



Managing Cisco NFVI Security

The following topics describe Cisco NFVI network and application security and best practices.

- [Verifying Management Node Network Permissions, on page 1](#)
- [Verifying Management Node File Permissions, on page 2](#)
- [Viewing Administrator Access Attempts, on page 2](#)
- [Verifying SELinux, on page 3](#)
- [Validating Port Listening Services, on page 3](#)
- [Validating Non-Root Users for OpenStack Services, on page 4](#)
- [Verifying Password Strength, on page 4](#)
- [Reconfiguring Passwords and OpenStack Configurations, on page 5](#)
- [Enabling CVIMMON Post Pod Installation, on page 8](#)
- [Enabling NFVIMON Post Pod Install, on page 9](#)
- [Reconfiguring CIMC Password on an Existing Install, on page 11](#)
- [Increasing Provider and Tenant VLAN Ranges, on page 12](#)
- [Fernet Key Operations, on page 12](#)
- [Managing Certificates, on page 13](#)
- [Reconfiguring TLS Certificates, on page 14](#)
- [Enabling Keystone v3 on an Existing Install, on page 15](#)

Verifying Management Node Network Permissions

The Cisco NFVI management node stores sensitive information related to Cisco NFVI operations. Access to the management node can be restricted to requests coming from IP addresses known to be used by administrators. The administrator source networks is configured in the setup file, under **[NETWORKING]** using the **admin_source_networks** parameter.

To verify this host based firewall setting, log into the management node as an admin user and list the rules currently enforces by iptables. Verify that the source networks match the values configured. If no source networks have been configured, then all source traffic is allowed. However, note that only traffic destined to ports with known admin services is allowed to pass. The **admin_source_networks** value can be set at install time or changed through a reconfigure.

```
[root@control-server-1 ~]# iptables -list
Chain INPUT (policy ACCEPT)
target     prot opt source                destination
ACCEPT    icmp -- anywhere             anywhere
ACCEPT    tcp  -- 10.0.0.0/8           anywhere             tcp dpt:ssh
```

```

ACCEPT      tcp  --  172.16.0.0/12      anywhere      tcp dpt:ssh
ACCEPT      tcp  --  10.0.0.0/8         anywhere      tcp dpt:https
ACCEPT      tcp  --  172.16.0.0/12      anywhere      tcp dpt:https
ACCEPT      tcp  --  10.0.0.0/8         anywhere      tcp dpt:4979
ACCEPT      tcp  --  172.16.0.0/12      anywhere      tcp dpt:4979
ACCEPT      tcp  --  10.0.0.0/8         anywhere      tcp dpt:esmagent
ACCEPT      tcp  --  172.16.0.0/12      anywhere      tcp dpt:esmagent
ACCEPT      tcp  --  10.0.0.0/8         anywhere      tcp dpt:8008
ACCEPT      tcp  --  172.16.0.0/12      anywhere      tcp dpt:8008
ACCEPT      tcp  --  10.0.0.0/8         anywhere      tcp dpt:copy
ACCEPT      tcp  --  172.16.0.0/12      anywhere      tcp dpt:copy
ACCEPT      tcp  --  10.0.0.0/8         anywhere      tcp dpt:22250
ACCEPT      tcp  --  172.16.0.0/12      anywhere      tcp dpt:22250
ACCEPT      all  --  anywhere           anywhere      state RELATED,ESTABLISHED
DROP        all  --  anywhere           anywhere

```

Verifying Management Node File Permissions

The Cisco NFVI management node stores sensitive information related to Cisco NFVI operations. These files are secured by strict file permissions. Sensitive files include `secrets.yaml`, `openrc`, `*.key`, and `*.pem`. To verify the file permissions, log into the management node as an admin user and list all of the files in the `~/openstack-configs/` directory. Verify that only the owner has read and write access to these files. For example:

```

[root@control-server-1 ~]# ls -l ~/openstack-configs
total 172
-rw-----. 1 root root  3272 Jun 21 17:57 haproxy.key
-rw-----. 1 root root  5167 Jun 21 17:57 haproxy.pem
-rw-----. 1 root root   223 Aug  8 18:09 openrc
-rw-----. 1 root root   942 Jul  6 19:44 secrets.yaml

[...]

```

Viewing Administrator Access Attempts

As the UCS servers are part of the critical Cisco NFVI infrastructure, Cisco recommends monitoring administrator login access periodically.

To view the access attempts, use the `journalctl` command to view the log created by ssh. For example:

```

[root@control-server-1 ~]# journalctl -u sshd
-- Logs begin at Tue 2016-06-21 17:39:35 UTC, end at Mon 2016-08-08 17:25:06 UTC. --
Jun 21 17:40:03 hh23-12 systemd[1]: Started OpenSSH server daemon.
Jun 21 17:40:03 hh23-12 systemd[1]: Starting OpenSSH server daemon...
Jun 21 17:40:03 hh23-12 sshd[2393]: Server listening on 0.0.0.0 port 22.
Jun 21 17:40:03 hh23-12 sshd[2393]: Server listening on :: port 22.
Jun 21 17:40:43 hh23-12 sshd[12657]: Connection closed by 171.70.163.201 [preauth]
Jun 21 17:41:13 hh23-12 sshd[12659]: Accepted password for root from 171.70.163.201 port 40499
Jun 21 17:46:41 hh23-12 systemd[1]: Stopping OpenSSH server daemon...
Jun 21 17:46:41 hh23-12 sshd[2393]: Received signal 15; terminating.
Jun 21 17:46:41 hh23-12 systemd[1]: Started OpenSSH server daemon.
Jun 21 17:46:41 hh23-12 systemd[1]: Starting OpenSSH server daemon...
Jun 21 17:46:41 hh23-12 sshd[13930]: Server listening on 0.0.0.0 port 22.
Jun 21 17:46:41 hh23-12 sshd[13930]: Server listening on :: port 22.
Jun 21 17:50:45 hh23-12 sshd[33964]: Accepted password for root from 171.70.163.201 port 40545
Jun 21 17:56:36 hh23-12 sshd[34028]: Connection closed by 192.168.212.20 [preauth]

```

```

Jun 21 17:57:08 hh23-12 sshd[34030]: Accepted publickey for root from 10.117.212.20 port
62819
Jun 22 16:42:40 hh23-12 sshd[8485]: Invalid user user1 from 10.117.212.20
Jun 22 16:42:40 hh23-12 sshd[8485]: input_userauth_request: invalid user user1 [preauth]
s

```

Verifying SELinux

To minimize the impact of a security breach on a Cisco NFVI server, the Cisco VM enables SELinux (Security Enhanced Linux) to protect the server resources. To validate that SELinux is configured and running in enforcing mode, use the `sestatus` command to view the status of SELinux and verify that its status is enabled and in enforcing mode. For example:

```

[root@mgmt1 ~]# /usr/sbin/sestatus -v
SELinux status:                enabled
SELinuxfs mount:              /sys/fs/selinux
SELinux root directory:       /etc/selinux
Loaded policy name:           targeted
Current mode:                 enforcing
Mode from config file:        permissive
Policy MLS status:           enabled
Policy deny_unknown status:   allowed
Max kernel policy version:    28

```

Validating Port Listening Services

To prevent access by unauthorized users and processes, Cisco NFVI has no extra services listening on network ports. To verify this, use the `netstat -plnt` command to get a list of all services listening on the node and verify that no unauthorized services are listening. For example:

```

[root@control-server-1 ~]# netstat -plnt
Active Internet connections (only servers)

```

Proto	Recv-Q	Send-Q	Local Address	Foreign Address	State	PID/Program
tcp	0	0	23.23.4.101:8776	0.0.0.0:*	LISTEN	24468/python2
tcp	0	0	23.23.4.101:5000	0.0.0.0:*	LISTEN	19874/httpd
tcp	0	0	23.23.4.101:5672	0.0.0.0:*	LISTEN	18878/beam.smp
tcp	0	0	23.23.4.101:3306	0.0.0.0:*	LISTEN	18337/mysqld
tcp	0	0	127.0.0.1:11211	0.0.0.0:*	LISTEN	16563/memcached
tcp	0	0	23.23.4.101:11211	0.0.0.0:*	LISTEN	16563/memcached
tcp	0	0	23.23.4.101:9292	0.0.0.0:*	LISTEN	21175/python2
tcp	0	0	23.23.4.101:9999	0.0.0.0:*	LISTEN	28555/python
tcp	0	0	23.23.4.101:80	0.0.0.0:*	LISTEN	28943/httpd
tcp	0	0	0.0.0.0:4369	0.0.0.0:*	LISTEN	18897/epmd
tcp	0	0	127.0.0.1:4243	0.0.0.0:*	LISTEN	14673/docker
tcp	0	0	0.0.0.0:22	0.0.0.0:*	LISTEN	2909/sshd
tcp	0	0	23.23.4.101:4567	0.0.0.0:*	LISTEN	18337/mysqld
tcp	0	0	23.23.4.101:15672	0.0.0.0:*	LISTEN	18878/beam.smp
tcp	0	0	0.0.0.0:35672	0.0.0.0:*	LISTEN	18878/beam.smp
tcp	0	0	127.0.0.1:25	0.0.0.0:*	LISTEN	4531/master

```

tcp        0      0 23.23.4.101:35357    0.0.0.0:*        LISTEN      19874/httpd
tcp        0      0 23.23.4.101:8000     0.0.0.0:*        LISTEN      30505/python
tcp        0      0 23.23.4.101:6080     0.0.0.0:*        LISTEN      27996/python2
tcp        0      0 23.23.4.101:9696     0.0.0.0:*        LISTEN      22396/python2
tcp        0      0 23.23.4.101:8004     0.0.0.0:*        LISTEN      30134/python
tcp        0      0 23.23.4.101:8773     0.0.0.0:*        LISTEN      27194/python2
tcp        0      0 23.23.4.101:8774     0.0.0.0:*        LISTEN      27194/python2
tcp        0      0 23.23.4.101:8775     0.0.0.0:*        LISTEN      27194/python2
tcp        0      0 23.23.4.101:9191     0.0.0.0:*        LISTEN      20752/python2
tcp6       0      0 :::9200              :::*              LISTEN      18439/xinetd
tcp6       0      0 :::4369              :::*              LISTEN      18897/epmd
tcp6       0      0 :::22                :::*              LISTEN      2909/sshd
tcp6       0      0 :::1:25              :::*              LISTEN      4531/master

```

Validating Non-Root Users for OpenStack Services

To prevent unauthorized access, Cisco NFVI runs OpenStack processes as a non-root user. To verify OpenStack processes are not running as root, use the `ps` command to get a list of all node processes. In the following example the user is 162:

```

[root@control-server-1 ~]# ps -aux | grep nova-api
162      27194  0.6  0.0 360924 132996 ?        S    Aug08   76:58 /usr/bin/python2
/usr/bin/nova-api
162      27231  0.0  0.0 332192 98988 ?        S    Aug08    0:01 /usr/bin/python2
/usr/bin/nova-api
162      27232  0.0  0.0 332192 98988 ?        S    Aug08    0:01 /usr/bin/python2
/usr/bin/nova-api
162      27233  0.0  0.0 332192 98988 ?        S    Aug08    0:01 /usr/bin/python2
/usr/bin/nova-api

```

Verifying Password Strength

Cisco NFVI passwords can be generated in two ways during installation:

- The Cisco NFVI installer generates unique passwords automatically for each protected service.
- You can provide an input file containing the passwords you prefer.

Cisco-generated passwords are unique, long, and contain a mixture of uppercase, lowercase, and numbers. If you provide the passwords, password strength is your responsibility.

You can view the passwords by displaying the `secrets.yaml` file. For example:

```

[root@mgmt1 ~]# cat ~/openstack-configs/secrets.yaml
ADMIN_USER_PASSWORD: QaZ12n13wvvNY7AH

```

```

CINDER_DB_PASSWORD: buJL8pAfytoJ0Icm
CINDER_KEYSTONE_PASSWORD: AYbcB8mx6a50t549
CLOUDPULSE_KEYSTONE_PASSWORD: HAT6vb17Z56yZLtN
COBBLER_PASSWORD: bax8leYFyyDon0ps
CPULSE_DB_PASSWORD: aYGSzURpGChztbMv
DB_ROOT_PASSWORD: bjb3Uvwus6cvaNe5
KIBANA_PASSWORD: c50e57Dbm7LF0dRV
[...]

```

Reconfiguring Passwords and OpenStack Configurations



Note This topic does not apply if you have installed the optional Cisco Virtual Topology System. For information about use of passwords when VTS is installed, see the *Installing Cisco VTS* section in the *Cisco NFV Infrastructure 2.4 Installation Guide*.

You can reset some configurations after installation including the OpenStack service password and debugs, TLS certificates, and ELK configurations. Two files, `secrets.yaml` and `openstack_config.yaml` which are located in `:/root/installer-{tag id}/openstack-configs/`, contain the passwords, debugs, TLS file location, and ELK configurations. Also, Elasticsearch uses disk space for the data that is sent to it. These files can grow in size, and Cisco VIM has configuration variables that establishes the frequency and file size under which they are rotated.

Cisco VIM installer generates the OpenStack service and database passwords with 16 alphanumeric characters and stores those in `/root/openstack-configs/secrets.yaml`. You can change the OpenStack service and database passwords using the password reconfigure command on the deployed cloud. The command identifies the containers affected by the password change and restarts them so the new password can take effect.



Note Always schedule password reconfiguration in a maintenance window because container restarts might disrupt the control plane

Run the following command to view the list of passwords and configurations :

```

[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 installer-xxxx]# ciscovim help reconfigure
usage: ciscovim reconfigure [--regenerate_secrets] [--setpassword <secretkey>]
                             [--setopenstackconfig <option>]

```

Reconfigure the openstack cloud

Optional arguments:

```

--regenerate_secrets           Regenerate All Secrets
--setpassword <secretkey>     Set of secret keys to be changed.
--setopenstackconfig <option> Set of Openstack config to be changed.

```

```

[root@mgmt1 ~]# ciscovim list-openstack-configs

```

Name	Option
CINDER_DEBUG_LOGGING	False
KEYSTONE_DEBUG_LOGGING	False
CLOUDPULSE_VERBOSE_LOGGING	True
MAGNUM_VERBOSE_LOGGING	True
NOVA_DEBUG_LOGGING	True

```

| NEUTRON_VERBOSE_LOGGING | True |
| external_lb_vip_cert | /root/openstack-configs/haproxy.pem |
| GLANCE_VERBOSE_LOGGING | True |
| | |
| elk_rotation_frequency | monthly |
| CEILOMETER_VERBOSE_LOGGING | True |
| elk_rotation_del_older | 10 |
| HEAT_DEBUG_LOGGING | False |
| KEYSTONE_VERBOSE_LOGGING | True |
| external_lb_vip_cacert | /root/openstack-configs/haproxy-ca.crt |
| MAGNUM_DEBUG_LOGGING | True |
| CINDER_VERBOSE_LOGGING | True |
| elk_rotation_size | 2 |
| CLOUDPULSE_DEBUG_LOGGING | False |
| NEUTRON_DEBUG_LOGGING | True |
| HEAT_VERBOSE_LOGGING | True |
| CEILOMETER_DEBUG_LOGGING | False |
| GLANCE_DEBUG_LOGGING | False |
| NOVA_VERBOSE_LOGGING | True |
+-----+
[root@mgmt1 installer-xxxx]#
[root@mgmt1 installer-xxxx]# ciscovim list-password-keys
+-----+
| Password Keys |
+-----+
| COBBLER_PASSWORD |
| CPULSE_DB_PASSWORD |
| DB_ROOT_PASSWORD |
| KIBANA_PASSWORD |
| GLANCE_DB_PASSWORD |
| GLANCE_KEYSTONE_PASSWORD |
| HAPROXY_PASSWORD |
| HEAT_DB_PASSWORD |
| HEAT_KEYSTONE_PASSWORD |
| HEAT_STACK_DOMAIN_ADMIN_PASSWORD |
| HORIZON_SECRET_KEY |
| KEYSTONE_ADMIN_TOKEN |
| KEYSTONE_DB_PASSWORD |
| METADATA_PROXY_SHARED_SECRET |
| NEUTRON_DB_PASSWORD |
| NEUTRON_KEYSTONE_PASSWORD |
| NOVA_DB_PASSWORD |
| NOVA_KEYSTONE_PASSWORD |
| RABBITMQ_ERLANG_COOKIE |
| RABBITMQ_PASSWORD |
| WSREP_PASSWORD |
+-----+
[root@mgmt1 installer-xxxx]#

```

You can change specific password and configuration identified from the available list.

Run the reconfiguration command as follows:

```

[root@mgmt1 ~]# ciscovim help reconfigure
usage: ciscovim reconfigure [--regenerate_secrets] [--setpassword <secretkey>]
                             [--setopenstackconfig <option>]

```

Reconfigure the Openstack cloud

Optional arguments:

```

--regenerate_secrets      Regenerate All Secrets
--setpassword <secretkey> Set of secret keys to be changed.
--setopenstackconfig <option> Set of Openstack config to be changed.

```

```

[root@mgmt1 ~]# ciscovim reconfigure --setpassword ADMIN_USER_PASSWORD,NOVA_DB_PASSWORD

```

```
--setopenstackconfig HEAT_DEBUG_LOGGING,HEAT_VERBOSE_LOGGING
Password for ADMIN_USER_PASSWORD:
Password for NOVA_DB_PASSWORD:
Enter T/F for option HEAT_DEBUG_LOGGING:T
Enter T/F for option HEAT_VERBOSE_LOGGING:T
```

The password must be alphanumeric and can be maximum 32 characters in length.

Following are the configuration parameters for OpenStack:

Configuration Parameter	Allowed Values
CEILOMETER_DEBUG_LOGGING	T/F (True or False)
CEILOMETER_VERBOSE_LOGGING	T/F (True or False)
CINDER_DEBUG_LOGGING	T/F (True or False)
CINDER_VERBOSE_LOGGING	T/F (True or False)
CLOUDPULSE_DEBUG_LOGGING	T/F (True or False)
CLOUDPULSE_VERBOSE_LOGGING	T/F (True or False)
GLANCE_DEBUG_LOGGING	T/F (True or False)
GLANCE_VERBOSE_LOGGING	T/F (True or False)
HEAT_DEBUG_LOGGING	T/F (True or False)
HEAT_VERBOSE_LOGGING	T/F (True or False)
KEYSTONE_DEBUG_LOGGING	T/F (True or False)
KEYSTONE_VERBOSE_LOGGING	T/F (True or False)
MAGNUM_DEBUG_LOGGING	T/F (True or False)
MAGNUM_VERBOSE_LOGGING	T/F (True or False)
NEUTRON_DEBUG_LOGGING	T/F (True or False)
NEUTRON_VERBOSE_LOGGING	T/F (True or False)
NOVA_DEBUG_LOGGING	T/F (True or False)
NOVA_VERBOSE_LOGGING	T/F (True or False)
elk_rotation_del_older	Days after which older logs are purged
elk_rotation_frequency	Available options: "daily", "weekly", "fortnightly", "monthly"
elk_rotation_size	Gigabytes (entry of type float/int is allowed)
external_lb_vip_cacert	Location of HAProxy CA certificate
external_lb_vip_cert	Location of HAProxy certificate

NOVA_RAM_ALLOCATION_RATIO	Mem oversubscription ratio (from 1.0 to 4.0)
NOVA_CPU_ALLOCATION_RATIO	CPU allocation ratio (from 1.0 to 16.0)
ES_SNAPSHOT_AUTODELETE	Elastic search auto-delete configuration, can manage the following: period: ["hourly", "daily", "weekly", "monthly"] # Frequency of cronjob to check for disk space threshold_warning: <1-99> # % of disk space occupied to display warning message threshold_low: <1-99> # % of disk space occupied after cleaning up snapshots threshold_high: <1-99> # % of disk space when starting to delete snapshots

Alternatively, you can regenerate all passwords using `regenerate_secrets` command option as follows:

```
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim reconfigure --regenerate_secrets
```

In addition to the services passwords, you can change the debug and verbose options for Heat, Glance, Cinder, Nova, Neutron, Keystone and Cloudpulse in `/root/openstack-configs/openstack_config.yaml`. You can modify the other configurations including the ELK configuration parameters, API and Horizon TLS certificates, Root CA, `NOVA_EAMALLOCATION_RATIO` and `ES_SNAPSHOT_AUTODELETE`. When reconfiguring these options (For Example API and TLS), some control plane downtime will occur, so plan the changes during maintenance windows.

The command to reconfigure these elements are:

```
ciscovim reconfigure
```

The command includes a built-in validation to ensure you do not enter typos in the `secrets.yaml` or `openstack_config.yaml` files.

When reconfiguration of password or enabling of `openstack-services` fails, all subsequent pod management operations are blocked. In such cases, we recommend that you contact Cisco TAC to resolve the situation.

Enabling CVIMMON Post Pod Installation

CVIMMON, an extensive monitoring solution, is designed to monitor a single pod from a single management system. Cisco VIM can be optionally installed with CVIMMON, to monitor the health and performance of the NFV infrastructure. CVIMMON is enabled by extending the `setup_data.yaml` with relevant information on an existing pod, using the `reconfigure` option.

Post installation of Cisco VIM 2.4.3 or later versions, you can enable CVIMMON and CVIM-TRAP (SNMP, `SERVER_MON`) using the `reconfigure` option.



Note CVIM-TRAP can be enabled, only if CVIMMON exists. Once the CVIMMON or CVIM-TRAP is enabled, it cannot be disabled again.

To enable the CVIMMON and SNMP features or to change the individual parameters in CVIMMON and SNMP:

1. Take a backup of `setup_data` file and update it manually with the configuration details by entering the following command:

```
# cd /root/  
# mkdir MyDir  
# cp /root/openstack-configs/setup_data.yaml /root/MyDir  
# cd /root/MyDir
```

2. Edit the setup data.
3. Save the file and execute the below command. For sample configuration, see *Enabling CVIMMON on Cisco VIM* section of *CVIM Installation Guide*

```
#ciscovim --setupfile /root/MyDir/setup_data.yaml reconfigure
```



Note Migration from SNMPv2 to SNMPv3 is only supported, but not vice-versa.

Enabling NFVIMON Post Pod Install

Cisco VIM can be optionally installed with a third party software known as NFVIMON. NFVIMON can monitor the health and performance of the NFV infrastructure. The NFVIMON feature enables extensive monitoring and 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 can be enabled by extending the `setup_data.yaml` with relevant information on an existing pod, through the `reconfigure` option.

NFVIMON consists of 4 components: dispatcher, collector, Resource Manager (RM) and control-center with Cisco Zenpacks (CC). As NFVIMON is a third party software, care has been taken to 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 with Cisco Zenpacks (CC)), are Cisco Advance Services led activity and those steps are outside the scope of the current install guide.

Before you Begin

Ensure that you have engaged with Cisco Advance Services on the planning and installation of the NFVIMON accessories along with its network requirements. Also, the image information of collector, Resource Manager (RM) and control-center with Cisco Zenpacks (CC) 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 2 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 sitting in an independent node, 4 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 (CC) are Cisco Advance Services led activity.

Installation of NFVIMON Dispatcher

The dispatcher is the only component in NFVIMON offering 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 NFVI Zenpack sitting in the CC/RM 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`.

```
TORSWITCHINFO:
  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
    ....
```

To initiate the integration of NFVIMON on an existing pod, copy the `setupdata` into a local dir and update it manually with information listed above, and then run the reconfiguration command as follows:

```
[root@mgmt1 ~]# cd /root/
[root@mgmt1 ~]# mkdir MyDir
```

```
[root@mgmt1 ~]# cd MyDir
[root@mgmt1 ~]# cp /root/openstack-configs/setup_data.yaml <my_setup_data.yaml>
[root@mgmt1 ~]# vi my_setup_data.yaml (update the setup_data to include NFVIMON related info)
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim --setupfile ~/MyDir/<my_setup_data.yaml> reconfigure
```



- Note**
- Unconfiguration of this feature is not supported.
 - NFVIMON is supported only on a pod running with Keystone v2.
 - NFVIMON needs root privileges as the non-root admin keys cannot be used for monitoring.

Reconfiguring CIMC Password on an Existing Install

Cisco VIM, allows you to reconfigure the CIMC password on an existing install along with OpenStack services.



- Note** You must have a C-series pod, up and running with Cisco to reconfigure the CIMC password.

- Step 1** Update the `cimc_password` in the CIMC-COMMON section, and/or the individual `cimc_password` for each server and then run the reconfigure option provided by `Ciscovimclient`.

```
CIMC-COMMON:
  cimc_username: "admin"
  cimc_password: <"new password">
:
:
SERVERS:
:
control-server-2:
  cimc_info: {'cimc_ip': '<ip_addr>',
             'cimc_username': 'admin',
             'cimc_password': <'update with new passowrd'>} # only needed if each server has specific
password
```

- Step 2** To change the CIMC password for the pod, copy the setupdata into a local location and update it manually with the CIMC password as shown in the snippet above. The new password must satisfy atleast three of the following conditions:

Note Do not change CIMC password directly into the exiting `/root/openstack-configs/setup_data.yaml` file.

- Must contain at least one lower case letter.
- Must contain at least one upper case letter.
- Must contain at least one digit between 0 to 9.
- One of these special characters `!$#@%^-_=*&`
- Your password has to be 8 to 14 characters long.

Step 3 Run the vim reconfiguration command to post update the setup_data as follows:

```
[root@mgmt1 ~]# cd /root/
[root@mgmt1 ~]# mkdir MyDir
[root@mgmt1 ~]# cd MyDir
[root@mgmt1 ~]# cp /root/openstack-configs/setup_data.yaml <my_setup_data.yaml>
[root@mgmt1 ~]# cp <my_setup_data.yaml> <my_setup_data_original.yaml>
[root@mgmt1 ~]# vi my_setup_data.yaml (update the relevant CIMC setup_data to include LDAP info)
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim --setupfile ~/MyDir/<my_setup_data.yaml> reconfigure
```

Note After successful completion of the CIMC Password, reconfigure operation triggers an auto-back when the management node auto-back recovery feature is enabled. If the CIMC Password reconfigure fails, contact Cisco TAC to recover from the failure.

Increasing Provider and Tenant VLAN Ranges

Cisco VIM, provides the flexibility of increasing the provider and tenant VLAN ranges after the post pod installation. Increasing provider and tenant VLAN ranges applies to C-series and B-series pod that is enabled with Cisco UCS Manager plugin. B-series pod running without Cisco UCS Manager plugin, cannot use this feature because of the inherent day-0 networking configuration to be done in FI.



Note You should have the tenant and provider networks enabled on the pod from day-0.

To increase provider and tenant VLAN ranges enter the TENANT_VLAN_RANGES and/or PROVIDER_VLAN_RANGES in the setup_data.yaml file and run the reconfigure command through Ciscovimclient as follows:

```
TENANT_VLAN_RANGES: old_vlan_info, new_vlan_info
or/and
PROVIDER_VLAN_RANGES: old_vlan_info, new_vlan_info
```

To change the pod, copy the setupdata into a local dir and update it manually by running the following command:

```
[root@mgmt1 ~]# cd /root/ [root@mgmt1 ~]# mkdir MyDir [root@mgmt1 ~]# cd MyDir
```

Update the setup_data, by running the following command:

```
[root@mgmt1 ~]# cp /root/openstack-configs/setup_data.yaml <my_setup_data.yaml> [root@mgmt1 ~]# vi my_setup_data.yaml (update the setup_data with the right info)
```

Run the re-configuration command as follows:

```
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ./ciscovimclient/ciscovim --setupfile ~/MyDir/<my_setup_data.yaml> reconfigure
```

Fernet Key Operations

Keystone fernet token format is based on the cryptographic authentication method - Fernet. Fernet is an implementation of Symmetric Key Encryption. Symmetric key encryption is a cryptographic mechanism that uses the same cryptographic key to encrypt plaintext and the same cryptographic key to decrypt ciphertext.

Fernet authentication method also supports multiple keys where it takes a list of symmetric keys, performs all encryption using the first key in a list and attempts to decrypt using all the keys from that list.

The Cisco NFVI pods uses Fernet keys by default. The following operations can be carried out in Cisco NFVI pods.

To check if the fernet keys are successfully synchronized across the keystone nodes.

```
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim help check-fernet-keys
usage: ciscovim check-fernet-keys
```

Check whether the fernet keys are successfully synchronized across keystone nodes.

To set the fernet key frequency:

```
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim help period-rotate-fernet-keys
usage: ciscovim period-rotate-fernet-keys <SET_PERIOD_ROTATION_FERNET_KEYS>
Set the frequency of fernet keys rotation on keystone
Positional arguments:
  <SET_PERIOD_ROTATION_FERNET_KEYS>
Frequency to set for period rotation
```

To forcefully rotate the fernet keys:

```
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim help rotate-fernet-keys
usage: ciscovim rotate-fernet-keys
Trigger rotation of the fernet keys on keystone
```

To resync the fernet keys across the keystone nodes:

```
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim help resync-fernet-keys
usage: ciscovim resync-fernet-keys
Resynchronize the fernet keys across all the keystone nodes
```

Managing Certificates

When TLS protection is configured for the OpenStack APIs, the two certificate files, haproxy.pem and haproxy-ca.crt, are stored in the /root/openstack-configs/ directory. Clients running on servers outside of the deployed cloud to verify cloud authenticity need a copy of the root certificate (haproxy-ca.crt). If a well-known certificate authority has signed the installed certificate, no additional configuration is needed on client servers. However, if a self-signed or local CA is used, copy haproxy-ca.crt to each client. Following instructions specific to the client operating system or browser to install the certificate as a trusted certificate.

Alternatively, you can explicitly reference the certificate when using the OpenStack CLI by using the environment variable OS_CACERT or command line parameter `-cacert`.

While Cisco NFVI is operational, a daily check is made to monitor the expiration dates of the installed certificates. If certificates are not nearing expiration, an informational message is logged. As the certificate approaches expiration, an appropriate warning or critical message is logged.

```
2017-04-24T13:56:01 INFO Certificate for OpenStack Endpoints at 192.168.0.2:5000 expires
in 500 days
```

It is important to replace the certificates before they expire. After Cisco NFVI is installed, you can update the certificates by replacing the haproxy.pem and haproxy-ca.crt files and running the reconfigure command:

```
cd ~/installer-xxxx; ciscovim reconfigure
```

Reconfiguring TLS Certificates

Cisco VIM provides a way to configure TLS certificates on-demand for any reason. For Example: certificate expiration policies governing certificate management.

Reconfiguration of certificates in general is supported in the following components:

- Cisco VIM Rest API endpoints:

Steps to be performed to reconfigure certificate files are as follows:

- Copy the new key, CA root and certificate files into the ~/openstack-configs folder under the following filenames

```
cp <new-ca-root-cert> ~/openstack-configs/mercury-ca.crt
cp <new-key-file> ~/openstack-configs/mercury.key
cp <new-cert-file> ~/openstack-configs/mercury.crt
```

- Once copied run the reconfigure steps as under:

```
cd ~/installer-xxxx/tools
./restapi.py -a reconfigure-tls
```

- OpenStack API endpoints

Steps to be performed to reconfigure certificate files are as follows:

- Copy the new key, CA root and certificate files into the ~/openstack-configs folder under the following filenames

```
cp <new-ca-root-cert> ~/openstack-configs/haproxy-ca.crt
cp <new-cert-file> ~/openstack-configs/haproxy.pem
```

- Once copied run the reconfigure steps as follows:

```
cd ~/installer-xxxx; ciscovim reconfigure
```

- SwiftStack Service through Horizon and CinderBackup Service.

- Reconfiguring TLS certificates for SwiftStack mainly involves client side certificate updates. The CA root certificate in both these cases is updated for components within OpenStack that are clients of the SwiftStack service in general.

- Copy the new CA root certificate to the ~/openstack-configs folder and run reconfigure.

```
cp <new-ca-root-cert> ~/openstack-configs/haproxy-ca.crt
cd ~/installer-xxxx; ciscovim reconfigure
```

- Logstash service and Fluentd (client-side certificates).

- For the Logstash service on the management node, both the key and certificate file are reconfigured as part of the reconfigure operation.

- For the Fluentd service on the controllers, compute and storage nodes, the certificate file are reconfigured as part of the reconfigure operation.

- Copy of the key and certificate files to the ~/openstack-configs folder on the management node and run reconfigure operation.

```
cp <new-key-file> ~/openstack-configs/logstash-forwarder.key
cp <new-cert-file> ~/openstack-configs/logstash-forwarder.crt
cd ~/installer-xxxx; ciscovim reconfigure
```

Enabling Keystone v3 on an Existing Install

To continue enhancing our security portfolio, and multi-tenancy with the use of domains, Keystone v3 support has been added in Cisco VIM from an authentication end-point. It should be noted that Keystone v2 and v3 are mutually exclusive. The administrator has to decide during install time the authentication end-point version to go with. By default, VIM orchestrator picks keystone v2 as the authentication end-point. So one can enable Keystonev3 as an install option on day-0 (see 2.4 CiscoVIM install guide), or enable it as a reconfigure option after the pod is installed. To enable Keystone v3 after the pod is installed, one needs to define the following under the optional service section in the setup_data.yaml file.

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

To initiate the integration of Keystone v3 on an existing pod, copy the setupdata into a local dir and update it manually, then run reconfiguration command as follows:

```
[root@mgmt1 ~]# cd /root/
[root@mgmt1 ~]# mkdir MyDir
[root@mgmt1 ~]# cd MyDir
[root@mgmt1 ~]# cp /root/openstack-configs/setup_data.yaml <my_setup_data.yaml>
[root@mgmt1 ~]# vi my_setup_data.yaml (update the setup_data to include keystone v3 info)
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim --setupfile ~/MyDir/<my_setup_data.yaml> reconfigure
```

It should be noted that un-configuration of this feature is not supported today. Additionally, re-versioning Keystone API from v3 to v2 is also not supported.

LDAP/AD support with Keystone v3

With the introduction of KeystoneV3, the openstack service authentication can now be delegated to an external LDAP/AD server. In Cisco VIM, this feature has been introduced optionally if the authorization is done by Keystone v3. Just like Keystonev3, this feature can be enabled on an existing pod running Cisco VIM. To avail of this feature post pod deployment, the setup_data needs to be augmented with the following information during the installation of the pod.

An important pre-requisite for enabling AD/LDAP integration is that the AD/LDAP endpoint MUST be reachable from all the Controller nodes that run OpenStack Keystone Identity Service.

```
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'
or
url: '<ldaps|ldap>://[<ip6-address>]:[port] '
e.g.ldap://[2001:420:293:2487:dlca:67dc:94b1:7e6c]:389 ---> note the mandatory "[. . ]"
around the ipv6 address
  user: '<DN of bind user>' # e.g. 'dc=admin,dc=cisco,dc=com'
  password: <password> # e.g. password of bind user
```

```

user_filter = (memberOf=CN=os-users,OU=OS-Groups,DC=mercury,DC=local)
user_id_attribute = sAMAccountName
user_name_attribute = sAMAccountName
user_mail_attribute = mail # Optional
group_tree_dn = ou=OS-Groups,dc=mercury,dc=local
group_name_attribute = sAMAccountName

```

To initiate the integration of LDAP with Keystone v3 on an existing pod, copy the setupdata into a local dir and update it manually with the relevant LDAP and Keystone v3 (if absent from before) configuration, then run reconfiguration command as follows:

```

[root@mgmt1 ~]# cd /root/
[root@mgmt1 ~]# mkdir MyDir
[root@mgmt1 ~]# cd MyDir
[root@mgmt1 ~]# cp /root/openstack-configs/setup_data.yaml <my_setup_data.yaml>
[root@mgmt1 ~]# vi my_setup_data.yaml (update the setup_data to include LDAP info)
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim --setupfile ~/MyDir/<my_setup_data.yaml> reconfigure

```

The reconfigure feature supports a full or partial reconfiguration of the LDAP integration service.



Note All the parameters within the LDAP stanza are configurable with the exception of the domain parameter.

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.

Additionally, 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 domainname (FQDN) or an IPv4 or v6 Address depending on how the SSL certificates are generated. .

The port number is optional and if not provided assumes that the ldap services are running on the default ports. For Example: 389 for non-ssl and 636 for ssl. However, if these are not the defaults, then the non-standard port numbers must be provided. Except for the domain, all other item values can be changed via the 'reconfigure' option.

Moving Netapp transport from http to https

For deployments, with NETAPP running over http protocol you can migrate it to https, post-deployment.

Step 1 To initiate the change, copy the setupdata into a local dir and update it manually the name/value pair in the netapp section:

```

NETAPP:
...
...
server_port: 443
transport_type: https
...
netapp_cert_file: <root ca path for netapp cluster only if protocol is https>

```

Step 2 Execute the following commands to update the netapp section:

```
[root@mgmt1 ~]# cd /root/
[root@mgmt1 ~]# mkdir MyDir [root@mgmt1 ~]# cd MyDir
[root@mgmt1 ~]# cp /root/openstack-configs/setup_data.yaml <my_setup_data.yaml>
[root@mgmt1 ~]# vi my_setup_data.yaml (update the setup_data to netapp section as listed above)
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim --setupfile ~/MyDir/<my_setup_data.yaml> reconfigure
```

Enabling ACI in Cisco VIM

With Cisco VIM, we have integrated the Opflex ML2 plugin (in Unified mode) to manage the tenant VLANs dynamically, as VMs come and go in the cloud. In addition, we support an administrator driven automated workflow to provision the provider networks. In VIM, this is supported on a C-series based Fullon or micropod running with Cisco VIC 1227. While the integration of ACI into Cisco VIM is a day-0 activity, VIM supports the replacement of the ACI controller in the ACI cluster, and the expansion of the leaf switches to increase the fabric.

Step 1 To update the setup_data with one or both follow the below steps:

```
APICINFO:
apic_hosts: '<ip1|host1>:[port], <ip2|host2>:[port], <ip3|host3>:[port]'
```

max of 3, min of 1, not 2; reconfigurable

Since the APIC manages the Leaf switches, its mandatory to define the new Leaf switches (in pairs) in the following format:

```
TORSWITCHINFO: (mandatory)

SWITCHDETAILS:
:
:
-
hostname: <leaf-hostname-1>
vpc_peer_keepalive: <leaf-hostname-2>
vpc_domain: 1 # Must be unique across pairs
br_mgmt_port_info: 'eth1/27' # br_mgmt_* attributes must exist on at least one pair
br_mgmt_vlan_info: '3401'
node_id: <int> # unique across switches

-
hostname: <leaf-hostname-2>
vpc_peer_keepalive: <leaf-hostname-1>
vpc_domain: 1
br_mgmt_port_info: 'eth1/27' # br_mgmt_* attributes must exist on at least one pair
br_mgmt_vlan_info: '3401'
node_id: <int> # unique across switches
```

Step 2 To initiate the change in ACI config on an existing pod, copy the setupdata into a local dir and update it manually with the relevant apic_hosts and/or new TORSWITCH information, then run reconfiguration commands follows:

```
[root@mgmt1 ~]# cd /root/ [root@mgmt1 ~]# mkdir MyDir [root@mgmt1 ~]# cd MyDir
[root@mgmt1 ~]# cp /root/openstack-configs/setup_data.yaml <my_setup_data.yaml> [root@mgmt1 ~]# vi
my_setup_data.yaml (update the setup_data to include ACI info)
[root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim --setupfile ~/MyDir/<my_setup_data.yaml> reconfigure
```

Hardening Cisco VIM Deployment

If you want to harden the Cisco VIM deployment, set up the firewalls ahead of the external interfaces.

The following tables provide information about the expected traffic from the management interfaces of Cisco VIM.

Table 1: Management Nodes

Interface	Direction	Protocol	UDP/TCP	Port	Application	Note
br_api	incoming	HTTPS	TCP	8445	RestAPI	
br_api	incoming	HTTPS	TCP	8008	RestAPI logs	
br_api	incoming	HTTPS	TCP	9000	Insight UI	
br_api	incoming	HTTPS	TCP	5601	Kibana	
br_api	incoming	SSH	TCP	22	SSH	
br_api	incoming	HTTPS	TCP	3000	Grafana	Technical preview
br_api	outgoing	NTP	UDP	123	NTP	
br_api	outgoing	DNS	UDP	53	DNS	
br_api	outgoing	Syslog	UDP	514	Syslog	User configurable. Default value is 514.
br_mgmt	incoming	HTTP	TCP	7081	Fluentd-aggr	From all nodes to mgmt node
localhost	outgoing	HTTP	TCP	9090	Prometheus	Technical preview
localhost	outgoing	HTTP	TCP	9093	Alertmanager	Technical preview
localhost	incoming/outgoing	HTTP	TCP	1162	SNMCMON	Technical preview
br_api	incoming	SNMP	UDP	162	SNMP	Technical preview. Userdefined. Default value is 162

Interface	Direction	Protocol	UDP/TCP	Port	Application	Note
br_api	incoming	HTTP	TCP	22	SERVER_MON	Technical preview; from CIMC of the UCS servers.
br_api	incoming	LDAP	TCP	389	LDAP	Default: 389 or defined in setup_data
br_api	incoming	LDAPS	TCP	636	LDAPS	Default: 636 or defined in setup_data

Table 2: Controller Nodes

Interface	Direction	Protocol	UDP/TCP	Port	Application	Note
external_lb_vip	incoming	HTTP	TCP	80	Redirects to 443	
external_lb_vip	incoming	HTTPS	TCP	443	Horizon	
external_lb_vip	incoming	HTTPS	TCP	8774	Nova	
external_lb_vip	incoming	HTTPS	TCP	6080	Nova NoVNC Proxy	
external_lb_vip	incoming	HTTPS	TCP	9696	Neutron	
external_lb_vip	incoming	HTTPS	TCP	8776	Cinder	
external_lb_vip	incoming	HTTPS	TCP	9292	Galance	
external_lb_vip	incoming	HTTPS	TCP	8000	Heat	
external_lb_vip	incoming	HTTPS	TCP	8004	Heat	
external_lb_vip	incoming	HTTPS	TCP	9999	Cloudpulse	
external_lb_vip	incoming	HTTPS	TCP	8777	Ceilometer	
external_lb_vip	incoming	HTTPS	TCP	8778	Placement	
external_lb_vip	incoming	HTTPS	TCP	5000	Keystone	
br_mgmt	incoming	HTTP	TCP	156272	RabbitMQ monitoring	From management node only
br_mgmt	incoming	LDAP	TCP	389	LDAP	Default: 389 or defined in setup_data

Interface	Direction	Protocol	UDP/TCP	Port	Application	Note
br_mgmt	incoming	LDAPS	TCP	636	LDAPS	Default: 636 or defined in setup_data
br_mgmt	outgoing	HTTP	TCP	7081	Fluentd	To management node

Table 3: SDS Node

Interface	Direction	Protocol	UDP/TCP	Port	Application	Note
br_public	outgoing	NTP	UDP	123	NTP	
br_public	incoming	HTTPS	TCP	443	HTTPD	Browsing artifacts on a web browser
br_private	incoming	HTTPS	TCP	8441	HTTPD	Reverse proxy for docker registry
br_public	incoming	SSH	TCP	22	SSH	

Table 4: Unified Management Node

Interface	Direction	Protocol	UDP/TCP	Port	Application	Note
br_api	outgoing	HTTPS	TCP	8445	Insight	Connect to Cisco VIM management node RestAPI
br_api	incoming	HTTPS	TCP	9000	HTTPD	UI
br_api	incoming	SSH	TCP	22	SSH	