



Managing Cisco NFVI Security

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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: HAT6vbl7Z56yZLtN
COBBLER_PASSWORD: bax8leYFyyDonOps
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 2.2 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`, 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 will be rotated.

The Cisco VIM installer dynamically 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. 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 configuration that can be changed :

```

[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 |
| ELK_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. The password and configuration values can be supplied on the command line 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 will be 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

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 Cloudpuls 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. 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 will be blocked. In this case, we recommend that you contact Cisco TAC to resolve the situation.

Reconfiguring CIMC Password on an Existing Install

Cisco VIM 2.2, 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 sections)
[root@mgmt1 ~]# ciscovim --setupfile reconfigure ~/MyDir/<my_setup_data.yaml> cimc_password
```

Note After successful completion of the CIMC Password, reconfigure operation will trigger 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 2.2, 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
```

Enabling NFVIMON Post Pod Install

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 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
```

It should be noted that un-configuration of this feature is not supported today. Additionally, NFVIMON is supported only on a pod running with Keystone v2.

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
```

Enabling TLS post install

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 information has to be provided to the installer: `haproxy.pem` and `haproxy-ca.crt`. These must be placed in the `~/installer-xxxx/openstack-configs` directory.

Step 1 Along with updating the `~/installer-xxxx/openstack-configs` with the right certificates, take a backup of the `setupdata` file and update the file manually with the configs listed as,

```
external_lb_vip_tls: True # if using VIP IP for TLS
or
external_lb_vip_fqdn: host or DNS name matching external_lb_vip_address (if FQDN is needed)
```

Step 2 Run the reconfigure command as follows:

```
[root@mgmt1 ~]# cd /root/ [root@mgmt1 ~]# mkdir MyDir
[root@mgmt1 ~]# cp /root/openstack-configs/setup_data.yaml /root/MyDir/
```

Step 3 Update the `setup_data` to include TLS option and copy the certificates to `~/installer-xxxx/openstack-configs` directory.

```
[root@mgmt1 ~]# cd /root/MyDir/
[root@mgmt1 ~]# vi setup_data.yaml [root@mgmt1 ~]# cd ~/installer-xxxx
[root@mgmt1 ~]# ciscovim --setupfile /root/MyDir/setup_data.yaml 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 2.2 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 2.2, 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 2.2. 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:d1ca: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 domain name (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.

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
```
