
Step 8 Enter new password and then confirm the same password.
Step 9 Click **Submit**.



CHAPTER 8

Installing Cisco VIM through Cisco VIM Insight (Tech Preview)

The VIM Insight has an UI admin, who has the privilege to manage the UI offering. The Insight UI admin, has the rights to add the right users as Pod administrators. Post bootstrap, the URL for the UI will be: https://br_api:9000.

The following topics helps you to install and configure Cisco Virtual Infrastructure Manager with VIM Insight:

Registering New Pod to Insight

In this step the User registers a new pod to Insight. Pod registration includes the following steps:

Before you begin

Insight UI Admin needs to register a Pod Admin to allow the user to register a pod. Following are the steps required for UI Admin to register a Pod Admin:

Step 1 Login as UI Admin and navigate to **Manage Pod Admin(s)** page.

Step 2 Click **Add Pod Admin**.

Step 3 Enter the username of the user.

a) If email is already registered then Username will be populated automatically.

b) If not registered, am email would be sent to the user email ID.

Step 4 Navigate to https://br_api:9000.

Step 5 Click the **Register Management Node** link.

a) Enter the Endpoint which is the br_api IP for the management node.

Run time validation will check if the endpoint is already registered.

b) Give a Friendly name / tag for the particular management node.

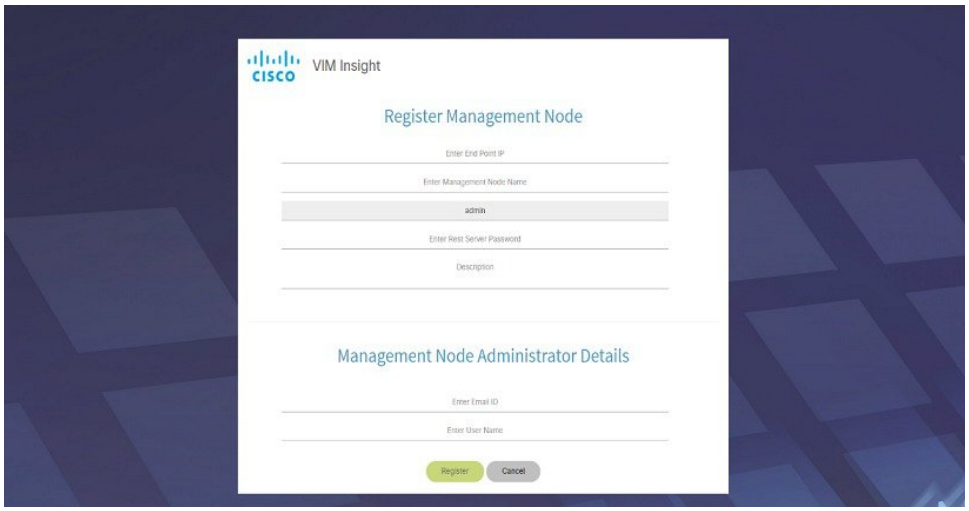
c) Enter the REST API Password. (REST Password is present on the Pod at "/opt/cisco/ui_config.json")

d) Provide a brief description about the management node (Max 200 characters are allowed).

e) Enter the Pod Admin's Email ID.

1. Run time validation will check if the entered Email ID belong to the Pod Admin.
2. If entered Email ID is not the Pod Admin's ID, then User is not registered as Pod Admin error is displayed.
3. If entered Email ID is the Pod Admin's ID, then User-Name is auto-populated and the **Register** button is enabled.

Figure 33: Register Management Node



f) Click **Register** to move to the login page and Pod Admin will get a notification mail.

Login to Insight as Pod Admin

To login to Insight as Pod Admin, complete the instructions below:

Step 1 Enter the relevant registered email id.

Step 2 Enter the valid password.

Step 3 Click **login as POD**.

Note After successful Sign in user will be redirected to the Dashboard.

The VIM Insight UI

The VIM Insight UI is divided into four parts:

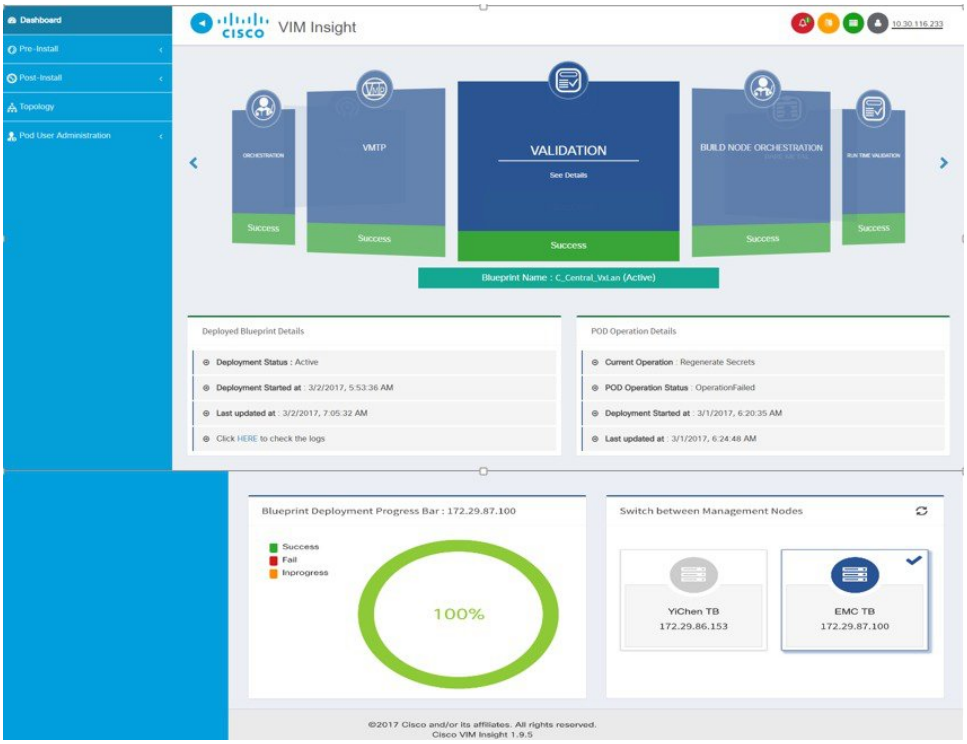
1. **Dashboard**

   Dashboard of the VIM Installer provides the user an intuitive view of monitoring deployment. Dashboard provides a 3D view of 8 stages, which are present in the Installer CLI. The Carrousel displays the real-time status of the install steps, and it rotates automatically once an install stage is completed and a new install

stage is started or scheduled. Dashboard maintains the pod state even when the User logs out. It will show the most recent data available via the VIM REST API on the management node. Dashboard provides the following rights to the administrator:

1. **Deployed Blueprint Details**: Shows information about the current Blueprint (Active/In-Progress). In case of an Inactive Blueprint, the table will be blank.
    1. Deployment Status: This tells the status of the Blueprint. There are 3 stages of a Blueprint : Active, in-progress and Failed. Incase of in-progress and Failed states, the stage name would be mentioned in Deployment Status which is a hyperlink. If you click on the stage name, the carrousel will directly jump to that particular stage.
    2. Deployment Started at: This tells the time when the installation was started.
    3. Last Updated at: This tells the last updated time of the installation.
    4. Click Here to check logs: If you click **Here** you will be redirected to the logs page in a new tab for which you will have to enter the REST Username and Password locatated at /opt/cisco/ui_config.json on the node. By default REST Username is "admin".
2. **POD Operation Details**: Displays the status regarding all the POD Activities done POST Installation like POD Management, Re-generate Secrets, etc. Following are the information shared in POD Operation Details table:
    1. Current Operation: Name of the Operation Running.
    2. POD Operation Status: Status of the Operation.
    3. Operation Started at: Operation Start time.
    4. Last Updated at: Operation last update time.
3. **Blueprint Deployment Progress bar for a given POD**: Shows the Blueprint success or failure state in percentage.
4. **Switch Between Management Nodes**: Will be covered later in this chapter.

Figure 34: VIM Insight Dashboard



2. **Pre-install**

   This section has two menus:

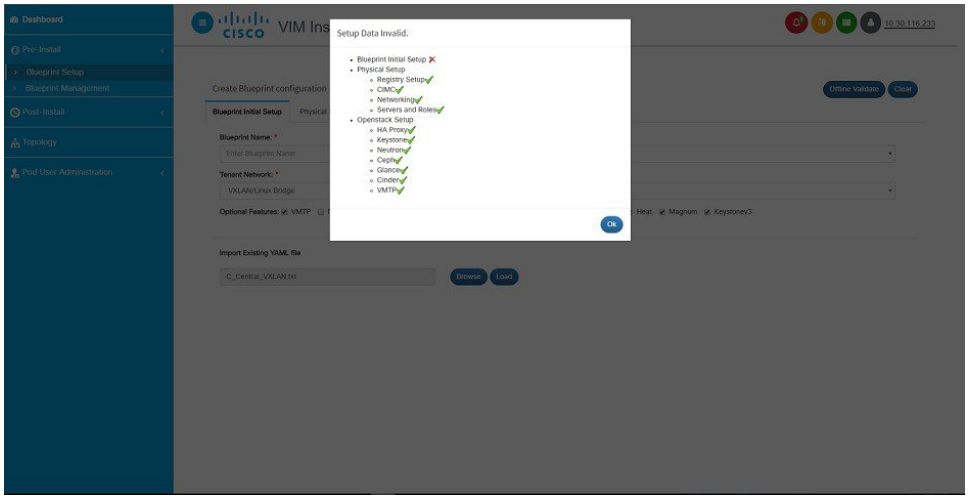
   1. **Blueprint Setup**: Blueprint is the YAML (setupdata) present in the Management node. There are two ways to create a Blueprint:

      1. Form based through the UI.
      2. Upload an existing YAML.

      In case of manual creation the user has to fill in details for Initial setup, physical setup and OpenStack, which covers core and optional features like VMTP, NFVI Monitoring, COLLECTED, Auto configuration of ToR, Optional services like Heat, Keystonev3 and so on. In case of upload of an existing YAMLl, the user can just upload the file and click **Upload** to automatically populate all the corresponding fields in the UI. At any given point, one can initiate the offline validation of the entry, by clicking the **Offline Validate** button, on the upper right hand corner in the **Blueprint Setup** menu.

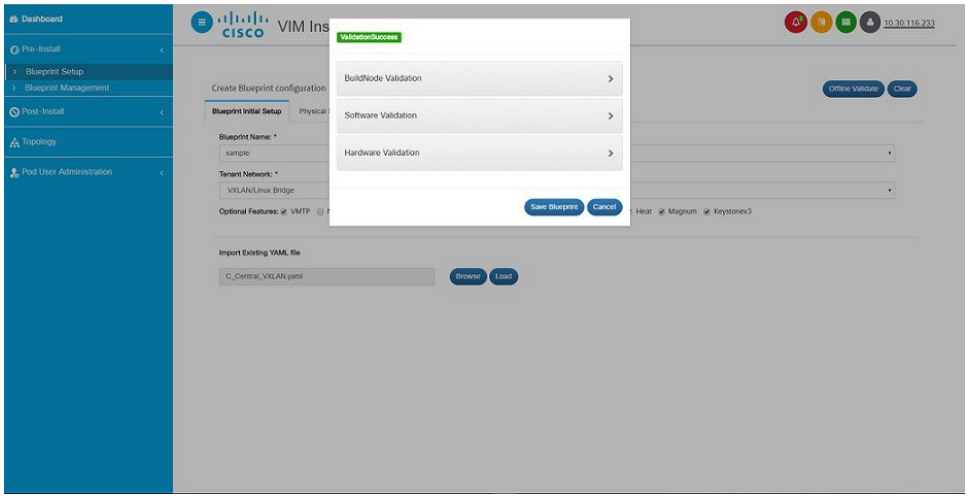
      Offline Validation will only take place if all the fields marked in Blueprint are filled and there are no client side validations remaining. Even if they are the Offline Validation, pop up will show which field is missing.

Figure 35: Blueprint Creation



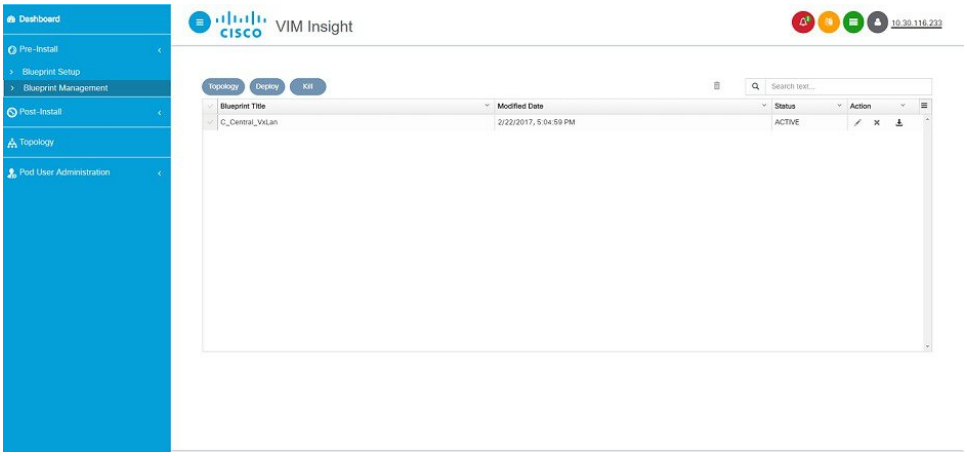
After filling all the details offline validation will take place, if successful, **Save Blueprint** option will be enabled, else user will not be allowed to save the Blueprint. Click **Save blueprint** to be redirected to Blueprint Management.

Figure 36: Blueprint Successful



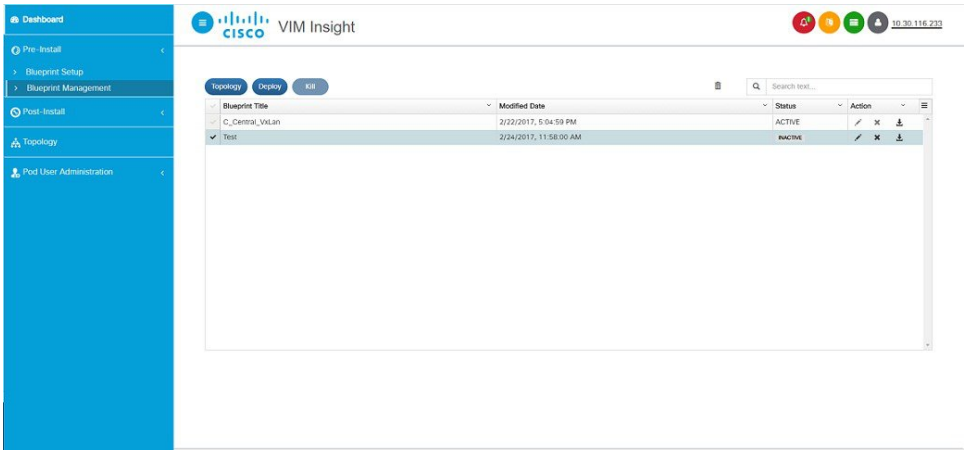
2. **Blueprint Management**:Blueprint Management gives CRUD access to users for Blueprints in the System. A user can use following features in Blueprint Management:

Figure 37: Blueprint Management



1. Delete Single or Multiple Blueprints which are in Inactive State.
2. Edit Blueprint which are in Inactive State.
3. Deploy Blueprint.
4. Uninstall or Abort Blueprint.
5. View Topology.
6. Preview and Download created Blueprint on local machine.
7. Search Blueprint from created Blueprints.

Figure 38: Blueprint Management Test



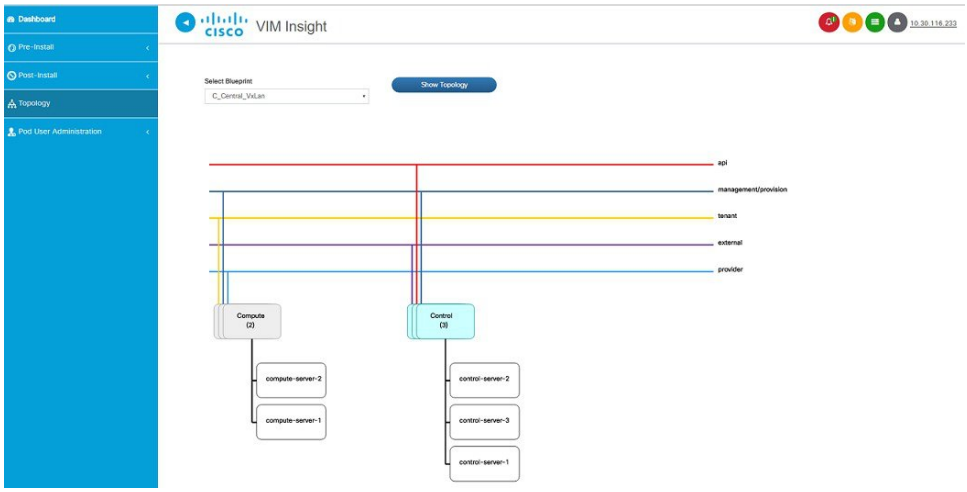
3. **Post-install**.

   This section is active only when a Blueprint is in active state; that is if the install is successful, hence day-n operations are allowed.

4. **Topology**.

Topology is a logical representation of the Blueprint where it tells the user about the nodes connectivity with the respective networks and hardware information. Topology shows the active blueprints and user can select one among them.

Figure 39: Topology

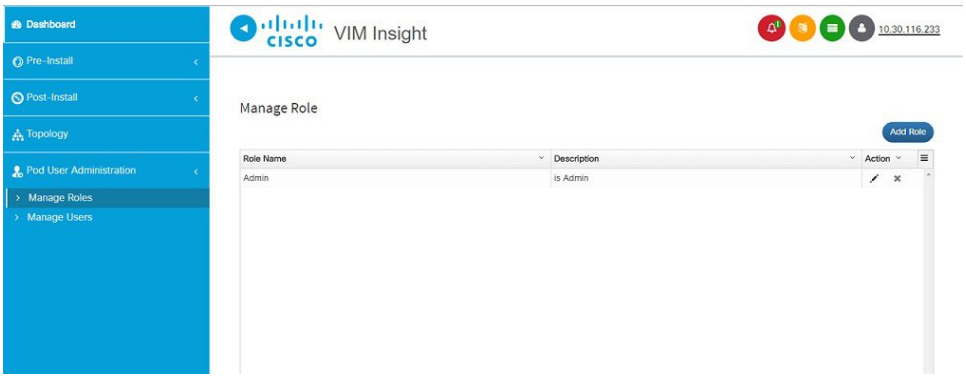


5. **Pod User Administration**

   Pod User Administration menu is available only to admin of the Management Node. This admin can be default admin of the pod or users assigned with Pod Admin role by the default admin. It has two additional sub-panel options:

   1. **Manage Roles**:
      1. Add/Edit/Delete Roles.
      2. Permissions to restrict the user access.
      3. Roles provide the granular access to a specific user.
      4. A role cannot be deleted directly if it is associated to an user.

      Figure 40: Manage roles

   2. **Manage Users**:
      1. Add/Edit/Delete Users.

2. List User name and Email ID for the users registered in the system.
3. Roles associated to users.
4. The current status of the user (Online and Offline user with Green and Red dot respectively).
5. User registration status.
6. Refresh button to get latest information about the users status.

Figure 41: Manage users

VIM Insight also have some extra features in the header (top right hand corner):

1. Notification - Tells the current status of Blueprint.
2. Context Switching - User can switch between two or more nodes.
3. User Profile - User can change the Password or Logout or Switch from UI to pod admin or vice-versa.

Context Switching within Insight

There are two ways that you can switch to another pod:

1. **Context Switching Icon**: Context Switching Icon is situated on the top right corner of the UI and is the third Icon from the left tool tip. Click **Management Node Context Switching**, to access all pods. There can be a case when a pod has red dot right next to it which indicates that the REST Password provided during registration of Management node does not matches with the current REST Password for that particular node. The Pod Admin/User can reach out to UI Admin and ask them to update the password for that Node from **Manage Nodes** in Insight UI Admin Portal.
2. **Switch Between Management Nodes**: Switch Between Management Nodes is situated in Dashboard. You can navigate to the pods by a single click. If mouse changes form hand or cursor to a red not sign then it is the same case as mentioned above for the REST Password mismatch.

Configuring OpenStack Installation

Before you begin

You need to create a Blueprint (B or C Series) to initiate OpenStack Installation through the VIM.

Step 1 In the **Navigation** pane, choose **Pre-Install** > **Blueprint Setup**.

Step 2 To create a **B Series Blueprint**:

1. On the **Blueprint Initial Setup** page of the Cisco VIM Insight , complete the following fields:

Name	Description
Blueprint Name field.	Enter blueprint configuration name.
Platform Type drop-down list	B-Series (By Default) and C-Series
Tenant Network drop-down list	Choose one of the following tenant network types: • Linuxbridge/VXLAN • OVS/VLAN
Ceph Mode drop-down list	Choose one of the following Ceph types: • Dedicated (By Default) • Central
Optional and ServicesFeatures Checkbox	Swiftstack, LDAP, Syslog Export Settings, COLLECTD, Install Mode, TorSwitch Information, TLS, Nfvmon, Pod Name, VMTP, Nfvbench, Auto Backup, Heat, Keystone v3 If any one is selected, the corresponding section is visible in various Blueprint sections. By default all features are disabled.
Import Existing YAML file	If you have an existing B Series YAML file you can use this feature to upload the file. Insight will automatically fill in the fields and if any mandatory field is missed then it will be highlight it in the respective section.

2. Click **Physical Setup** to navigate to the **Registry Setup configuration** page. Fill in the following details for Registry Setup:

Name	Description
Registry User Name Text field	User-Name for Registry **(Mandatory)**.

Name	Description
Registry Password Text field	Password for Registry **(Mandatory)**.
Registry Email Text field	Email ID for Registry **(Mandatory)**.

Once all Mandatory fields are filled the **Validation Check Registry Page** will show a Green Tick.

3. Click **UCSM Common Tab** and complete the following fields:

Name	Description
User name disabled field	By default value is Admin.
Password text field	By default value is Admin.
UCSM IP text field	Enter Password for UCSM Common **(Mandatory)**.
Resource Prefix text field	Max six characters are allowed **(Mandatory)**.
QOS Policy Type drop-down	Choose one of the following types: • NFVI (Default) • Media
Enable Prov FI PIN optional checkbox	Default is false.
MRAID-CARD optional checkbox	Enables JBOD mode to be set on disks. Applicable only if you have RAID controller configured on Storage C240 Rack servers.
Enable UCSM Plugin optional checkbox	Visible when Tenant Network type is OVS/VLAN
Enable QoS Policy optional checkbox	Visible only when UCSM Plugin is enabled. If UCSM Plugin is disabled then this option is set to False.
Enable QOS for Port Profile optional checkbox	Set True only when UCSM plugin and QoS Policy is enabled else this is set to false.
SRIOV Multi VLAN Trunk optional grid	Visible when UCSM Plugin is enabled. Enter the values for network and vlans ranges. Grid can handle all CRUD operations like Add, Delete, Edit and, Multiple Delete.

4. Click **Networking** to advance to the networking section of the Blueprint:

Name	Description
Domain Name field	Enter the domain name **(Mandatory)**.
NTP Servers field	Enter a maximum of four and minimum of one IPv4 addresses in the table.
Domain Name Servers field	Enter a maximum of three and minimum of one IPv4 addresses.

Name	Description
HTTP Proxy Server field	If your configuration uses an HTTP proxy server, enter the IP address of the server.
HTTPS Proxy Server field	If your configuration uses an HTTPS proxy server, enter the IP address of the server.

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Network table</td><td>Network table is pre-populated with Segments. To add Networks you can either clear all the table using Delete All or click Edit icon for each segment and fill in the details.

You can add, edit, or delete network information in the table:

• Click Edit to enter new entries (networks) to the table.

• Specify the following fields in the Edit Entry to Networks dialog box.

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Segment drop-down list.</td><td>By default already selected.</td></tr>
<tr><td>Management Node IP field.</td><td>Enter the IP address of the build node.

This field is only available for the Mgmt/Provision segment and is mandatory if Zenoss is selected to be a part of Blueprint.</td></tr>
<tr><td>VLAN field.</td><td>Enter the VLAN ID.

For Segment - Provider, the VLAN ID value is always "none".</td></tr>
<tr><td>Subnet field.</td><td>Enter the IPv4 address for the subnet.</td></tr>
<tr><td>Gateway field.</td><td>Enter the IPv4 address for the Gateway.</td></tr>
<tr><td>Pool field.</td><td>Enter the pool information in the required format, for example: 10.1.1.5-10.1.1.10,10.2.1.5-10.2.1.10

This field is available for the Mgmt/Provision, Storage, and Tenant segments.</td></tr>
</table>
Click Save.</td></tr>
</table>

5. On the **Servers and Roles** page of the Cisco VIM Suite wizard, you will see a pre-populated table filled with Roles: Control, Compute and Block Storage (Only if CEPH Dedicated is selected in Blueprint Initial Setup. You can clear

the table and click **Add (+)** to add a new entry in the table, and complete the following fields: You can edit or delete existing entries in the **Server and Roles** table.

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Add Entry to Servers and Roles</td><td>Click Edit or + to add a new server and role to the table.
<table>
<tr><td>Server Name.</td><td>Enter a server name</td></tr>
<tr><td>Server Type drop-down list</td><td>Choose Blade or Rack from the drop-down list.</td></tr>
<tr><td>Rack ID field</td><td>The Rack ID for the server.</td></tr>
<tr><td>Chassis ID field</td><td>Enter a Chassis ID.</td></tr>
<tr><td>If Rack is chosen, the Rack Unit ID field is displayed.</td><td>Enter a Rack Unit ID.</td></tr>
<tr><td>If Blade is chosen, the Blade ID field is displayed.</td><td>Enter a Blade ID.</td></tr>
<tr><td>If Rack is chosen, the Rack Unit ID field is displayed.</td><td>Enter a Rack Unit ID.</td></tr>
<tr><td>Select the Role from the drop down list.</td><td>If Server type is Blade then select Control and Compute. If server is Rack then select Block Storage.</td></tr>
<tr><td>Management IP.</td><td>It is an optional field but if provided for one server then it is mandatory to provide details for other Servers as well.</td></tr>
</table></td></tr>
<tr><td>Save or Add button.</td><td>Click Save or Add button, to give information for Servers and Roles; provided, all mandatory fields are filled.</td></tr>
</table>

6. Click **ToR Switch** Checkbox in **Blueprint Initial Setup** to enable the **TOR SWITCH** configuration page. It is an **Optional** section in Blueprint Setup but once all the fields are filled it is a part of the Blueprint.

Name	Description
Configure ToR optional checkbox.	Enabling this checkbox, changes the configure tor section from false to true.

<table>
<tr><th>Name</th><th colspan="2">Description</th></tr>
<tr><td>ToR Switch Information mandatory table to enter Tor information.</td><td colspan="2">Click (+) to add information for Tor Switch.<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Name</td><td>ToR switch name.</td></tr>
<tr><td>Username</td><td>ToR switch username.</td></tr>
<tr><td>Password</td><td>Tor switch password.</td></tr>
<tr><td>SSH IP</td><td>ToR switch SSH IP Address.</td></tr>
<tr><td>SSN Num</td><td>ToR switch ssn num.</td></tr>
<tr><td>VPC Peer Keepalive</td><td>Peer Management IP. You do not define if there is no peer.</td></tr>
<tr><td>VPC Domain</td><td>Do not define if peer is absent.</td></tr>
<tr><td>VPC Peer Port Info</td><td>Interface for vpc peer ports.</td></tr>
<tr><td>VPC Peer VLAN Info</td><td>VLAN ids for vpc peer ports (optional).</td></tr>
<tr><td>BR Management Port Info</td><td>Management interface of build node.</td></tr>
<tr><td>BR Management PO Info</td><td>Port channel number for management interface of build node.</td></tr>
<tr><td>BR Management VLAN info</td><td>vlan id for management interface of build node (access).</td></tr>
</table></td></tr>
<tr><td>On clicking save button, Add Tor Info Connected to Fabric field will be visible.</td><td>Port Channel field.</td><td>Enter the Port Channel input.</td></tr>
<tr><td></td><td>Switch Name Field.</td><td>Enter the friendly name.</td></tr>
</table>

7. Click **OpenStack Setup** Tab to advance to the OpenStack Setup page.
8. On the **OpenStack Setup** page of the Cisco VIM Insight wizard, complete the following fields:

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>HA Proxy</td><td>Mandatory Field. Fill in the following details:<table>
<tr><td>External VIP Address</td><td>Enter IP Address of External VIP</td></tr>
<tr><td>Virtual Router ID</td><td>Enter the Router ID for HA</td></tr>
<tr><td>Internal VIP Address</td><td>Enter IP Address of Internal VIP</td></tr>
</table></td></tr>
<tr><td>Keystone</td><td>Mandatory field and prepopulated. This option would always be true.<table>
<tr><td>Admin Username</td><td>admin</td></tr>
<tr><td>Admin Tenant Name</td><td>admin</td></tr>
</table></td></tr>
<tr><td>Ldap on keystone</td><td>Ldap enable checkbox by default is false.<table>
<tr><td>Domain Namefield.</td><td>Enter name for Domain name.</td></tr>
<tr><td>Object class for Userfield.</td><td>Enter a string as input.</td></tr>
<tr><td>Object class for Group</td><td>Enter a string.</td></tr>
<tr><td>Domain Name tree for Groups</td><td>Enter a string.</td></tr>
<tr><td>Domain Name tree for User field.</td><td>Enter a string.</td></tr>
<tr><td>Suffix for domain name field.</td><td>Enter a string.</td></tr>
<tr><td>URL field.</td><td>Enter a URL with ending port number.</td></tr>
<tr><td>Domain Name for Bind User field.</td><td>Enter a string.</td></tr>
<tr><td>Password field.</td><td>Enter Password as string format.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Neutron</td><td>Neutron fields would change on the basis of Tenant Network Type Selection from Blueprint Initial Setup. Following are the options available for Neutron for OVS/VLAN:
<table>
<tr><td>Tenant Network Type</td><td>Auto Filled based on the Tenant Network Type selection in Blueprint Initial Setup page.</td></tr>
<tr><td>Mechanism Drivers</td><td>Auto Filled based on the Tenant Network Type selection in Blueprint Initial Setup page.</td></tr>
<tr><td>NFV Hosts</td><td>Auto filled with the Compute you added in Server and Roles. If you select All in this section NFV_HOSTS: "ALL" will be added to the Blueprint or else you can select particlula computes as well for eg: NFV_HOSTS: "compute-server-1, compute-server-2"</td></tr>
<tr><td>Tenant VLAN Ranges</td><td>Only with VTS/VLAN and VPP/VLAN</td></tr>
<tr><td>Enable Jumbo Frames</td><td>Check Box default is false</td></tr>
</table>
For Tenant Network Type Linux Bridge everything will remain the same but Tenant VLAN Ranges will be removed.</td></tr>
<tr><td>CEPH</td><td>Ceph has two pre-populated fields
CEPH Mode : By default Dedicated.
NOVA Boot from: Drop Down selection. You can choose Ceph or local.</td></tr>
<tr><td>GLANCE</td><td>By default populated for CEPH Dedicated with Store Backend value as CEPH.</td></tr>
<tr><td>CINDER</td><td>By default Populated for CEPH Dedicated with Volume Driver value as CEPH.</td></tr>
</table>

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>VMTP optional section will only be visible once VMTP is selected from Blueprint Initial Setup.</td><td>Check one of the check boxes to specify a VMTP network:
• Provider Network
• External Network

For the Provider Network complete the following:
<table><tr><td>Network Name field</td><td>Enter the name for the external network.</td></tr><tr><td>IP Start field</td><td>Enter the starting floating IPv4 address.</td></tr><tr><td>IP End field</td><td>Enter the ending floating IPv4 address.</td></tr><tr><td>Gateway field</td><td>Enter the IPv4 address for the Gateway.</td></tr><tr><td>DNS Server field</td><td>Enter the DNS server IPv4 address.</td></tr><tr><td>Segmentation ID field</td><td>Enter the segmentation ID.</td></tr><tr><td>Subnet</td><td>Enter the Subnet for Provider Network.</td></tr></table>For External Network fill in the following details:
<table><tr><td>Network Name field</td><td>Enter the name for the external network.</td></tr><tr><td>Network IP Start field</td><td>Enter the starting floating IPv4 address.</td></tr><tr><td>Network IP End field</td><td>Enter the ending floating IPv4 address.</td></tr><tr><td>Network Gateway field</td><td>Enter the IPv4 address for the Gateway.</td></tr><tr><td>DNS Server field</td><td>Enter the DNS server IPv4 address.</td></tr><tr><td>Subnet</td><td>Enter the Subnet for External Network.</td></tr></table></td></tr>
</table>

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>TLS This optional section will only be visible once TLS is selected from Blueprint Initial Setup Page.</td><td>TLS has two options:
External LB VIP FQDN - Text Field.
External LB VIP TLS - True/False. By default this option is false.</td></tr>
<tr><td>SwiftStack optional section will be visible once SwiftStack is selected from Blueprint Initial Setup Page. SwiftStack is only supported with KeyStonev2 . If you select Keystonev3, swiftstack will not be available for configuration.</td><td>Following are the options that needs to be filled for SwiftStack:<table>
<tr><td>Cluster End Point</td><td>IP address of PAC (proxy-account-container) endpoint.</td></tr>
<tr><td>Admin User</td><td>Admin user for swift to authenticate in keystone.</td></tr>
<tr><td>Admin Tenant</td><td>The service tenant corresponding to the Account-Container used by Swiftstack.</td></tr>
<tr><td>Reseller Prefix</td><td>Reseller_prefix as configured for Keysone Auth,AuthToken support in Swiftstack E.g KEY_</td></tr>
<tr><td>Admin Password</td><td>swiftstack_admin_password</td></tr>
<tr><td>Protocol</td><td>http or https ?</td></tr>
</table></td></tr>
</table>

9. If **Syslog Export** or **NFVBENCH** is selected in **Blueprint Initial Setup** Page, the **Services Setup** page will be **enabled** for user to view. Following are the options under **Services Setup** Tab:

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Syslog Export</td><td>Following are the options for Syslog Settings:<table>
<tr><td>Remote Host</td><td>Enter Syslog IP Addr.</td></tr>
<tr><td>Protocol</td><td>Drop-down selection for UDP and TCP by default is UDP.</td></tr>
<tr><td>Facility</td><td>Defaults to local5.</td></tr>
<tr><td>Severity</td><td>Defaults to debug.</td></tr>
<tr><td>Clients</td><td>Defaults to ELK.</td></tr>
<tr><td>Port</td><td>Defaults to 514 but can be modified by the User.</td></tr>
</table></td></tr>
</table>

Name	Description
NFVBENCH	**NFVBENCH enable checkbox** which by default is **false**. **If Tor Configured:** (Optional). • tor_info: {po: <int>, switch_a_hostname: ethx/y, switch_b_hostname: ethx/y} • tor_info: {po: <int>, switch_c_hostname: 'etha/b,ethx/y'} • nfvbench_vlan_info (when VTS option is choosen, and TORSWITCH Info is there; VLAN1:VLAN2; Correct format: start_vlan:end_vlan; with end_vlan " values"greater than start_vlan 1")

Step 3 To create a **C Series Blueprint**:

1. On the **Blueprint Initial Setup** page of the Cisco VIM Insight, complete the following fields:

Name	Description
Blueprint Name field.	Enter the name for the blueprint configuration.
Platform Type drop-down list	• B-Series (By Default) • C-Series (Select C Series)
Tenant Network drop-down list	Choose one of the following tenant network types: • Linux Bridge/VXLAN • OVS/VLAN • VTS/VLAN • ML2VPP/VLAN
Ceph Mode drop-down list	Choose one of the following Ceph types: • Dedicated (By Default) • Central
Optional and Services Features checkbox	Swiftstack, LDAP, Syslog Export Settings, COLLECTD, Install Mode, TorSwitch Information, TLS, Nfvmon, Pod Name, VMTP, Nfvbench, Auto Backup, Heat, Keystone v3 If any one is selected, the corresponding section is visible in various Blueprint sections. By default all features are disabled.
Import Existing YAML file	If you have an existing C Series YAML file you can use this feature to upload the file. Insight will automatically fill in the fields and any missed mandatory field will be highlighted in the respective section.

2. Click **Physical Setup** to advance to the **Registry Setup** configuration page. Fill in the following details for Registry Setup:

Name	Description
Registry User Name text field	User-Name for Registry **(Mandatory)**.
Registry Password text field	Password for Registry **(Mandatory)**.
Registry Email text field	Email ID for Registry **(Mandatory)**.

Once all the mandatory fields are filled the **Validation Check Registry Page** will be changed to a Green Tick.

3. Click **CIMC Common Tab** and complete the following fields:

Name	Description
User name disabled field	By default value is Admin.
Password text field	Enter Password for UCSM Common **(Mandatory)**.

4. Click Networking to advance to the networking section of the Blueprint.

Name	Description
Domain Name field	Enter the domain name. **(Mandatory)**
NTP Servers field	Enter a maximum of four and minimum of one IPv4 addresses in the table.
Domain Name Servers field	Enter a maximum of three and minimum of one IPv4 addresses.
HTTP Proxy Server field	If your configuration uses an HTTP proxy server, enter the IP address of the server.
HTTPS Proxy Server field	If your configuration uses an HTTPS proxy server, enter the IP address of the server.

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Networks table</td><td>Network table is pre-populated with Segments. To add Networks you can either clear all the table with Delete all or click edit icon for each segment and fill in the details.

You can add, edit, or delete network information in the table.

• Click Edit button to add new entries (networks) to the table.

• Specify the following fields in the Edit Entry to Networks dialog:

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Segment drop-down list</td><td>Selected by Default.</td></tr>
<tr><td>Management Node IP field</td><td>Enter the IP address of the build node.This field is only available for the Mgmt/Provision segment and is Mandatory if Zenoss is selected as a part of Blueprint.</td></tr>
<tr><td>VLAN field</td><td>Enter the VLAN ID.

For Segment - Provider, the VLAN ID value is 'none'.</td></tr>
<tr><td>Subnet field</td><td>Enter the IPv4 address for the subnet.</td></tr>
<tr><td>Gateway field</td><td>Enter the IPv4 address for the Gateway.</td></tr>
<tr><td>Pool field</td><td>Enter the pool information in the required format, for example: 10.1.1.5-10.1.1.10,10.2.1.5-10.2.1.10

This field is available only for the Mgmt/Provision, Storage, and Tenant segments.</td></tr>
<tr><td colspan="2">Click Save.</td></tr>
</table>
</td></tr>
</table>

5. On the **Servers and Roles** page of the Cisco VIM Suite wizard, a pre-populated table filled with Roles : Control, Compute and Block Storage (Only if CEPH Dedicated is selected in Blueprint Initial Setup is available. You can

clear the table and click **Add (+)** to add a new entry in the table, and complete the following fields: You can edit or delete existing entries in the **Server and Roles** table.

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Add Entry to Servers and Roles</td><td>Click Edit or + to add a new server and role to the table.
<table>
<tr><td>Server Name</td><td>Entry a friendly name.</td></tr>
<tr><td>Boot Drive drop-down list</td><td>Choose LOCALHDD or SDCARD from the drop-down list.</td></tr>
<tr><td>Rack ID field</td><td>The rack ID for the server.</td></tr>
<tr><td>VIC Slot field</td><td>Enter a VIC Slot.</td></tr>
<tr><td>CIMC IP field</td><td>Enter a IP address.</td></tr>
<tr><td>CIMC Username field</td><td>Enter a Username.</td></tr>
<tr><td>CIMC Password field</td><td>Enter a Password for CIMC.</td></tr>
<tr><td>Select the Role from the drop down list</td><td>Choose Control or Compute or BlockStorage from the drop-down list.</td></tr>
<tr><td>Management IP</td><td>It is an optional field but if provided for one Server then it is mandatory to provide it for other Servers as well.</td></tr>
</table></td></tr>
<tr><td>If Tor checkbox is selected, these fields will be displayed.</td><td>• Port Channel field
• Switch Name Field</td><td>• Enter the Port Channel input.
• Enter the friendly name.</td></tr>
<tr><td>If Intel NIC support is checked in server and roles with ToR field.</td><td>Add SRIOV tor info connected to switch.</td><td>Enter the switch-name.</td></tr>
<tr><td>If Intel NIC is checked with an entry of integer value then Add DP tor info connected to switch filed.</td><td>• Port Channel field.
• Switch-Name field</td><td>• Enter the Port channel.
• Enter the string.</td></tr>
<tr><td>Click Save or Add button.</td><td colspan="2">If all mandatory fields are filled click Save or Add button information for Servers and Roles</td></tr>
</table>

6. Click **Tor Switch** checkbox in **Blueprint Initial Setup** to enable the **TOR SWITCH** configuration page. It is an **Optional** section in Blueprint Setup but once all the fields are filled in then it will become a part of the Blueprint.

Name	Description
Configure ToR optional checkbox.	Enabling this checkbox, changes the configure tor section from false to true.

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>ToR Switch Information mandatory table if you want to enter ToR information.</td><td>Click (+) to add information for ToR Switch.
<table>
<tr><td>Name</td><td>Description</td></tr>
<tr><td>Name</td><td>ToR switch name.</td></tr>
<tr><td>Username</td><td>TOR switch username.</td></tr>
<tr><td>Password</td><td>ToR switch password.</td></tr>
<tr><td>SSH IP</td><td>ToR switch SSH IP.</td></tr>
<tr><td>SSN Num</td><td>ToR switch ssn num.</td></tr>
<tr><td>VPC Peer Keepalive</td><td>Peer Management IP. You cannot define if there is no peer.</td></tr>
<tr><td>VPC Domain</td><td>Cannot define if there is no peer.</td></tr>
<tr><td>VPC Peer Port Info</td><td>Interface for vpc peer ports.</td></tr>
<tr><td>VPC Peer VLAN Info</td><td>VLAN ids for vpc peer ports (optional).</td></tr>
<tr><td>BR Management Port Info</td><td>Management interface of build node.</td></tr>
<tr><td>BR Management PO Info</td><td>Port channel number for management interface of build node.</td></tr>
<tr><td>BR Management VLAN info</td><td>VLAN id for management interface of build node (access).</td></tr>
</table></td></tr>
<tr><td colspan="2">Click Save.</td></tr>
</table>

7. Click **OpenStack Setup** Tab to advance to the **OpenStack Setup** page.
8. On the **OpenStack Setup** page of the Cisco VIM Insight wizard, complete the following fields:

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>HA Proxy</td><td>Fill in the Mandatory details:
<table>
<tr><td>External VIP Address</td><td>Enter IP Address of External VIP.</td></tr>
<tr><td>Virtual Router ID</td><td>Enter the Router ID for HA.</td></tr>
<tr><td>Internal VIP Address</td><td>Enter IP Address of Internal VIP.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Keystone</td><td>Mandatory field are pre-populated.
<table>
<tr><td>Admin Username</td><td>admin.</td></tr>
<tr><td>Admin Tenant Name</td><td>admin.</td></tr>
</table></td></tr>
<tr><td>Ldap on keystone</td><td>Ldap enable checkbox which by default is false, if LDAP is enabled on keystone.
<table>
<tr><td>Domain Namefield</td><td>Enter name for Domain name.</td></tr>
<tr><td>Object class for Userfield</td><td>Enter a string as input.</td></tr>
<tr><td>Object class for Group</td><td>Enter a string.</td></tr>
<tr><td>Domain Name tree for Groups</td><td>Enter a string.</td></tr>
<tr><td>Domain Name tree for User field</td><td>Enter a string.</td></tr>
<tr><td>Suffix for domain name field</td><td>Enter a string.</td></tr>
<tr><td>URL field</td><td>Enter a URL with ending port number.</td></tr>
<tr><td>Domain Name for Bind User field</td><td>Enter a string.</td></tr>
<tr><td>Password field</td><td>Enter Password as string format.</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Neutron</td><td>Neutron fields will change based on Tenant Network Type selection from Blueprint Initial Setup.
Following are the options available for Neutron for OVS/VLAN:
<table>
<tr><td>Tenant Network Type</td><td>Auto Filled based on the Tenant Network Type selection in Blueprint Initial Setup page.</td></tr>
<tr><td>Mechanism Drivers</td><td>Auto Filled based on the Tenant Network Type selection in Blueprint Initial Setup page.</td></tr>
<tr><td>NFV Hosts</td><td>Auto filled with the Compute added in Server and Roles.
Selecting All in this section of NFV_HOSTS: "ALL" will be added to the Blueprint or you can select the particular compute. For Eg:
NFV_HOSTS:
compute-server-1,
compute-server-2.</td></tr>
<tr><td>Tenant VLAN Ranges</td><td>Only with VTS/VLAN and VPP/VLAN.</td></tr>
<tr><td>Enable Jumbo Frames</td><td>By default Check Box is false.</td></tr>
</table>
For Tenant Network Type Linux Bridge everything will remain the same but Tenant VLAN Ranges will be Removed.</td></tr>
<tr><td>CEPH</td><td>Ceph has two pre-populated fields:
• CEPH Mode : By default Dedicated.
• NOVA Boot: From drop down selection you can choose Ceph or local.</td></tr>
<tr><td>GLANCE</td><td>By default Populated for CEPH Dedicated with Store Backend value as CEPH.</td></tr>
<tr><td>CINDER</td><td>By default Populated for CEPH Dedicated with Volume Driver value as CEPH.</td></tr>
</table>

Name	Description
VMTP optional section, this will be visible only if VMTP is selected from Blueprint Initial Setup.	

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td></td><td>Check one of the check boxes to specify a VMTP network:
• Provider Network.
• External Network.

For the Provider Network complete the following:
<table><tr><td>Network Name field</td><td>Enter the name for the external network.</td></tr><tr><td>IP Start field</td><td>Enter the starting floating IPv4 address.</td></tr><tr><td>IP End field</td><td>Enter the ending floating IPv4 address</td></tr><tr><td>Gateway field</td><td>Enter the IPv4 address for the Gateway.</td></tr><tr><td>DNS Server field</td><td>Enter the DNS server IPv4 address.</td></tr><tr><td>Segmentation ID field</td><td>Enter the segmentation ID.</td></tr><tr><td>Subnet</td><td>Enter the Subnet for Provider Network.</td></tr></table>For External Network fill in the following details:
<table><tr><td>Network Name field</td><td>Enter the name for the external network.</td></tr><tr><td>Network IP Start field</td><td>Enter the starting floating IPv4 address.</td></tr><tr><td>Network IP End field</td><td>Enter the ending floating IPv4 address.</td></tr><tr><td>Network Gateway field</td><td>Enter the IPv4 address for the Gateway.</td></tr><tr><td>DNS Server field</td><td>Enter the DNS server IPv4 address.</td></tr><tr><td>Subnet.</td><td>Enter the Subnet for External Network.</td></tr></table>For External Network fill in the following details:
<table><tr><td>Network Name field</td><td>Enter the name for the external network.</td></tr></table></td></tr>
</table>

<table>
<tr><th>Name</th><th colspan="2">Description</th></tr>
<tr><td></td><td colspan="2"><table>
<tr><td>Network IP Start field</td><td>Enter the starting floating IPv4 address.</td></tr>
<tr><td>Network IP End field</td><td>Enter the ending floating IPv4 address.</td></tr>
<tr><td>Network Gateway field</td><td>Enter the IPv4 address for the Gateway.</td></tr>
<tr><td>DNS Server field</td><td>Enter the DNS server IPv4 address.</td></tr>
<tr><td>Subnet field</td><td>Enter the Subnet for External Network.</td></tr>
</table></td></tr>
<tr><td>TLS optional section, this will be visible only if TLS is selected from Blueprint Initial Setup Page.</td><td colspan="2">TLS has two options:
External LB VIP FQDN - Text Field.
External LB VIP TLS - True/False. By default this option is false.</td></tr>
<tr><td>SwiftStack optional section will be visible only if SwiftStack is selected from Blueprint Initial Setup Page. SwiftStack is only supported with KeyStonev2. If you select Keystonev3, swiftstack will not be available to configure.</td><td colspan="2">Following are the options that needs to be filled for SwiftStack:<table>
<tr><td>Cluster End Point</td><td>IP address of PAC (proxy-account-container) endpoint.</td></tr>
<tr><td>Admin User</td><td>Admin user for swift to authenticate in keystone.</td></tr>
<tr><td>Admin Tenant</td><td>The service tenant corresponding to the Account-Container used by Swiftstack.</td></tr>
<tr><td>Reseller Prefix</td><td>Reseller_prefix as configured for Keysone Auth,AuthToken support in Swiftstack E.g KEY_</td></tr>
<tr><td>Admin Password</td><td>swiftstack_admin_password</td></tr>
<tr><td>Protocol</td><td>http or https</td></tr>
</table></td></tr>
</table>

9. If **Syslog Export** or **NFVBENCH** is selected in **Blueprint Initial Setup** Page, then **Services Setup** page would be **enabled** for user to view. Following are the options under **Services Setup** Tab:

<table>
<tr><th>Name</th><th>Description</th></tr>
<tr><td>Syslog Export</td><td>Following are the options for Syslog Settings:<table>
<tr><td>Remote Host</td><td>Enter Syslog IP Addr.</td></tr>
<tr><td>Protocol</td><td>Drop-down selection for UDP and TCP is UDP by default.</td></tr>
<tr><td>Facility</td><td>Defaults to local5.</td></tr>
<tr><td>Severity</td><td>Defaults to debug.</td></tr>
<tr><td>Clients</td><td>Defaults to ELK.</td></tr>
<tr><td>Port</td><td>Defaults to 514 but can be modified by the User.</td></tr>
</table></td></tr>
<tr><td>NFVBENCH</td><td>NFVBENCH enable checkbox by default isfalse.
If Tor Configured: (Optional).
• tor_info: {po: <int>, switch_a_hostname: ethx/y, switch_b_hostname: ethx/y}
• tor_info: {po: <int>, switch_c_hostname: 'etha/b,ethx/y'}
• nfvbench_vlan_info (when VTS option is choosen, and TORSWITCH Info is there; VLAN1:VLAN2; Correct format: start_vlan:end_vlan; with end_vlan " values"greater than start_vlan 1")</td></tr>
</table>

Step 4 Click **Offlinevalidation**, to initiate an offline validation of the Blueprint.

Step 5 Blueprint can also be created using an **Upload functionality**:

- In Blueprint Initial Setup.
- Click the **Browse** button in the blueprint initial setup.
- Select the YAML file you want to upload.
- Click **Select** button.
- Clicking on load button in the Insight UI Application. All the fields present in the YAML file would be uploaded to the respective fields in UI.
- Enter the name of the Blueprint (Make sure you enter unique name while saving Blueprints. There would be no two Blueprints with same name.)
- Click **Offline Validation**.
- If all the mandatory fields in the UI are populated, then Offline Validation of the Blueprint will start else a pop up would be visible which will inform which section of Blueprint Creation has a missing information error.
- On Validation Success of Blueprint **Save Blueprint** button will be enabled with **Cancel** button
- A pop up will be generated asking to initiate the deployment with **Blueprint Name** and the stages you need to run.

  On Validation Failure of Blueprint **Cancel** button will be enabled.

Once the **Offlinevalidation** is successful, **Save** option will be enabled which will redirect you to the Blueprint Management Page.

The wizard advances to the Blueprint Management page. On the Blueprint Management page you can select the recently added Inactive Blueprint and click **Install** button which is disabled by default.

A pop up will be generated asking to initiate the deployment with **Blueprint Name** and the stages you need to run.

By default all stages are selected but you can also do an incremented install.

In case of Incremented Install you should select stages in the order. For Example: If you select **Validation Stage** then the 2nd stage Management Node Orchestration will be enabled. You cannot skip stages and run a deployment.

Once you click **Proceed** the Cloud Deployment would be initiated and the progress can be viewed from "Dashboard".

Note Once the Blueprint is in **Active** State, the **Post-Install** features listed in Navigation Bar will changed to **Active** stage.

Post Installation Features for Active Blueprint

This option is only available to a pod, which is successfully deployed. There are multiple sub-links available to manage the day-n operation of the pod. However, in many cases, Insight cross-launches the relevant services, thereby delegating the actual rendering to the individual services.

Monitoring the Pod

VIM 2.0 uses ELK (elasticsearch, logstash and Kibana) to monitor the OpenStack services, by cross-launching the Kibana dashboard.

To cross launch Kibana, complete the following instructions:

Step 1 In the **Navigation** pane, click **POST-Install** > **Monitoring**.
The **Authentication Required** browser pop up is displayed.

Step 2 Enter the **username** as admin.

Step 3 Enter the ELK_PASSWORD password obtained from /root/installer-<tagid>/openstack-configs/secrets.yaml in the management node.
Kibana is launched in an I-Frame

Note Click **Click here to view Kibana logs in new tab** link to view Kibana Logs in a new tab.

Cross Launching Horizon

Horizon is the canonical implementation of Openstack's Dashboard, which provides a web based user interface to OpenStack services including Nova, Swift and, Keystone.

Step 1 In the Navigation pane, click **Post-Install** > **Horizon**.

Step 2 Click **Click here to view Horizon logs in new tab**.
You will be redirected to Horizon landing page in a new tab.

Run VMTP

Run VMTP is divided in two sections:

- **Results for Auto Run**: This will show the results of VMTP which was run during cloud deployment (Blueprint Installation).
- **Results for Manual Run**: Here you have an option to run the VMTP on demand. To run VMTP on demand just click **Run VMTP** button.

Note If VMTP stage was skipped/not-run during Blueprint Installation, this section of POST Install would be disabled for the user.

Run CloudPulse

Following are the tests supported in CloudPulse:

1. cinder_endpoint
2. glace_endpoint
3. keystone_endpoint
4. nova_endpoint
5. neutron_endpoint
6. rabbitmq_check
7. galera_check
8. ceph_check

POD Management

One of the key aspects of Cisco VIM it that it provides the ability for the admin to perform pod life-cycle management from a hardware and software perspective. Nodes of a given pod corrupts at times and VIM provides the ability to add, remove or replace nodes, based on the respective roles with some restrictions. Details of pod management will be listed in the admin guide, however as a summary the following operations are allowed on a running pod:

Step 1 **Add or Remove Storage Nodes**: You can add one node at a time, given that we run Ceph as a distributed storage offering.

Step 2 **Add or Remove Computes Nodes**: N-computes nodes can be replaced simultaneously; however at any given point, at least one compute node should be active.

Step 3 **Replace Control Nodes**: We do not support double fault scenarios, replacement of one controller at a time is supported.

System Update

As part of the lifecycle management of the cloud, VIM has the ability to bring in patches (bug fixes related to code, security, etc.), thereby providing the additional value of seamless cloud management from software perspective. Software update of the cloud is achieved by uploading a valid tar file following initiation of a System Update from the Insight as follows:

Step 1 In the Navigation pane, click **Post-Install** > **System Update**.

Step 2 Click **Browse** button.

Step 3 Select the valid tar file.

Step 4 Click **Open** > **Upload and Update** .
Message stating System Update has been initiated will be displayed. Logs front-ended by hyperlink would be visible in the section below before Update Logs to help see the progress of the update. During the software update, all other pod management activities will be disabled. Post-update, normal cloud management will commence.

Reconfigure Password

There are two options to regenerate the Password:

1. **Regenerate all passwords**: Click the checkbox of Regenerate all passwords and click **Set Password**. This will automatically regenerate all passwords in alphanumeric format.
2. **Regenerate single or more password**: If user wants to set a specific password for any service like Horizon's ADMIN_USER_PASSWORD they can add it by doing an inline edit. Double click on the filed under Password and then enter the password which will enable **Set Password** button.

Note During the reconfiguration of password, all other pod management activities will be disabled. Post-update, normal cloud management will commence.

Reconfigure Openstack Services, TLS certs and ELK configurations

Cisco VIM supports the reconfiguration of OpenStack log level services, TLS certificates, and ELK configuration. Listed below are the steps to reconfigure the OpenStack and other services:

Step 1 In the Navigation pane, click **Post-Install** > **Reconfigure OpenStack Config**.

Step 2 Click on the specific item to be changed and updated; For TLS certificate it is the path to certificate location.

Step 3 Enter **Set Config** and the process will commence.

During the reconfiguration process, all other pod management activities will be disabled. Post-update, normal cloud management will commence.

Reconfigure Optional Services

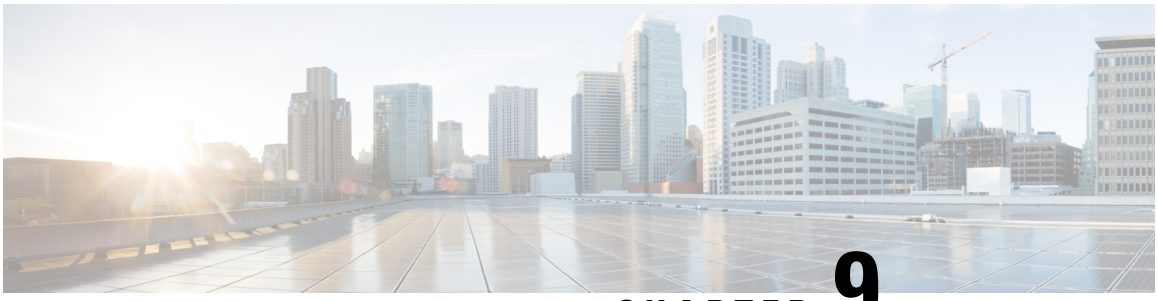
Cisco VIM offers optional services such as heat, migration to Keystone v3, NFVBench, NFVIMON and so on, that can be enabled as post-pod deployment. Optional services can be un-configured as post-deployment in 2.0 feature. These services can be enabled in one-shot or selectively. Listed below are the steps to enable optional services:

Step 1 In the Navigation pane, click **Post-Install** > **Reconfigure Optional Services**.

Step 2 Choose the right service and update the fields with the right values.

Step 3 Enter **Reconfigure** to commence the process.

During the reconfiguration process, all other pod management activities will be disabled. Post-update, normal cloud management will commence.



CHAPTER 9

Verifying the Cisco NFVI Installation

The following topics provide quick methods for checking and assessing the Cisco NFVI installation.

Displaying Cisco NFVI Node IP Addresses

To display the IP addresses for all Cisco NFVI nodes, enter the following command:

```
# cd /root/openstack-configs
[root @nfvi_management_node openstack-configs]# cat
/root/installer/openstack-configs/mercury_servers_info
```

Sample output is shown below:

```
Total nodes: 8
Controller nodes: 3
+---------------+---------------+------------+------------+-----------+---------+
| Server        | CIMC          | Management | Provision  | Tenant    | Storage |
+---------------+---------------+------------+------------+-----------+---------+
| c44-control-1 | 172.26.233.54 | 10.21.1.25 | 10.21.1.25 | 10.2.2.22 | None    |
|               |               |            |            |           |         |
| c44-control-3 | 172.26.233.56 | 10.21.1.27 | 10.21.1.27 | 10.2.2.24 | None    |
|               |               |            |            |           |         |
| c44-control-2 | 172.26.233.55 | 10.21.1.28 | 10.21.1.28 | 10.2.2.25 | None    |
|               |               |            |            |           |         |
+---------------+---------------+------------+------------+-----------+---------+
Compute nodes: 2
+---------------+---------------+------------+------------+-----------+---------+
|     Server    |      CIMC     | Management | Provision  |   Tenant  | Storage |
+---------------+---------------+------------+------------+-----------+---------+
| c44-compute-1 | 172.26.233.57 | 10.21.1.26 | 10.21.1.26 | 10.2.2.23 |   None  |
|               |               |            |            |           |         |
| c44-compute-2 | 172.26.233.58 | 10.21.1.23 | 10.21.1.23 | 10.2.2.21 |   None  |
|               |               |            |            |           |         |
+---------------+---------------+------------+------------+-----------+---------+
Storage nodes: 3
+---------------+---------------+------------+------------+--------+-----------+
```

```
|     Server    |      CIMC     | Management | Provision  | Tenant |  Storage  |
+---------------+---------------+------------+------------+--------+-----------+
| c44-storage-3 | 172.26.233.53 | 10.21.1.22 | 10.21.1.22 |  None  | 10.3.3.22 |
|               |               |            |            |        |           |
| c44-storage-2 | 172.26.233.52 | 10.21.1.24 | 10.21.1.24 |  None  | 10.3.3.23 |
|               |               |            |            |        |           |
| c44-storage-1 | 172.26.233.51 | 10.21.1.21 | 10.21.1.21 |  None  | 10.3.3.21 |
|               |               |            |            |        |           |
+---------------+---------------+------------+------------+--------+-----------+
[root@c44-top-mgmt openstack-configs]#
```

Verifying Cisco VIM Client CLI Availability

The Cisco VIM Client CLI is very important for managing Cisco NFVI pods. After the Cisco NFVI installation is complete, verify that the Cisco VIM client is running and pointing to the right management node installer directory. Cisco NFVI provides a tool that you can use to check the REST API server status and directory where it is running. To launch the tool, enter the following:

```
# cd installer-<tagid>/tools
#./restapi.py -a status
Status of the REST API Server:  active (running) since Thu 2016-08-18 09:15:39 UTC; 9h ago
REST API launch directory: /root/installer-<tagid>/
```

Confirm that the server status is active and check that the restapi launch directory matches the directory where the installation is launched. The restapi command also provides options to launch, tear down, and reset the restapi server password as listed below:

```
# ./restapi.py -h
usage: restapi.py [-h] --action ACTION [--yes] [--verbose]

REST API setup helper

optional arguments:
  -h, --help            show this help message and exit
  --action ACTION, -a ACTION
                        setup - Install and Start the REST API server.
                        teardown - Stop and Uninstall the REST API
       server.
                        restart - Restart the REST API server.
                        regenerate-password - Regenerate the password for
       REST API server.
                        reset-password - Reset the REST API password with
      user given password.
                        status - Check the status of the REST API server
  --yes, -y             Skip the dialog. Yes to the action.
  --verbose, -v         Perform the action in verbose mode.
```

If the REST API server is not running, executing **./ciscovimclinet/ciscovim** displays the following error message:

```
# cd installer-<tagid>/
#./ciscovimclient/ciscovim –setupfile ~/Save/<setup_data.yaml> run
ERROR: Error communicating with https://<api_ip:8445> [Errno 111] Connection refused
```

If the installer directory or the REST API state is not correct or pointing to an incorrect REST API launch directory, go to the installer-<tagid>/tools dir and execute:

```
# ./restapi.py –action setup
```

Confirm that the REST API server state and launch directory is correct:

```
# ./restapi.py –action status
```

If the REST API recovery step was run on an existing pod, run the following command to ensure that the REST API server continues to manage IT:

```
    # cd installer-<tagid>/
#./ciscovimclient/ciscovim --setup_file <setup_data_file_path> --perform 7 -y
```

Note Detailed information about the Cisco NFVI REST API is provided in the Cisco Network Function Virtualization Infrastructure Administrator Guide.

Displaying Cisco NFVI Logs

Cisco NFVI installation logs are generated in the management node /var/log/mercury//<*install_uuid*>/ directory. The last 20 log directories are tarred and kept in this directory. The logs are archived (tar.gz file) after each run. The following table lists the Cisco NFVI installation steps and corresponding log files:

Table 12: Cisco NFVI Installation Logs

Step	Description	Log File
1	INPUT_VALIDATION	mercury_baremetal_install.log
2	BUILDNODE_ORCHESTRATION	mercury_buildorchestration.log
3	VALIDATION	mercury_baremetal_install.log
4	BAREMETAL	mercury_baremetal_install.log
5	COMMONSETUP	mercury_os_install.log
6	CEPH	mercury_ceph_install.log
7	ORCHESTRATION	mercury_os_install.log
8	VMTP	none

Accessing OpenStack API Endpoints

The Cisco NFVI installer stores access credentials in the management node /root/installer-<*tag-number*>/openstack-configs/openrc. The external_lb_vip_address provided in setup_data.yaml is the IP address where OpenStack APIs are handled. An openrc example is shown below:

```
export OS_AUTH_URL=http://172.26.233.139:5000/v2.0 or
 https://172.26.233.139:5000/v2.0 (if TLS is enabled)
```

```
export OS_USERNAME=admin
export OS_PASSWORD=xyzabcd
export OS_TENANT_NAME=admin
export OS_REGION_NAME=RegionOne
#  For TLS, add
export OS_CACERT=/root/openstack-configs/haproxy-ca.crt
```

The corresponding setup_data.yaml entry:

```
###############################################
# HA Proxy
###############################################
external_lb_vip_address: 172.26.233.139
```

Assessing Cisco NFVI Health with CloudPulse

You can use the OpenStack CloudPulse tool to verify Cisco NFVI health. CloudPulse servers are installed in containers on all Cisco NFVI control nodes, and CloudPulse clients are installed on the management node. Run the following commands to display Cisco NFVI information. For information about CloudPulse, visit the OpenStack CloudPulse website.

To check the results of periodic CloudPulse runs:

```
# cd /root/openstack-configs
# source openrc
# cloudpulse result
+--------------------------------------+------+-------------------+----------+---------+
| uuid                                 | id   | name              | testtype | state   |
+--------------------------------------+------+-------------------+----------+---------+
| bf7fac70-7e46-4577-b339-b1535b6237e8 | 3788 | glance_endpoint   | periodic | success |
| 1f575ad6-0679-4e5d-bc15-952bade09f19 | 3791 | nova_endpoint     | periodic | success |
| 765083d0-e000-4146-8235-ca106fa89864 | 3794 | neutron_endpoint  | periodic | success |
| c1c8e3ea-29bf-4fa8-91dd-c13a31042114 | 3797 | cinder_endpoint   | periodic | success |
| 04b0cb48-16a3-40d3-aa18-582b8d25e105 | 3800 | keystone_endpoint | periodic | success |
| db42185f-12d9-47ff-b2f9-4337744bf7e5 | 3803 | glance_endpoint   | periodic | success |
| 90aa9e7c-99ea-4410-8516-1c08beb4144e | 3806 | nova_endpoint     | periodic | success |
| d393a959-c727-4b5e-9893-e229efb88893 | 3809 | neutron_endpoint  | periodic | success |
| 50c31b57-d4e6-4cf1-a461-8228fa7a9be1 | 3812 | cinder_endpoint   | periodic | success |
| d1245146-2683-40da-b0e6-dbf56e5f4379 | 3815 | keystone_endpoint | periodic | success |
| ce8b9165-5f26-4610-963c-3ff12062a10a | 3818 | glance_endpoint   | periodic | success |
| 6a727168-8d47-4a1d-8aa0-65b942898214 | 3821 | nova_endpoint     | periodic | success |
| 6fbf48ad-d97f-4a41-be39-e04668a328fd | 3824 | neutron_endpoint  | periodic | success |
```

To run a CloudPulse test on demand:

```
# cd /root/openstack-configs
# source openrc
# cloudpulse run --name <test_name>
# cloudpulse run --all-tests
# cloudpulse run --all-endpoint-tests
# cloudpulse run --all-operator-tests
```

To run a specific CloudPulse test on demand:

```
[root@vms-line2-build installer-3128.2]# cloudpulse run --name neutron_endpoint
+------------+--------------------------------------+
| Property   | Value                                |
+------------+--------------------------------------+
| name       | neutron_endpoint                     |
| created_at | 2016-03-29T02:20:16.840581+00:00     |
| updated_at | None                                 |
```

```
| state      | scheduled                            |
| result     | NotYetRun                            |
| testtype   | manual                               |
| id         | 3827                                 |
| uuid       | 5cc39fa8-826c-4a91-9514-6c6de050e503 |
+------------+--------------------------------------+
[root@vms-line2-build installer-3128.2]#
```

To show detailed results from a specific CloudPulse run:

```
[root@vms-line2-build installer-3128.2]# cloudpulse show 5cc39fa8-826c-4a91-9514-6c6de050e503
+------------+--------------------------------------+
| Property   | Value                                |
+------------+--------------------------------------+
| name       | neutron_endpoint                     |
| created_at | 2016-03-29T02:20:16+00:00            |
| updated_at | 2016-03-29T02:20:41+00:00            |
| state      | success                              |
| result     | success                              |
| testtype   | manual                               |
| id         | 3827                                 |
| uuid       | 5cc39fa8-826c-4a91-9514-6c6de050e503 |
+------------+--------------------------------------+
```

CloudPulse has two test sets: endpoint_scenario (runs as a cron or manually) and operator test (run manually). Endpoint tests include:

- nova_endpoint
- neutron_endpoint
- keystone_endpoint
- glance_endpoint
- cinder_endpoint

Operator tests include

- ceph_check
- docker_check
- galera_check
- node_check
- rabbitmq_check

The following table lists the operator tests you can perform with CloudPulse.

Table 13: CloudPulse Operator Tests

Test	Description
Ceph Check	Executes the ceph -f json status command on the Ceph-mon nodes and parses the output. If the result of the output is not HEALTH_OK, the ceph_check reports an error.

Test	Description
Docker Check	Finds out if all Docker containers are in running state on all nodes and reports an error if any containers are in the Exited state. The Docker check runs the command, docker ps -aq --filter 'status=exited',
Galera Check	Executes the command, mysql 'SHOW STATUS, on the controller nodes and displays the status.
Node Check	Checks if all the nodes in the system are up and online. It also compares the results of the Nova hypervisor list and determines whether all the compute nodes are available.
RabbitMQ Check	Runs the command, rabbitmqctl cluster_status, on the controller nodes and finds out if the RabbitMQ cluster is in quorum. If nodes are offline, the rabbitmq_check reports a failure.

Displaying HAProxy Dashboard and ELK Stack Logs

You can view the HAProxy dashboard at: http://< *external_lb_vip_address* >:1936 using the following username and password

- Username—haproxy
- Password—Value for HAPROXY_PASSWORD in /root/installer-<tag-number>/openstack-configs/secrets.yaml

You can use the Kibana dashboard to view logs aggregated by Logstash at: http://< *management_node_IP*>:5601 using the following username and password

- Username—admin
- Password—Value for ELK_PASSWORD in /root/installer-<tag-number>/openstack-configs/secrets.yaml

Checking Cisco NFVI Pod and Cloud Infrastructure

To test the Cisco NFVI pod and cloud infrastructure (host connectivity, basic mraiadb, rabbit, ceph cluster check), you can use the cloud-sanity tool available on the management node. To execute, enter:

```
# cd installer-<tagid>/tools
# ./cloud_sanity.py -h
usage: cloud_sanity.py [-h] [--check {all,control,compute,cephmon,cephosd}]
                       [--list] [--verbose]

cloud sanity helper

optional arguments:
  -h, --help            show this help message and exit
  -c, --check {all,control,compute,cephmon,cephosd}
              all - Run all sanity checks. [default action]
              control - Run controller sanity checks.
              compute - Run compute sanity checks.
              cephmon - Run cephmon sanity checks.
```

```
              cephosd - Run cephosd sanity checks.
  --list, -l   List all the available sanity checks.
      --verbose, -v         Run the sanity in verbose mode.
```

To list the available cloud-sanity checks, execute:

```
# ./cloud_sanity.py -l

Available sanity checks
-----------------------
1 -  Control - Ping All Controller Nodes
2 -  Control - Ping internal VIP
3 -  Control - Check Mariadb cluster size
4 -  Control - Check RabbitMQ is running
5 -  Control - Check RabbitMQ cluster status
6 -  Control - Check Nova service list
7 -  Compute - Ping All Compute Nodes
8 -  Compute - Check Nova Hypervisor list
9 -  CephMon - Check Ceph Mon status
10 -  CephMon - Check Ceph Mon results
11 -  CephOSD - Ping All Storage Nodes
12 -  CephOSD - Check OSD result with osdinfo
13 -  CephOSD - Check OSD result without osdinfo
```

A successful compute node check is shown below:

```
#./cloud_sanity.py -c compute
Executing Compute Cloud Sanity in quiet mode. This will take some time.

+---------+-------------------------------------------------------------+--------+
| Role    | Task                                                        | Result |
+---------+-------------------------------------------------------------+--------+
| Compute | Compute - Ping All Compute Nodes ***********************  | PASSED |
|         |                                                             |        |
| Compute | Compute - Check Nova Hypervisor list *******************  | PASSED |
|         |                                                             |        |
+---------+-------------------------------------------------------------+--------+
[PASSED] Cloud Sanity Compute Checks Passed
```

A failure example is shown below:

```
[root@MercTB1 tools]# ./cloud_sanity.py -c control
Executing Control Cloud Sanity in quiet mode. This will take some time.

+---------+-------------------------------------------------------------+--------+
| Role    | Task                                                        | Result |
+---------+-------------------------------------------------------------+--------+
| Control | Control - Ping All Controller Nodes ********************  | PASSED |
|         |                                                             |        |
| Control | Control - Ping internal VIP ****************************  | PASSED |
|         |                                                             |        |
| Control | Control - Check Mariadb cluster size *******************  | PASSED |
|         |                                                             |        |
| Control | Control - Check RabbitMQ is running ********************  | FAILED |
|         |                                                             |        |
+---------+-------------------------------------------------------------+--------+
[FAILED] FATAL ERROR occured when running sanity checks.
[NOTE] One or more testcase[s] skipped. Use --list to see the complete list.
```

To view the details of a failure, use the v option as shown below:

```
# ./cloud_sanity.py -c control -v
```

```
PLAY [Executes Cloud Sanity] ***************************************************

GATHERING FACTS ****************************************************************
ok: [7.7.7.15]
ok: [7.7.7.11]
ok: [7.7.7.14]

TASK: [cloud-sanity | Control - Ping All Controller Nodes] *********************
changed: [7.7.7.15 -> localhost] => (item=7.7.7.15)
changed: [7.7.7.15 -> localhost] => (item=7.7.7.11)
changed: [7.7.7.15 -> localhost] => (item=7.7.7.14)

TASK: [cloud-sanity | Control - Ping internal VIP] *****************************
changed: [7.7.7.15 -> localhost]

TASK: [cloud-sanity | Control - Check Mariadb cluster size] ********************
changed: [7.7.7.11]
changed: [7.7.7.15]
changed: [7.7.7.14]

TASK: [cloud-sanity | Control - Check RabbitMQ is running] *********************
failed: [7.7.7.11] => {"changed": true, "cmd": "docker ps -a | grep rabbit | grep Up | awk
 '{print $NF}' | cut -f2 -d '_'", "delta": "0:00:00.021044", "end": "2016-08-18
23:45:34.838817", "failed": true, "failed_when_result": true, "rc": 0, "start": "2016-08-18
 23:45:34.817773", "stdout_lines": [], "warnings": []}
changed: [7.7.7.15]
changed: [7.7.7.14]

FATAL: all hosts have already failed -- aborting

PLAY RECAP *********************************************************************
7.7.7.11                   : ok=4    changed=3    unreachable=0    failed=1
7.7.7.14                   : ok=5    changed=4    unreachable=0    failed=0
7.7.7.15                   : ok=5    changed=4    unreachable=0    failed=0

[FAILED] FATAL ERROR occured when running sanity checks.
[NOTE] One or more testcase[s] skipped. Use --list to see the complete list.
```