Host System Management

System Access Configuration

Host System Requirements

Table 1: Feature History

Feature Name	Release Information	Description
HugePage memory and CPU allocation	NFVIS Release 4.2.1	The system memory allocations are enhanced and all memory apart from the amount reserved for system is converted to HugePage memory. The VMs are deployed using hugepage memory even when DPDK is enabled on the system.
NFVIS resource allocation enhancement	NFVIS Release 4.10.1	The system memory allocations are updated.

The following resources are required for a standalone Cisco Enterprise NFVIS:

Table 2: CPU Allocation

Total Cores	Before NFVIS 3.12.x Release	NFVIS 3.12.x till NFVIS 4.9.x	NFVIS 4.10.x and later Releases
12 or less	1	1 + (1 core per socket applicable to DPDK systems)	1 + (1 core per socket applicable to DPDK systems)
Between 12 and 16 (including 16)	2	1 + (1 core per socket applicable to DPDK systems)	1 + (1 core per socket applicable to DPDK systems) + (1 if Multi-NUMA node system*)
More than 16	4	2 + (1 core per socket applicable to DPDK systems)	2 + (1 core per socket applicable to DPDK systems) + (1 if Multi-NUMA node system*)
* Indicates that Multi-NUMA node systems require an additional CPU core system reserved. This additional core is helpful in processing the cross NUMA nodes, indirectly improving the performance of Cisco NFVIS functions on the system cores.			

Note

- If hyper-threading is enabled on the device, each core reflects two logical CPUs.

Table 3: Memory Allocation

Reserved System Memory	Up to 16 GB	Up to 32 GB	Up to 64 GB	Up to 128 GB	Greater than 128 GB
Reserved for NFVIS 3.12.x and earlier releases	3 GB	3 GB	4 GB	4 GB	4 GB
Reserved for NFVIS 3.12.x and 4.1.x releases	3 GB	3 GB	4 GB	8 GB	8 GB
Reserved for NFVIS 4.2.1 release	3 GB	3 GB	4 GB	8 GB	16 GB
Reserved for NFVIS 4.2.2 till NFVIS 4.8.1	3 GB	4 GB	4 GB	8 GB	16 GB

Reserved System Memory	Up to 16 GB	Up to 32 GB	Up to 64 GB	Up to 128 GB	Greater than 128 GB
Reserved for NFVIS 4.9.1	3 GB	4 GB	4 GB	8 GB/ 10 GB*	16 GB/ 20 GB*
Reserved for NFVIS 4.10.1 and later releases	5 GB/ 6 GB*	5 GB/ 6 GB*	5 GB/ 6 GB*	8 GB/ 10 GB*	16 GB/ 20 GB*
* Indicates the memory allocation is applicable only for Multi-NUMA node systems. In case of single node systems, the memory allocation values without * is applicable.					

Note

- * indicates that the memory allocation is applicable only for Multi-NUMA node systems. In case of other systems, the memory allocation remains the same that is reserved for NFVIS Release 4.2.2 till NFVIS 4.8.1
- When you upgrade Cisco NFVIS from Cisco NFVIS Release 4.9.x to any of the later releases, some VMs may not function as there is not enough system memory allocated. When the memory utilization of the VMs used in Cisco NFVIS is equal to or closer to the total amount of memory allocated for the VMs, the VMs fail to function. The system allocates the memory for Cisco NFVIS and the remaining memory is converted into hugepage memory. From the hugepage memory, Cisco NFVIS allocated memory to DPDK and VMs when the memory is exhausted.

Total System Memory	Additional memory required for DPDK support per NUMA node
Upto 63 GB	1
64 GB - 127 GB	2
128 GB - 256 GB	4

Starting from NFVIS 4.2 release, all memory apart from the amount reserved for system is converted to HugePage memory. The system memory is allocated on socket 0 on system with multiple CPU sockets.

Note When you use Cisco Catalyst Edge uCPE 8300 for high throughput requirements, we recommend that you use NVME based storages (M.2 NVME or U.2 NVME) or E1.S based.

Note The additional memory required for DPDK support is counted per NUMA node available on the system.

System Setting Hostname

You must adhere to the following rules for hostname on NFVIS:

- Must contain minimum length of 2 and maximum length of 255.
- Must begin with a letter or digit and can contain alphabets, numbers and hyphen.
- Must not be deleted.
- The hostname range is from 1 to 58. The hostname range must contain a letter or a digit, it may contain alphabets, numbers, and hyphens.

Dual WAN Support

Dual WAN support provides multiple links to NFVIS connectivity. Starting from NFVIS 3.10.1 release, a second WAN bridge configured with DHCP by default is supported on ENCS 5000 series platform.

During NFVIS system initialization, NFVIS attempts to establish connectivity through DHCP on both WAN bridges. This allows connectivity to NFVIS during initial deployment even if the network is down on one of the WAN bridges. Once DHCP assigns an IP address through one WAN bridge, the other WAN bridge can be configured with static IP address for connectivity to NFVIS.

Restrictions for Dual WAN Support

- The DHCP toggle behavior is not supported during the upgrade flow. It is only triggered during fresh installation of NFVIS or after a factory default reset.
- Active/standby or redundant WAN bridges are not supported. NFVIS does not detect connectivity failure from one WAN bridge and switchover to another WAN bridge. In case connectivity fails on the WAN bridge with DHCP configurations, connectivity through the other WAN bridge is established only if static IP is applied to the second WAN bridge and static routing is configured for connectivity through that bridge.
- IPv6 is not supported for dual WAN toggle.
- If wan2-br is DHCP enabled WAN bridge, you must remove DHCP from wan2-br to apply default gateway from static IP configurations.

Dual WAN Bridge and DHCP Toggle

Note This feature is supported only on ENCS 5000 series devices.

In zero touch deployment, NFVIS requests for IPv4 assignments through DHCP for two WAN interfaces. During system initialization a second WAN bridge is configured with GE0-1 port attached. NFVIS toggles between the two default WAN bridges sending DHCP requests on any one of the WAN bridges at a time, for 30 second intervals. The toggling stops as soon as one WAN bridge is assigned an IP address through DHCP. The bridge with the assigned IP address is configured with DHCP. The other WAN bridge has no default IP configuration and can be manually configured with a static IP address if required.

If neither of the bridges is assigned an IP address through DHCP, the WAN DHCP toggle can be terminated by logging in to NFVIS using the default credentials. In this case, wan-br is configured with DHCP and wan2-br has no default IP configuration.

After zero touch deployment, the toggle feature is terminated and it is not possible to toggle between WAN bridges. To add additional connectivity to the NFVIS host, static IP address can be configured on the other WAN bridge and system static routing can be applied. A default gateway is not supported as the system default gateway is set through DHCP. If DHCP configuration is not required, then both WAN bridges can be configured with static IP addresses, and a default gateway can then be applied under system settings.

Accessing NFVIS

For initial login, use **admin** as the default user name, and **Admin123#** as the default password. Immediately after the initial login, the system prompts you to change the default password. You must set a strong password as per the on-screen instructions to proceed with the application. All other operations are blocked until default password is changed. API returns 401 unauthorized error if the default password is not reset.

If wan-br or wan2-br have not obtained IP addresses through DHCP, the zero touch deployment is terminated. To manually apply the IP configurations answer 'y' and the system proceeds with DHCP assignment on wan-br until the configurations are changed. For DHCP assignment to continue to request IP address for PnP flow on both WAN interfaces answer 'n'.

You must adhere to the following rules to create a strong password:

- Must contain at least one upper case and one lower case letter.
- Must contain at least one number and one special character (# _ - * ?).
- Must contain seven characters or greater. Length should be between 7 and 128 characters.

You can change the default password in three ways:

- Using the Cisco Enterprise NFVIS portal.
- Using the CLI (When you first log into Cisco Enterprise NFVIS through SSH, the system will prompt you to change the password).
- Using PnP (for details, see the Cisco Network Plug-n-Play Support , on page 46).
- Using console (After the initial login using the default password, you are prompted to change the default password).

```
NFVIS Version: 3.10.0-9

Copyright (c) 2015-2018 by Cisco Systems, Inc.
Cisco, Cisco Systems, and Cisco Systems logo are registered trademarks of Cisco
Systems, Inc. and/or its affiliates in the U.S. and certain other countries.

The copyrights to certain works contained in this software are owned by other
third parties and used and distributed under third party license agreements.
Certain components of this software are licensed under the GNU GPL 2.0, GPL 3.0,
LGPL 2.1, LGPL 3.0 and AGPL 3.0.

nfvis login: console (automatic login)

login:
login:
login:
login:
login: admin

Cisco Network Function Virtualization Infrastructure Software (NFVIS)
```

```
NFVIS Version: 3.10.0-9

Copyright (c) 2015-2018 by Cisco Systems, Inc.
Cisco, Cisco Systems, and Cisco Systems logo are registered trademarks of Cisco
Systems, Inc. and/or its affiliates in the U.S. and certain other countries.

The copyrights to certain works contained in this software are owned by other
third parties and used and distributed under third party license agreements.
Certain components of this software are licensed under the GNU GPL 2.0, GPL 3.0,
LGPL 2.1, LGPL 3.0 and AGPL 3.0.

admin@localhost's password:

admin connected from ::1 using ssh on nfvis
nfvis# show version


NFVIS Version: 3.12.3

Copyright (c) 2015-2020 by Cisco Systems, Inc.
Cisco, Cisco Systems, and Cisco Systems logo are registered trademarks of Cisco
Systems, Inc. and/or its affiliates in the U.S. and certain other countries.

The copyrights to certain works contained in this software are owned by other
third parties and used and distributed under third party license agreements.
Certain components of this software are licensed under the GNU GPL 2.0, GPL 3.0,
LGPL 2.1, LGPL 3.0 and AGPL 3.0.

login: admin
NFVIS service is OK
Warning: Permanently added 'localhost' (RSA) to the list of known hosts.
admin@localhost's password:


Cisco Network Function Virtualization Infrastructure Software (NFVIS)

NFVIS Version: 3.12.3-RC8

Copyright (c) 2015-2020 by Cisco Systems, Inc.
Cisco, Cisco Systems, and Cisco Systems logo are registered trademarks of Cisco
Systems, Inc. and/or its affiliates in the U.S. and certain other countries.

The copyrights to certain works contained in this software are owned by other
third parties and used and distributed under third party license agreements.
Certain components of this software are licensed under the GNU GPL 2.0, GPL 3.0,
LGPL 2.1, LGPL 3.0 and AGPL 3.0.


admin connected from ::1 using ssh on nfvis
admin logged with default credentials
Setting admin password will disable zero touch deployment behaviors.
Do you wish to proceed? [y or n]y
Please provide a password which satisfies the following criteria:
        1.At least one lowercase character
        2.At least one uppercase character
        3.At least one number
        4.At least one special character from # _ - * ?
        5.Length should be between 7 and 128 characters
Please reset the password :
Please reenter the password :


 Resetting admin password
```

```
New admin password is set

nfvis#
System message at 2020-01-08 03:10:10...
Commit performed by system via system using system.
nfvis#
```

Note To commit the target configuration to the active (running) configuration, use the **commit** command in any configuration mode. Changes made during a configuration session are inactive until the **commit** command is entered. By default, the commit operation is pseudo-atomic, meaning that all changes must succeed for the entire commit operation to succeed.

Connect to the System

Using IPv4

The three interfaces that connect the user to the system are the WAN and WAN2 interfaces and the management interface. By default, the WAN interface has DHCP configuration and the management interface is configured with a static IP address of 192.168.1.1. If the system has a DHCP server connected to the WAN interface, the WAN interface is assigned an IP address from this server. You can use this IP address to connect to the system.

You can connect to the server locally (with an Ethernet cable) using the static management IP address. However, to be able to use a static IP address to remotely connect to a server, the default gateway needs to be configured first.

You can connect to the system in the following ways:

- Using the local portal—After the initial login, you are prompted to change the default password.
- Using the KVM console—After the initial login using the default password, you are prompted to change the default password.
- Using PnP—After the initial provisioning through PnP, the configuration file pushed by the PNP server must include the new password for the default user (admin).

Using IPv6

IPv6 can be configured in static, DHCP stateful and Stateless Autoconfiguration (SLAAC) mode. By default, DHCP IPv6 stateful is configured on the WAN interface. If DHCP stateful is not enabled on the network, the router advertisement (RA) flag decides which state the network stays in. If the RA shows the Managed (M) flag, then the network stays in DHCP mode, even if there is no DHCP server in the network. If the RA shows the Other (O) flag, then the network switches from DHCP server to SLAAC mode.

SLAAC provides IPv6 address and default gateway. Stateless DHCP is enabled in the SLAAC mode. If the server has DNS and domain configured, then SLAAC also provides those values via stateless DHCP.

Perform Static Configuration without DHCP

Note Starting from NFVIS 3.10.1 release, for ENCS 5400 and ENCS 5100, wan2-br obtains an IP address from DHCP. To configure default gateway, first use the **no bridges bridge wan2-br dhcp** command.

If you want to disable DHCP and use static configuration, you need to perform the initial configuration by setting the WAN IP address and/or management IP address, and the default gateway. You can also configure a static IP on a created bridge.

To perform initial configuration on the system without using DHCP:

```
configure terminal
system settings mgmt ip address 192.168.1.2 255.255.255.0
bridges bridge wan-br ip address 209.165.201.22 255.255.255.0
system settings default-gw 209.165.201.1
commit
```

Note When an interface is configured with a static IP address, DHCP is automatically disabled on that interface.

Now you can either use the management IP or WAN IP to access the portal.

To configure static IPv6 on the WAN interface:

```
configure terminal
system settings mgmt ipv6 address 2001:DB8:1:1::72/64
bridges bridge wan-br ipv6 address 2001:DB8:1:1::75/64
system settings default-gw-ipv6 2001:DB8:1:1::76
commit
```

Note When an interface is configured with a static IPv6 address, DHCP IPv6 is automatically disabled on that interface. There are three options for IPv6 - static, DHCP and SLAAC, out of which only one can be enabled at a time.

Secure overlay is not supported when WAN interface is configured with IPv6.

To configure DHCP on the WAN interface:

```
configure terminal
no system settings default-gw
system settings wan dhcp
commit
exit
hostaction wan-dhcp-renew
```

Note Starting from NFVIS 3.10.1, you can configure DHCP IPv6 on any bridge. You can only have one DHCP IPv6 bridge or management interface active at a time. You cannot have DHCP IPv6 and default IPv6 gateway or SLAAC IPv6 configured at the same time.

To configure DHCP IPv6 on the WAN interface:

```
configure terminal
no system settings default-gw-ipv6
system settings wan dhcp-ipv6
commit
```

```
exit
hostaction wan-dhcp-renew
```

Verify Initial Configuration

Use the **show system settings-native** command to verify initial configuration. Use **show bridge-settings** and **show bridge-settings** *bridge_name* commands to verify the configuration for any bridge on the system.

Here is an extract from the output of the **show system settings-native** command when both WAN and management interfaces have a static configuration:

```
system settings-native mgmt ip-info interface lan-br
system settings-native mgmt ip-info ipv4_address 192.168.1.2
system settings-native mgmt ip-info netmask 255.255.255.0
!
!
!
system settings-native mgmt dhcp disabled
system settings-native wan ip-info interface wan-br
system settings-native wan ip-info ipv4_address 209.165.201.22
system settings-native wan ip-info netmask 255.255.255.0
!
!
!
system settings-native wan dhcp disabled
!
!
system settings-native gateway ipv4_address 209.165.201.1
system settings-native gateway interface wan-br
```

Here is an extract from the output of the **show system settings-native** command when the management interface has a DHCP configuration and the WAN interface has a static configuration:

```
system settings-native mgmt ip-info interface MGMT
system settings-native mgmt ip-info ipv4_address 192.168.1.2
system settings-native mgmt ip-info netmask 255.255.255.0
!
!
!
system settings-native mgmt dhcp enabled
system settings-native wan ip-info interface wan-br
system settings-native wan ip-info ipv4_address 209.165.201.22
system settings-native wan ip-info netmask 255.255.255.0
!
!
!
system settings-native wan dhcp disabled
```

Here is an extract from the output of the **show system settings-native** command when the WAN interface has a DHCP configuration and the management interface has a static configuration:

```
system settings-native mgmt ip-info interface lan-br
system settings-native mgmt ip-info ipv4_address 209.165.201.2
system settings-native mgmt ip-info netmask 255.255.255.0
!
!
!
```

```
system settings-native mgmt dhcp disabled
system settings-native wan ip-info interface wan-br
system settings-native wan ip-info ipv4_address 209.165.201.22
system settings-native wan ip-info netmask 255.255.255.0
!
!
!
system settings-native wan dhcp enabled
```

Configuring VLAN for NFVIS Management Traffic

A VLAN creates independent logical networks within a physical network. VLAN tagging is the practice of inserting a VLAN ID into a packet header in order to identify which VLAN the packet belongs to.

You can configure a VLAN tag on the WAN bridge (wan-br) interface to isolate Cisco Enterprise NFVIS management traffic from VM traffic. You can also configure VLAN on any bridge on the system (wan2-br for ENCS5400 or ENCS 5100, and user-br for all systems)

By default, WAN bridges and LAN bridges are in trunk mode and allows all VLANs. When you configure native VLAN, you must also configure all the allowed VLANs at the same time. The native VLAN becomes the only allowed VLAN if you do not configure all the VLANs. If you want a network that allows only one VLAN, then create another network on top of wan-net and lan-net and make it access network.

Note You cannot have the same VLAN configured for the NFVIS management and VM traffc.

For more details on the VLAN configuration, see the Understanding and Configuring VLANs module in the Catalyst 4500 Series Switch Cisco IOS Software Configuration Guide.

Configuring the IP Receive ACL

To filter out unwanted traffic, you can configure ip-receive-acl to block or allow certain traffic based on the IP address and service ports.

To configure the source network for Access Control List (ACL) access:

```
configure terminal
system settings ip-receive-acl 198.0.2.0/24
action accept priority 10
commit
```

Verifying the Trusted IP Connection

Use the **show running-config system settings ip-receive-acl** command to display the configured source network for ACL access to the management interface

```
nfvis# show running-config system settings ip-receive-acl
system settings ip-receive-acl 198.51.100.11/24
service
[ ssh https scpd]
action accept
priority 100
```

Port 22222 and Management Interface ACL

Port 22222 is used for SCP server and is closed by default on an NFVIS system. You cannot SCP a file into NFVIS from an external server. If you need to SCP file from an external server, you must first open the port.

To open port 22222:

```
config terminal
system settings ip-receive-acl address/mask_len service scpd priority 2 action accept
commit
```

The Access Control List (ACL) is identify by address. If this ACL is removed, all ACLs sharing the same address are also removed. Ensure that you configure the ACLs that share the same address once again.

Note From 3.8.1 release, only users with administrator priviledges can use the SCP command on port 22222 to upload or download only from restricted folders like /data/intdatastore/. For more information, see Host System Operations.

Caution SCP command cannot be used to copy files from one NFVIS device to another NFVIS device.

Use the **show running-config system settings ip-receive-acl** command to verify the interface configuration:

```
nfvis# show running-config system settings ip-receive-acl

system settings ip-receive-acl 10.156.0.0/16

 service  [ ssh https scpd ]

 action   accept

 priority 100

!
```

Configuring Secondary IP Address and Source Interface

Secondary IP Address

The Cisco Enterprise NFVIS supports multiple IP addresses per interface. You can configure a secondary IP address on the WAN interface, as an additional IP address to reach the software. Set the external routes for secondary IP address to reach the NFVIS. Routers configured with secondary addresses can route between the different subnets attached to the same physical interface.

To access secondary IP address through ISRv, the WAN physical port is removed from wan-br similar to single IP address.

To configure Secondary IP Address:

```
nfvis(config)# system settings wan secondary ip address 1.1.2.3 255.255.255.0
```

Source Interface

The Source Interface feature lets you assign an IP address to a source interface.. The IP address configured is used for packets generated by the NFVIS. The packets generated use the default route.

Prerequisites for configuring Source Interface

- The IP address must be one of the IP addresses configured in system settings.
- The source interface IP address can be one of the following:
  - mgmt
  - WAN
  - WAN Secondary IP
  - WAN2 IP or IP configured on any bridge
- Source-interface configuration must be applied if the WAN IP is static.
- For DHCP, source interface IP address is accepted but cannot be applied. The configuration takes effect once you switch from DHCP to static.

To configure source Interface:

```
nfvis(config)# system settings source-interface
1.1.2.3
```

The secondary IP address and source interface related errors are logged in **show log nfvis_config.log** file.

Secondary IP Address and Source Interface APIs and Commands

APIs	Commands
• /api/config/system/settings/wan/secondary	• system settings wan secondary
• /api/config/system/settings/source-interface	• system settings source-interface

CIMC Access Control

NFVIS administrators have authoritative control control over ENCS 5400 devices. This includes capability to change the IP address used to reach the CIMC and modifying the CIMC and BIOS passwords.

CIMC Access using NFVIS

Note CIMC access using NFVIS is supported only on ENCS 5400.

When CIMC access is enabled on NFVIS, ISRv can gain access to the host CIMC and internal switch management console. You must have authorization from Cisco Interactive Debug (CID) to access both consoles.

To access CIMC using NFVIS WAN or management interface IP address, use the **system settings cimc-access enable** command. Once you configure CIMC access on NFVIS, the stand alone CIMC access using CIMC IP address is disabled and you will be able to access CIMC using NFVIS management interface IP address. The configurations remain on the device even after the device reboot.

When the CIMC access is configured, it enables a few ports to access services like SSH, SNMP, HTTP and HTTPs into the CIMC.

The following port numbers are being used for forwarding services to CIMC:

- 20226 for SNMP
- 20227 for SSH
- 20228 for HTTP
- 20229 for HTTPS

If you are unable to access CIMC using NFVIS, check the show log nfvis_config.log file.

Use **system settings cimc-access disable** to disable this feature.

BIOS-CIMC Update

For releases 3.8.1 and later, if the BIOS or CIMC versions on Cisco ENCS 5400 routers are lower than the image version in the NFVIS ISO or upgrade package, the BIOS and CIMC versions on the routers are automatically upgraded to the version of the bundled image during NFVIS upgrade or installation. The CPU microcode is also upgraded as part of this upgrade or installation. Note that the upgrade process takes longer than in previous releases and the process cannot be stopped midway.

For Cisco ENCS 5100 routers, BIOS is automatically upgraded to the new version, but the server needs to be rebooted manually for the upgrade to show.

BIOS and CIMC Password

Table 4: Feature History

Feature Name	Release Information	Description
BIOS and CIMC password	NFVIS 4.2.1	New password restrictions and security measures are added for CIMC and BIOS.

To change the BIOS and CIMC password for ENCS 5400, use **hostaction change-bios-password newpassword** or **hostaction change-cimc-password newpassword** commands. The change in the password will take effect immediately after the commands are executed.

Note New password restrictions added for CIMC and BIOS in NFVIS 4.2.1 release.

You must adhere to the following rules to create a strong password for CIMC:

- Must contain at least one upper case and one lower case letter.
- Must contain at least one number and one special character from #, @ or _.
- Length should be between 8 and 20 characters.
- Should not contain the following string (case sensitive): admin

You must adhere to the following rules to create a strong password for BIOS:

- The first letter cannot be #.
- Must contain at least one upper case and one lower case letter.
- Must contain at least one number and one special character from #, @ or _.
- Length should be between 8 and 20 characters.
- Should not contain the following string (case sensitive): bios

Starting from BIOS version 2.11 and CIMC 3.2.10, the new BIOS password security measures are:

- BIOS password can only be set through CIMC XML API or NFVIS. It can no longer be configured in the BIOS setup menu.
- BIOS password is retained after BIOS updates and it does not have to be reconfigured after a BIOS update.
- Only an admin password can be set and user-level BIOS password can no longer be set.

BIOS and CIMC Password APIs and Commands

BIOS and CIMC Password APIs	BIOS and CIMC Password Commands
• /api/operations/hostaction/change-cimc-password /api/operations/hostaction/change-bios-password	• hostaction change-cimc-password • hostaction change-bios-password

UEFI Secure Boot on ENCS 5400

The Unified Extensible Firmware Interface (UEFI) Secure Boot mode ensures that all EFI drivers and applications, ROMs or operating systems are signed and verified for authenticity and integrity before they are loaded and executed. This feature can be enabled through the GUI or CLI. When you enable UEFI secure boot mode, the boot mode is set to UEFI mode and you cannot modify the configured boot mode until the UEFI boot mode is disabled.

Note If you enable UEFI secure boot on an unsupported OS, on the next reboot, you cannot boot the device from that particular OS when you try to reboot the next time. If you try to reboot from such unsupported OS, an error is reported and recorded under System Software Events in the GUI. You must disable the UEFI secure boot option using Cisco IMC to be able to boot from the OS that does not support UEFI secure boot.

Enabling UEFI Secure Boot Mode

To enable UEFI secure boot mode:

```
Server# scope bios
Server /bios # set secure-boot enable
Setting Value : enable
Commit Pending.
Server /bios *# commit
```

Reboot the server to have your configuration boot mode settings to take effect.

Disabling UEFI Secure Boot Mode

To disable UEFI secure boot mode:

```
Server# scope bios
Server /bios # set secure-boot disable
Setting Value : enable
Commit Pending.
Server /bios *# commit
```

Reboot the server to have your configuration boot mode settings to take effect.

To install NFVIS in UEFI mode, map the iso image through vmedia or kvm first, then enable secure boot and change the BIOS set-up parameters.

```
encs# scope bios
encs /bios # scope advanced
encs /bios/advanced # set BootOpRom UEFI
encs /bios/advanced # set BootOrderRules Loose
encs /bios/advanced *# commit
```

Reboot the device to start the installation.

To configure the UEFI virtual-mapped image as the first boot option, enter the BIOS menu using **F2** key when BIOS boots up. Use direction keys to move UEFI: Cisco CIMC-mapped image or KVM-mapped image to the top of the boot option list. For BIOS v2.10 onwards, you can also configure the UEFI boot order through CIMC GUI or CLI. For more information see, Install Cisco Enterprise NFVIS.

Note All VNFs and configurations are lost at reboot. Secure boot in UEFI mode works differently from the legacy mode. Therefore, there is no compatibility in between legacy mode and UEFI mode. The previous environment is not kept.

PXE Boot Mode

PXE (Preboot Execution Environment) boot mode is a new configuration option in the BIOS **Advanced** option list in CIMC, which can be configured like any other BIOS configuration option in the list. PXE boot mode allows you to configure PXE boot for legacy mode, UEFI mode, or disable it when not in use. Starting from NFVIS 4.5, BIOS 2.13 and CIMC 3.2.12.1, PXE boot is disabled by default.

It is recommended that you disable PXE boot mode when not using PXE, in order to gain boot time savings.

Enable or Disable Access to NFVIS Portal

The Cisco Enterprise NFVIS portal access is enabled by default. You can disable the access if required.

To disable the portal access:

```
configure terminal
system portal access disabled
commit
```

Note You can enable the portal access using the **enabled** keyword with the **system portal access** configuration.

Verifying the Portal Access

Use the **show system portal status** command to verify the portal access status as shown below:

```
nfvis# show system portal status
system portal status "access disabled"
```

Portal Access APIs and Commands

Portal Access APIs	Portal Access Commands
• /api/config/system/portal • /api/operational/system/portal/status	• system portal access • show system portal status

Users, Roles, and Authentication

Local User Account Management

Role based access enables the administrator to manage different levels of access to the system's compute, storage, database, and application services. It uses the access control concepts such as users, groups, and rules, which you can apply to individual API calls. You can also keep a log of all user activities.

Table 5: Supported User Roles and Privileges

User Role	Privilege
Administrators	Owns everything, can perform all tasks including changing user roles, but cannot delete basic infrastructure. An admin's role can't be changed
Operators	Start, stop, and delete a VM. Clear logs and view all information
Auditors	Read-only permission and can't perform any tasks

Rules for User Passwords

The user passwords must meet the following requirements:

- Must have at least seven characters length or the minimum required length configured by the admin user.
- Must not have more than 128 characters.
- Must contain a digit.
- Must contain one of the following special characters: hash (#), underscore (_), hyphen (-), asterisk (*), or question mark (?).
- Must contain an uppercase character and a lowercase character.
- Must not be the same as last five passwords.

Creating Users and Assigning Roles

The administrator can create users and define user roles as required. You can assign a user to a particular user group. For example, the user "test1" can be added to the user group "administrators".

Note All user groups are created by the system. You cannot create or modify a user group.

Starting from NFVIS 3.9.1, create-user, delete-user, change-role and change-password operations are configurable from exec mode.

To create a user:

```
rbac authentication users create-user name test1 password Test1_pass role administrators
```

To delete a user:

```
rbac authentication users delete-user name test1
```

Note To change the password, use the **rbac authentication users user test1 change-password new-password newPassword old-password oldPassword** command. To change the user role to administrators, operators or auditors, use the **rbac authentication users user test1 change-role new-role newRole old-role oldRole** command.

User Management APIs and Commands

User Management APIs	User Management Commands
• /api/operations/rbac/authentication/users /user/<user-name>/change-password • /api/operations/rbac/authentication/users/user /<user-name>/change-role • /api/operations/rbac/authentication/users/create-user • /api/operations/rbac/authentication/users/delete-user	• rbac authentication users • rbac authentication users user <user-name> change-password old-password <old_pwd> new-password <new_pwd> • rbac authentication users user <user-name> change-role old-role <old_role> new-role <new_role> • rbac authentication users create-user name <user-name> password <password> role <role> • rbac authentication users delete-user name <user-name>

Configuring Minimum Length for Passwords

The admin user can configure the minimum length required for passwords of all users. The minimum length must be between 7 to 128 characters. By default, the minimum length required for passwords is set to 7 characters.

```
configure terminal
rbac authentication min-pwd-length 10
commit
```

Minimum Password Length APIs and Commands

APIs	Commands
/api/config/rbac/authentication/min-pwd-length	rbac authentication min-pwd-length

Configuring Password Lifetime

The admin user can configure minimum and maximum lifetime values for passwords of all users and enforce a rule to check these values. The default minimum lifetime value is set to 1 day and the default maximum lifetime value is set to 60 days.

When a minimum lifetime value is configured, the user cannot change the password until the specified number of days have passed. Similarly, when a maximum lifetime value is configured, a user must change the password

before the specified number of days pass. If a user does not change the password and the specified number of days have passed, a notification is sent to the user.

Note The minimum and maximum lifetime values and the rule to check for these values are not applied to the admin user.

```
configure terminal
rbac authentication password-lifetime enforce true min-days 2 max-days 30
commit
```

Password Lifetime APIs and Commands

APIs	Commands
/api/config/rbac/authentication/password-lifetime/	rbac authentication password-lifetime

Deactivating Inactive User Accounts

The admin user can configure the number of days after which an unused user account is marked as inactive and enforce a rule to check the configured inactivity period. When marked as inactive, the user cannot login to the system. To allow the user to login to the system, the admin user can activate the user account by using the **rbac authentication users user** *username* **activate** command.

Note The inactivity period and the rule to check the inactivity period are not applied to the admin user.

```
configure terminal
rbac authentication account-inactivity enforce true inactivity-days 2
commit
```

Deactivate Inactive User Accounts APIs and Commands

APIs	Commands
/api/config/rbac/authentication/account-inactivity/	rbac authentication account-inactivity

Activating an Inactive User Account

The admin user can activate the account of an inactive user.

```
configure terminal
rbac authentication users user guest_user activate
commit
```

Activate Inactive User Account APIs and Commands

APIs	Commands
/api/operations/rbac/authentication/users/user/username/activate	rbac authentication users user activate

NFVIS Password Recovery

1. Load the NFVIS ISO image, using the CIMC KVM console.
2. Select Troubleshooting from the Boot Selection menu.
3. Select Rescue a NFVIS Password.
4. Select Continue.
5. Press Return to get a shell.
6. Run the **chroot /mnt/sysimage** command.
7. Run the **./nfvis_password_reset** command to reset the password to admin.
8. Confirm the change in password and enter Exit twice.

   Disconnect the NFVIS ISO image in the CIMC KVM console and reboot NFVIS.
9. Login to NFVIS with the default credentials admin/Admin123#.

   After login to NFVIS, enter a new password at prompt.
10. Connect to NFVIS with the new password.

Note You can update and recover NFVIS 3.8.1 and older passwords using NFVIS 3.9.1.

User Groups

Granular Role-Based Access Control

Table 6: Feature History

Feature Name	Release Information	Description
Granular Role-Based Access Control	NFVIS 4.7.1	This feature introduces a new resource group policy that allows the system administrator to define a set of user groups. You can assign users to these defined group to control VNF access, during a VNF deployment.

Restrictions for Granular Role-Based Access Control

- A group can only be associated with one policy, either the `resource-access-control` policy or the `local-authentication-only` policy.
- One user can be assigned to one group only.
- A VM can only belong to one group.

Information About Granular Role-Based Access Control

The Granular Role-Based Access Control (Granular RBAC) feature allows you to restrict VM management to a particular set of users. The system administrator can define a set of resource groups, and assign VNFs and system resources such as VMs, disk files, and system level configurations to these defined groups. When you create a user, you can assign that user to one of the resource groups, and this enables the user to access the associated VNFs. Following is the detailed descriptions of roles, users, and groups.

Roles

The three roles defined by the system are:

- Administrator: An administrator user has complete access to configure, update or delete a resource.
- Operator: An operator user can only view and operate a resource.
- Auditor: An auditor user can only view a resource and cannot perform any action on it.

Note All three roles have a read-access to all host level configurations, VMs, and images.

Users

- Users are created with a role definition. A user's role is defined during the user creation, and it is consistent across all groups.
- All users have a read access to NFVIS configurations, filesystems, logs, VMs and images.
- A user can be a member of only one group.
- admin user:
  - The admin user is a special user that cannot be deleted or modified. The admin user permanently has the administrator role in the default global group.
  - The admin user functions as a member of every group, and can execute administrative privileges for every group.
  - The admin user cannot be assigned to a specific user group.
- The roles of remote users such as TACACS and RADIUS, is mapped to NFVIS roles based on the privilege level.

Groups

- The global group is a special group assigned to users who are not members of any other group. A user in the global group can access all resources on the system, at the privilege level.
- Resources can be assigned to the global group or a specific group.
- When creating a group, the `resource-access-control` policy should be enabled, to have resource restrictions.
- All members of a group have access to the resources that are assigned to that group, the privileges of which are defined by the user's role.
- A resource can belong to one specific group, and all users that are members of that group containing a resource have access to that resource.

For more details on Granular RBAC feature capabilities, see Appendix.

Create Groups and Assign Local Users to the Groups

The following example shows how to create a group with or without a policy:

```
nfvis(config)# aaa groups group rac_group policy resource-access-control
nfvis(config-policy-resource-access-control)# commit
Commit complete.
```

The following example shows how to create a local user and assign them to a group:

```
nfvis# rbac authentication users create-user name local_admin_3 password Cisco123\# role
administrators group rac_group
```

The following example shows how to view a list of RBAC users with role and group information:

```
nfvis# show running-config rbac authentication users
rbac authentication users user admin
 role administrators
!
rbac authentication users user local_admin_1
 role administrators
!
rbac authentication users user local_admin_2
 role administrators
!
rbac authentication users user local_admin_3
 role administrators
 groups group rac_group
 !
!
rbac authentication users user local_oper_1
 role operators
!
rbac authentication users user local_test_1
 role operators
!
```

Assign Remote Users to the Group

NFVIS depends on a remote server for user authentication and authorization. Hence, NFVIS uses a different way to assign remote users to a resource control group. When remote users login to NFVIS, they can only manage the deployment that belongs to its own resource control group, based on their defined role in the

remote server. Any remote user that is not mentioned in the resource group, is treated as a global group user and that user can operate the system and manage the deployments based on their defined role.

The following example shows how to assign remote users to the group:

```
nfvis(config)# aaa groups group tac_group user remote_admin1
nfvis(config-user-remote_admin1)# user remote_admin2
nfvis(config-user-remote_admin2)# user remote_operator3
nfvis(config-user-remote_operator3)# policy resource-access-control
nfvis(config-policy-resource-access-control)# commit
Commit complete.
nfvis(config-policy-resource-access-control)# end
nfvis# show running-config aaa groups group tac_group
aaa groups group tac_group
policy resource-access-control
!
user remote_admin1
!
user remote_admin2
!
user remote_operator3
!
!
nfvis#
nfvis# show rbac authentication users
NAME
-------
admin
```

Note In the above example, `remote_admin1`, `remote_admin2`, and `remote_operator3` are TACACS+/RADIUS users.

Local Authentication for a Specific Group of Users

Table 7: Feature History

Feature Name	Release Information	Description
Local Authentication for a Specific Group of Users	NFVIS 4.6.1	This feature enables you to create a group with specific users, who can perform only the local authentication; and don't have to authenticate externally through TACACS.

Restrictions for Local Authentication for a Specific Group of Users

- One user can be assigned to a maximum of one group.
- If a local user assigned to the local authentication group has the same user name as a remote (TACACS+/RADIUS) user, then only the local user's credentials are taken into consideration. The remote user's credentials are considered even if the local user's authentication fails.

Information about Local Authentication for a Specific Group of Users

Typically, users who need authentication go through the default authentication order. The default order involves external authentication through TACACS as the first step, and local authentication as the second step. The local authentication for a specific group of users feature enables you to create a group and add specific users to it, allowing these users to bypass the default authentication order. The users in this group skip the external TACACS authentication and only go through local authentication. For this group to function as expected, assign the 'local-authentication-only' policy to the group.

Create Groups and Assign Users to the Groups

The following example shows how to create a group:

```
nfvis#(config) aaa groups group [ group-name ] policy local-authentication-only
```

The following example shows how to assign a user:

```
nfvis# rbac authentication users user <username> assign-group [ group-name ]
```

The following example shows how to remove a user:

```
nfvis# rbac authentication users user <username> remove-group [ group-name ]
```

The following example shows how to assign a user to a group while creating the user:

```
nfvis# rbac authentication users create-user name <username> password <password> role <role>
 group [ group-name ]
```

RADIUS Support

About RADIUS

Remote Authentication Dial-In User Service (RADIUS) is a distributed client-server system that secures networks against unauthorized access. In the Cisco implementation, RADIUS clients run on Cisco routers and send authentication requests to a central RADIUS server that contains all user authentication and network service access information.

RADIUS is a fully open protocol, distributed in source code format, that can be modified to work with any security system currently available on the market.

Cisco supports RADIUS under its AAA security paradigm. RADIUS has been implemented in a variety of network environments that require high levels of security while maintaining network access for remote users.

Note You can configure upto four RADIUS servers. When multiple RADIUS servers are configured, if the first server is unreachable, NFVIS tries the next server in the order it is configured.

RADIUS Operation

When a user attempts to log in and authenticate to an access server using RADIUS, the following steps occur:

1. The user is prompted to enter the username and password.

2. The username and encrypted password are sent over the network to the RADIUS server.
3. The user receives one of the following responses from the RADIUS server:
   a. ACCEPT—The user is authenticated.
   b. CHALLENGE—A challenge is issued by the RADIUS server. The challenge collects additional data from the user.
   c. CHANGE PASSWORD—A request is issued by the RADIUS server, asking the user to select a new password.
   d. REJECT—The user is not authenticated and is prompted to reenter the username and password, or access is denied.

The ACCEPT or REJECT response is bundled with additional data that is used for EXEC or network authorization. You must first complete RADIUS authentication before using RADIUS authorization. The additional data included with the ACCEPT or REJECT packets consists of the following:

- Services that the user can access, including connections such as Telnet, rlogin, or local-area transport (LAT), and services such as PPP, Serial Line Protocol (SLIP), or EXEC services.
- Connection parameters, including the host or client IP address, access list, and user timeouts.

Configuring RADIUS

To configure RADIUS support:

```
configure terminal
radius-server host 103.1.4.3
shared-secret cisco123
admin-priv 15
oper-priv  11
commit
```

Starting from NFVIS 3.9.2 release, RADIUS secret encryption is supported. You can only configure either secret key or encrypted secret key at a given time. Use encrypted secret if special characters are used in secret. To configure encrypted RADIUS secret:

```
configure terminal
radius-server host 103.1.4.3
encrypted-shared-secret cisco123
admin-priv 15
oper-priv  11
commit
```

Verifying the RADIUS configuration

Use the **show running-config radius-server** command to verify the interface configuration for a RADIUS session:

```
nfvis# show running-config radius-server

radius-server host 103.1.4.3
 key           0
 shared-secret cisco123
```

```
admin-priv    15
oper-priv     11
```

RADIUS Support APIs and Commands

APIs	Commands
• /api/config/security_servers/radius-server	• radius-server host • key • admin-priv • oper-priv • encrypted-shared-secret or shared-secret

TACACS+ Support

About TACACS+

TACACS+ is a security application that provides centralized validation of users attempting to gain access to a router or network access server. TACACS+ services are maintained in a database on a TACACS+ daemon running, typically, on a UNIX or Windows NT workstation. You must configure a TACACS+ server before the configured TACACS+ features on your network access server are available.

On the TACACS+ server, ensure you configure Cisco attribute-value (AV) pair privilege level (priv-lvl) for Cisco Enterprise NFVIS as a service for the minimum privilege level of administrators and operators.

Note In NFVIS 3.11.1 or earlier release, users with no privilege level or users with a privilege level that is less than the operator's privilege level are considered as auditors with read-only permission.

After NFVIS 3.12.1 release, users with privilege level zero won't be able to login to NFVIS anymore.

Note You can configure upto four TACACS+ servers. When multiple TACACS+ servers are configured, if the first server is unreachable, NFVIS tries the next server in the order it is configured.

TACACS Operation

When a user attempts a simple ASCII login by authenticating to NFVIS using TACACS+, this process occurs:

1. When the user tries to log in, NFVIS sends user credential to TACACS+ server.
2. NFVIS will eventually receive one of the following responses from the TACACS+ server:
   a. ACCEPT—The user is authenticated and service can begin. If NFVIS is configured to require authorization, authorization begins at this time.
   b. REJECT—The user is not authenticated. The user can be denied access or is prompted to retry the login sequence, depending on the TACACS+ server.

c. ERROR—An error occurred at some time during authentication with the server or in the network connection between the server and NFVIS. If an ERROR response is received, NFVIS typically tries to use an alternative method for authenticating the user.

d. CONTINUE—The user is prompted for additional authentication information.

After authentication, NFVIS will send authorization request to TACACS+ server.

3. Based on authorization result, NFVIS will assign user's role.

Configuring a TACACS+ Server

To configure TACACS+:

```
configure terminal
tacacs-server host 209.165.201.20 shared-secret
test1

key 0
admin-priv
14

oper-priv
9

commit
```

In this configuration, privilege level 14 is assigned to the administrator role, and privilege level 9 is assigned to the operator role. This means a user with privilge level 14 or higher will have all admin privileges when the user logs into the system, and a user with privilege level 9 or higher will have all privileges of an operator at the time of login.

Starting from NFVIS 3.9.2 release, TACACS+ secret encryption is supported. You can only configure either secret key or encrypted secret key at a given time. Encrypted secret key can contain special characters but secret key cannot. For NFVIS 3.12.1 release, the following pattern is supported for encryped-shared-key: [-_a-zA-Z0-9./\\<>%!*$€#{}()+].

To configure encrypted TACACS+ key:

```
configure terminal
tacacs-server host 209.165.201.20 encrypted-shared-secret test1
key 0
admin-priv
14

oper-priv
9

commit
```

Verifying the TACAC+ configuration

Use the **show running-config tacacs-server** command to verify the configuration if encrypted TACACS+ key is configured:

```
nfvis# show running-config tacacs-server
```

```
tacacs-server host 209.165.201.20
 encrypted-shared-secret $8$mRTnL9TKZCFi1BUP7Mwbm3JVIo4Z7QvJ
 admin-priv              15
 oper-priv               11
!
```

TACACS+ APIs and Commands

TACACS+ APIs	TACACS+ Commands and Descriptions
• /api/config/security_servers/tacacs-server • /api/config/security_servers/tacacs-server?deep • /api/config/security_servers/tacacs-server /host/<ip-address/domain-name>	• tacacs-server host IP address of the TACACS host server • key Configures a preshared key to authenticate comms between Security client and server. • admin-priv Minimum privilege level for administrator • oper-priv Minimum privilege for operator • encrypted-shared-secret or shared-secret Preshared secret to authenticate comms between Security client and server.

Default Authentication Order

NFVIS supports both TACACS+ and RADIUS but only one authentication method can be enabled at a time. After you have identified the TACACS+ and RADIUS server and defined an associated TACACS+ and RADIUS authentication key, you must define method lists for TACACS+ and RADIUS authentication. Because TACACS+ and RADIUS authentication is operated through AAA, you need to issue the aaa authentication command, specifying TACACS+ or RADIUS as the authentication method.

```
nfvis(config)# aaa authentication ?
Possible completions:
  radius   Use RADIUS for AAA
  tacacs   Use TACACS+ for AAA
  users    List of local users
```

Note

- Only when TACACS+ or RADIUS is enabled, it can be used for authentication.
- When TACACS+ or RADIUS is not accessible, local authentication is used. It is recommended to use **aaa authentication TACACS local** command to authenticate using local database. Local authentication is disabled if the connection between TACACS+ or RADIUS and NFVIS is restored.
- If the same username is registered for both local authentication and authentication through RADIUS or TACACS+, RADIUS or TACACS+ is chosen as the authentication method.
- It is recommended to configure Syslog so that it is easier to debug if TACACS+ or RADIUS does not work as expected.

All login attempts will be logged in syslogs in the local *nfvis_syslog.log*, *nfvis-ext-auth.log* files and in remote syslog servers.

Enchancements for NFVIS 3.12.3, User Specific Authentication Order

Starting from NFVIS 3.12.3 release, the supported aaa authentication order is local authentication followed by TACACS+.

- If the user is part of the local database, local authentication is executed and the user is permitted or denied access.
- If the user is not part of the local database, TACACS+ is used for authentication.
- If the same user is part of both the databases (local and TACACS+), the user can login with either the local password or the TACACS+ password. However, registering the same user in both the databases is not recommended.

In NFVIS 3.12.3 release, the only supported combination for authentication order is **aaa auth-order local tacacs**. Any other combinations are not supported. **aaa auth-order** configuration is mutually exclusive to **aaa authentication** and if one is configured, the other is automatically replaced.

```
nfvis(config)# aaa ?
Possible completions:
auth-order Configure authentication order; Mutually exclusive to authentication method
configuration
authentication Configure external authentication method; Mutually exclusive to auth-order
configuration
ios Specific IOS settings

nfvis(config)# aaa auth-order ?
Description: Configure authentication order; Mutually exclusive to authentication method
configuration
Possible completions:local radius tacacs
nfvis(config)# aaa auth-order local ?
Possible completions:
radius tacacs <cr>
nfvis(config)# aaa auth-order local tacacs ?
Possible completions:radius <cr>
nfvis(config)# aaa auth-order local tacacs
nfvis(config)#
```

Networking

Bridges

The IP configuration on bridges and the **show bridge-settings** command were added in NFVIS 3.10.1 release. A bridge can be used for NFVIS connectivity. Each bridge can be configured with IPv4 or IPv6 configurations such as Static IP, DHCP, SLAAC, or VLAN. Each bridge can have a port or port channel associated with it.

NFVIS is installed with LAN and WAN bridges by default. A service bridge can also be created. On all NFVIS systems, lan-br and wan-br are generated by default and populated with the appropriate ports for that system. On ENCS 5000 series platforms, wan2-br is also generated by default for the dual WAN initialization. For more information, see Dual WAN Support, on page 4. Except on ENCS 5000 Series platforms, the default LAN bridge is configured with a static IP address 192.168.1.1 and the WAN bridges uses DHCP for initial NFVIS connectivity.

On ENCS 5400 series platforms, configuration changes are not allowed on the lan-br bridge. The LAN bridge cannot be modified in any way.

Using IPv4

If the system has a DHCP server connected to a bridge with DHCP configured, the bridge receives the IP address from the server. You can use this IP address to connect to the system.

You can also connect to the server locally with an ethernet cable using a static IP address. To connect to the device remotely using a static IP address, you must configure the default gateway or setup an appropriate static route.

DHCP and a default gateway cannot be configured on NFVIS simultaneously. NFVIS only supports one system level default gateway. If DHCP is configured, the default gateway is assigned to the system through the DHCP server. Also, only one bridge can be configured with DHCP at any time.

Using IPv6

IPv6 can be configured in static, DHCP stateful, and Stateless Auto configuration (SLAAC) modes. By default, DHCP IPv6 stateful is configured on the WAN interface. If DHCP stateful is not enabled on the network, the router advertisement (RA) flag decides which state the network stays in. If the RA shows the Managed (M) flag, then the network stays in DHCP mode, even if there is no DHCP server in the network. If the RA shows the Other (O) flag, then the network switches from DHCP server to SLAAC mode.

SLAAC provides IPv6 address and a default gateway. Stateless DHCP is enabled in the SLAAC mode. If the server has DNS and domain configured, then SLAAC also provides those values through stateless DHCP.

Similar to IPv4, IPv6 DHCP and IPv6 default gateway cannot be configured on the system simultaneously, nor can stateful and stateless IPv6 DHCP. Also, only one bridge can be configured with either stateful or stateless IPv6 DHCP at any time.

Creating Bridges

To configure a new bridge:

```
configure terminal
```

```
bridges bridge my-br
commit
```

To verify the bridge generation, use the **show bridge-settings** command:

```
nfvis# show bridge-settings my-br ip-info interface
ip-info interface my-br
```

Configuring Bridge Port

A bridge can be tied to a physical interface by applying the port configuration. A bridge can have as many ports as are available, however a port must be unique to at most one bridge. If a port channel is applied to a bridge, it must be the only port configuration on that bridge.

To configure a port on a bridge:

```
configure terminal
bridges bridge my-br port eth3
commit
```

To configure a port channel on a bridge:

```
configure terminal
bridges bridge my-br port pc1
commit
```

To verify the port settings applied to a bridge, use the **support ovs vsctl** command:

```
nfvis# support ovs vsctl list-ports my-br
eth3
```

The same command can be used to verify the port channel settings applied to a bridge:

```
nfvis# support ovs vsctl list-ports my-br
bond-pc1
```

Configuring Bridge IP Connectivity

Configuring DHCP on Bridge

DHCP configuration can be applied to any bridge if no other bridge on the system has DHCP configured, and default gateway is not applied under system settings. Starting from NFVIS 3.12.1 release, DHCP configuration on a bridge automatically triggers a DHCP renew request from the bridge. For an additional DHCP renew trigger, use the **hostaction bridge-dhcp-renew** command.

To configure DHCP on a bridge:

```
configure terminal
bridges bridge my-br dhcp
commit
```

To verify the DHCP settings applied to a bridge, use the **show bridge-settings <br_name> dhcp** command.

```
nfvis# show bridge-settings my-br dhcp

dhcp enabled
dhcp offer                          true
```

```
dhcp interface                     my-br
dhcp fixed_address                 10.10.10.14
dhcp subnet_mask                    255.255.255.128
dhcp gateway                        10.10.10.1
dhcp lease_time                     7200
dhcp message_type                     5
dhcp name_servers                    NA
dhcp server_identifier              10.10.10.1
dhcp renewal_time                   3600
dhcp rebinding_time                   6300
dhcp vendor_encapsulated_options     NA
dhcp domain_name                      NA
dhcp renew                       2019-12-11T13:28:29-00:00
dhcp rebind                     2019-12-11T14:17:12-00:00
dhcp expire                     2019-12-11T14:32:12-00:00
```

Configuring Static IP on a Bridge

An IPv4 address and subnet can be configured on any bridge which does not have DHCP configured. To enable routing outside of the subnet, apply the default gateway under system settings or confirgure system routes.

To configure an IPv4 address on a bridge:

```
configure terminal
bridges bridge my-br ip address 172.25.220.124 255.255.255.0
commit
```

To verify the IPv4 settings applied to a bridge, use the **show bridge-settings <br_name> ip_info** command.

```
nfvis# show bridge-settings my-br ip_info
ip-info interface                        my-br
ip-info ipv4_address                     172.25.220.124
ip-info netmask                          255.255.255.0
ip-info link-local ipv6 address          fe80::4e00:82ff:fead:e802
ip-info link-local ipv6 prefixlen        64
ip-info global ipv6                     address::
ip-info global ipv6 prefix               len0
ip-info mac_address                      4c:00:82:ad:e8:02
ip-info mtu                             9216
ip-info txqueuelen                      1000
```

Configuring IPv6 DHCP on a Bridge

IPv6 DHCP configuration can be applied to any bridge if no other bridge on the system has IPv6 DHCP or IPv6 SLAAC configured, and IPv6 default gateway is not applied under system settings. Starting from NFVIS 3.12.1 release, an IPv6 DHCP configuration on a bridge automatically triggers an IPv6 DHCP renew request from the bridge. For an additional IPv6 DHCP renew trigger use the **hostaction bridge-dhcp-renew** command.

To configure IPv6 DHCP on a bridge:

```
configure terminal
bridges bridge my-br dhcp-ipv6
commit
```

To verify the IPv6 DHCP settings applied to a bridge, use the **show bridge-settings <br_name> dhcp-ipv6** command.

```
nfvis# show bridge-settings my-br dhcp-ipv6
```

```
dhcp-ipv6 offer true
dhcp-ipv6 interface my-br
dhcp-ipv6 ia-naec:d2:7d:b4
dhcp-ipv6 starts 1554792146
dhcp-ipv6 renew 43200
dhcp-ipv6 rebind 69120
dhcp-ipv6 iaaddr 2001:420:30d:201:ffff:ffff:fffa:8e48
dhcp-ipv6 preferred-life 86400
dhcp-ipv6 max-life 172800
dhcp-ipv6 client-id 0:1:0:1:24:3e:fb:50:0:62:ec:d2:7d:b4
dhcp-ipv6 server-id 0:3:0:1:0:25:45:1b:c2:2a
dhcp-ipv6 name_servers NA
dhcp-ipv6 domain_name NA
dhcp-ipv6 option [ ]
```

Configuring IPv6 SLAAC on a Bridge

IPv6 SLAAC configuration can be applied to any bridge if no other bridge on the system has IPv6 SLAAC or IPv6 DHCP configured, and IPv6 default gateway is not applied under system settings.

To configure IPv6 SLAAC on a bridge:

```
configure terminal
bridges bridge my-br slaac-ipv6
commit
```

To verify the IPv6 SLAAC settings applied to a bridge, use the **show bridge-settings <br_name> slaac-ipv6** command.

```
nfvis# show bridge-settings my-br slaac-ipv6
slaac-ipv6 enabled
```

Configuring Static IPv6 Address on a Bridge

An IPv6 address can be configured on any bridge which does not have IPv6 DHCP or SLAAC configured. To enable routing outside of the subnet, apply the default gateway under system settings or confirgure system routes.

To configure an IPv6 address on a bridge:

```
configure terminal
bridges bridge my-br ipv6 address 2001:db8:85a3::8a2e:370:7334/64
commit
```

To verify the IPv6 settings applied to a bridge, use the **show bridge-settings <br_name> ip_info** command.

```
nfvis# show bridge-settings my-br ip_info
ip-info interface my-br
ip-info ipv4_address 172.25.220.124
ip-info netmask 255.255.255.0
ip-info link-local ipv6 address fe80::4e00:82ff:fead:e802
ip-info link-local ipv6 prefixlen 64
ip-info global ipv6 address 2001:db8:85a3::8a2e:370:7334
ip-info global ipv6 prefixlen 64
ip-info mac_address 4c:00:82:ad:e8:02
ip-info mtu 9216
ip-info txqueuelen 1000
```

Configuring VLAN on a Bridge

A VLAN is a method of creating independent logical networks within a physical network. VLAN tagging is the practice of inserting a VLAN ID into a packet header in order to identify which VLAN the packet belongs to.

You can configure a VLAN tag on the WAN bridge (wan-br) interface to isolate Cisco Enterprise NFVIS management traffic from VM traffic. You can also configure VLAN on any bridge on the system (wan2-br for ENCS5400 or ENCS 5100, and user-br for all systems)

By default, Wan bridge and LAN bridge are in trunk mode and allows all VLANs. When you configure native VLAN, you must also configure all the allowed VLANs at the same time. The native VLAN becomes the only allowed VLAN if you do not configure all the VLANs. If you want a network that allows only one VLAN, then create another network on top of wan-net and lan-net and make it access network.

Note You cannot have the same VLAN configured for the NFVIS management and VM traffc.

For more details on the VLAN configuration, see the Understanding and Configuring VLANs module in the Catalyst 4500 Series Switch Cisco IOS Software Configuration Guide.

To configure a VLAN:

```
configure terminal
bridges bridge wan-br vlan 120
commit
```

To verify the VLAN settings applied to a bridge, use the **show bridge-settings my-br vlan** command.

```
nfvis# show bridge-settings my-br vlan
vlan tag 10
```

Configuring MAC Aging Time on Bridge

MAC aging time specifies the time at which a MAC address entry ages out of the MAC address table. The max-aging-time specifies the maximum number of seconds to retain a MAC learning entry for which no packets have been seen. The default value is 300 seconds.

To configure MAC aging time on a bridge:

```
configure terminal
bridges bridge my-br mac-aging-time 600
commit
```

To verify the MAC aging time settings applied to a bridge, use the **show bridge-settings <br_name> mac-aging-time** command.

```
nfvis# show bridge-settings my-br mac-aging-time
mac-aging-time 600
```

Bridge APIs and Commands

Bridge APIs	Bridge Commands
/api/operational/bridge-settings /api/config/bridges/bridge/	bridges bridge <br_name> bridges bridge <br_name> port bridges bridge <br_name> ip address bridges bridge <br_name> dhcp bridges bridge <br_name> ipv6 address bridges bridge <br_name> dhcp-ipv6 bridges bridge <br_name> slaac-ipv6 bridges bridge <br_name> vlan bridges bridge <br_name> mac-aging-time show bridge-settings <br_name> support ovs vsctl list-ports <br_name>

Physical Network Interface Cards

Configuring LLDP

Starting from NFVIS 3.7.1 release, LLDP is supported on NFVIS. The Link Layer Discovery Protocol (LLDP) is used by network devices for advertising their identity, capabilities, and neighbors. You can configure LLDP on a PNIC which is not a port channel or a DPDK port. By default, LLDP is disabled for all PNICs.

LLDP information is sent by devices from each of their interfaces at a fixed interval, in the form of an Ethernet frame. Each frame contains one LLDP Data Unit (LLDPDU). Each LLDPDU is a sequence of type-length-value (TLV) structures.

LLDP is enabled in transmit and receive mode. The LLDP agent can transmit the local system capabilities and status information and receive the remote system's capabilities and status information

If LLDP is enabled on two connected devices, they can see each other as neighbors.

Note LLDP packets are not propagated to VMs. LLDP cannot be enabled on port channel or DPDK ports.

To enable LLDP on a PNIC:

```
configure terminal
pnic eth0 lldp enabled
commit
```

To disable LLDP on a PNIC:

```
configure terminal
pnic eth0 lldp disabled
commit
```

Use the **show lldp neighbors** command to display the peer information:

```
nfvis# show lldp neighbors eth0
-----------------------------------------------------------------
DEVICE
NAME ID      HOLDTIME  CAPS  PLATFORM  PORTID  DESCRIPTION

-----------------------------------------------------------------
eth0 Switch1623 120 Bridge, Router Cisco IOS Software, Catalyst L3 Switch Software
(CAT3K_CAA-UNIVERSALK9-M), Version 15.0(1)EX3, RELEASE SOFTWARE (fc2)Ifname:
Gi1/0/4GigabitEthernet1/0/4
```

Use the **show lldp stats** command to display the tx and rx information:

```
nfvis# show lldp stats eth0
-------------------------------------------------------------------
TX      DISCARD  ERROR  RX      DISCARDED  UNREC
NAME   FRAMES  RX       RX     FRAMES    TLVS       TLVS   AGEOUTS
-------------------------------------------------------------------
eth0    23      0        0       19667     0         0         0
```

LLDP Configuration APIs and Commands

APIs	Commands
/api/config/pnics/pnic/<pnic_name>/lldp /api/operational/lldp/neighbors /api/operational/lldp/stats	pnic <pnic_name> lldp enabled pnic <pnic_name> lldp disabled show lldp neighbors <pnic_name> show lldp stats <pnic_name>

Configuring Administrative Status of a Port

Administrative status provides a mechanism for configuring the administrative status of a port. It can be set to up or down and the default setting is on.

Note Administrative status cannot be enabled on port channel.

To configure the admin status on a pnic for a VM:

```
configure terminal
pnic GE0-1 admin status down
commit
```

Use the **show pnic** command to verify the admin status configuration. Use the **show pnic link_state** command to verify the admin state configuration.

```
nfvis# show pnic GE0-1 link_state
link_state down
```

Admin Status Configuration APIs and Commands

APIs	Commands
/api/config/pnics/pnic/<pnic_name>/adminstatus	pnic <pnic_name> adminstatus

Tracking Changes for a Port

Note This feature is supported only on ENCS 5400 starting from NFVIS 3.10.1 release.

In a virtual environment when the PNIC goes down there is no indication to the interfaces inside the VNFs. It is useful to track state changes of PNICs including switch ports to one or more VNF interfaces and accordingly bring down or up the vNICs. This feature brings the appropriate interfaces inside the VNF up or down based on the PNIC state changes. Most of the VNFs support this functionality.

Track state can also be configured for LAN-SRIOV. The LAN network is not physically connected to LAN-SRIOV. Switch ports are connected to an embedded switch on the LAN side. The switch has an int-LAN interface which is a 10G interface the VMs can connect to from the LAN network using VFs (virtual functions). Therefore, the VM is not directly connected to LAN-SRIOV.

Track state configuration on WAN-SRIOV is not needed, as there is a one to one connection between WAN-SRIOV and the VM.

Track state can be configured for monitored and un-monitored VMs. If a track state configuration is deleted, the PNIC or switch port state changes will not be notified to the vNICs or VFs.

The VM has to be first deployed before you can configure PNIC track state for the VM. VNFs or vNICs do not have to be attached to a bridge connected to the PNIC.

To configure track state on a pnic for a VM use the following commands: **pnic <pnic_name> track-state <vm_name> <vnic>** or **pnic <pnic_name> track-state <deploy_name.vm_grp_name> <vnic>**

```
configure terminal
pnic GE0-0 track-state ROUTER 0
end
```

To verify the track state configuration on the VM use the **show interface** or **ethtool** commands or the VM specific command that displays the interface link state.

In the following example, the vedge VM deployed and vNIC 0 is being tracked by GE0-1. The **if-oper-status** command shows the state of the vNIC being tracked by pNIC. When GE0-1 is down, **if-oper-status** also shows as down.

Track StateAPIs and Commands

Track StateAPIs	Track State Commands
• api/config/pnics/pnic/<pnic_name>/track-state	• pnic <pnic_name> track-state <vm_name> <vnic> • pnic <pnic_name> track-state <deploy_name.vm_grp_name> <vnic>

Speed, Duplex and Autonegotiation

NFVIS supports autonegotiation by default on all PNICs. Speed and duplex are set to *auto* mode to indicate autonegotiation is enabled.

Autonegotiation allows a PNIC to communicate with the device on the other end of the link to determine the optimal duplex mode and speed for the connection. Autonegotiation can be turned off by configuring speed and duplex. Supported Ethernet speed is 10 Mbps, 100 Mbps, and 1G and 10 G.

Duplex mode displays the data flow on the interface. Duplex mode on an interface can be full or half duplex. A half-duplex interface can only transmit or receive data at any given time and a full-duplex interface can send and receive data simultaneously.

When autonegotiation is enabled on a port, it does not automatically determine the configuration of the port on the other side of the ethernet cable to match it. Autonegotiation only works if it is enabled on both sides of the link. If one side of a link has auto-negotiation enabled, and the other side of the link does not, then autonegotiation cannot determine the speed and duplex configurations of the other side. If autonegotiation is enabled on the other side of the link, the two devices decide together on the best speed and duplex mode. Each interface advertises the speed and duplex mode at which it can operate, and the best match is selected. Higher speed and full duplex is the preferred mode.

If one side of a link does not have autonegotiation enabled, then the speed and duplex on both sides must match so that the data can transmit without collisions. Autonegotiation fails on 10/100 links, if one side of the link has been set to 100/full, and the other side has been set to autonegotiation which is 100/half.

Note Not all ports on ENCS 5000 series devices support auto-mdix feature. When autonegotiation is disabled, you need to use the correct cable to configure speed and duplex correctly. The cable type depends on the remote system, based on which you can try straight through or cross over cable.

To disable autonegotiation on a PNIC, speed and duplex must be configured:

```
configure terminal
pnic GE0-0 speed 100 duplex full
commit
```

To enable autonegotiation on a PNIC:

```
configure terminal
pnic GE0-0 speed auto duplex auto
commit
```

To configure speed and duplex with non auto values:

```
configure terminal
pnic GE0-0 speed 100 duplex full
commit
```

Use the **show pnic GE0-0 operational-speed**, **show pnic GE0-0 operational-duplex** and **show pnic GE0-0 autoneg** to verify the configurations.

```
nfvis# show pnic GE0-0 operational-speed
operational-speed 100
```

```
nfvis# show pnic GE0-0 operational-duplex
operational-duplex full


nfvis# show pnic GE0-0 autoneg
autoneg off
```

To verify the PNIC speed and duplex configurations, use the **show notification stream nfvis Event** command.

```
notification
event Time 2019-12-16T22:52:49.238604+00:00
nfvisEvent
    user_id admin
    config_change true
    transaction_id 0
    status FAILURE
    status_code 0
    status_message Pnic GE0-1 speed did not update successfully
    details NA
    event_type PNIC_SPEED_UPDATE
    severity INFO
    host_name nfvis
    !
!
notification
event Time 2019-12-16T22:53:05.01598+00:00
nfvisEvent
    user_id admin
    config_change true
    transaction_id 0
    status SUCCESS
    status_code 0
    status_message Pnic GE0-1 duplex updated successfully:full
    details NA
    event_type PNIC_DUPLEX_UPDATE
    severity INFO
    host_name nfvis
    !
!
```

Speed, Duplex, and Autonegotiation APIs and Commands

Speed, Duplex and Autonegotiation APIs	Speed, Duplex and Autonegotiation Commands
/api/config/pnics/pnic/GE0-0/speed	pnic GE0-0 speed auto duplex auto
/api/config/pnics/pnic/GE0-0/duplex	pnic GE0-0 speed 100 duplex full show
/api/operational/pnics/pnic/GE0-0/operational-speed	show pnic GE0-0 operational-speed
/api/operational/pnics/pnic/GE0-0/operational-duplex	show pnic GE0-0 operational-duplex
/api/operational/pnics/pnic/GE0-0/autoneg	show pnic GE0-0 autoneg

Port Channels

Information About Port Channels

Port channels combine individual links into a group to create a single logical link that provides the aggregate bandwidth of up to eight physical links. Creating port channels helps to increase bandwidth and redundancy

and to load balance traffic between the member ports. If a member port within a port channel fails, the traffic from the failed port switches to the remaining member ports.

Port channels must have atleast two ports and can be configured using static mode or Link Access Control Protocol (LACP). Configuration changes that are applied to the port channel are applied to each member port of the port channel. A port channel can also be added to a bridge. When a port channel has two or more than two members and the port channel is added to a bridge, a bond is created.

A port can be a member of only one port channel and all the ports in a port channel must be compatible. Each port must use the same speed and operate in full-duplex mode.

Note

- The Physical Network Interface Controllers (PNICs) added to the port channel should be uniform. For example, all the PNICs associated with the port channel must have SRIOV VFs or they should not have SRIOV VFs.
- The Data Plane Development Kit (DPDK) can be associated only with port channels that have no SRIOV VFs attached to them. When a port channel is attached to a bridge and if the port channel has SRIOV VFs attached, the bridge gets automatically downgraded to a non-DPDK bridge.

Port Channels Bond Mode

A port channel can be configured for the following bond modes:

- **`active-backup`**: In this mode, one of the ports in the aggregated link is active and all others ports are in the standby mode.
- **`balance-slb`**: In this mode, load balancing of traffic is done based on the source MAC address and VLAN.
- **`balance-tcp`**: In this mode, 5-tuple (source and destination IP, source and destination port, protocol) is used to balance traffic across the ports in an aggregated link.

Port Channels LACP Mode

A port channel can be configured for the following LACP modes:

- **`off`**: Indicates that no mode is applicable.
- **`active`**: Indicates that the port initiates transmission of LACP packets.
- **`passive`**: Indicates that the port only responds to the LACP packets that it receives but does not initiate the LACP negotiation.

Configuring a Port Channel

Creating a Port Channel

To create a port channel:

```
configure terminal
```

```
pnic egroup type port_channel lacp_type active bond_mode balance-tcp trunks 10,20
commit
```

Note Ensure to commit the changes.

Adding a Port to a Port Channel

You can add a port to a new port channel or a port channel that already contains ports. To add a port to a port channel:

Adding GE0-0 and GE0-1 to egroup:

```
configure terminal
pnic GE0-0 member_of egroup
commit
```

Note Ensure to commit the changes.

```
configure terminal
pnic GE0-1 member_of egroup
commit
```

Note Ensure to commit the changes.

Adding a Port Channel to a Bridge

You can add a port channel to a new bridge or an existing bridge. When a port channel is added to a bridge, a bond is added for the port channel.

To add a port channel to a bridge:

```
configure terminal
bridges bridge test-br port egroup
commit
```

Note Ensure to commit the changes.

Deleting a Port Channel

Before deleting a port channel, you must remove all members assigned to the port channel. If the port channel is configured on the bridge, you must remove the port channel from the bridge.

1. Remove ports from port channel. If GE0-0 and GE0-1 are part of port channel pc, remove them from pc first.

```
configure terminal
no pnic pc GE0-0 member_of egroup
commit
```

Note Ensure to commit the changes.

```
configure terminal
no pnic GE0-1 member_of egroup
commit
```

Note Ensure to commit the changes.

2. Remove port channel from the bridge.

```
configure terminal
no bridges bridge test-br port egroup
commit
```

Note Ensure to commit the changes.

3. Delete port channel.

```
configure terminal
no pnic egroup
commit
```

Note Ensure to commit the changes.

Verifying Port Channel Configurations

To verify port channel configurations, use the **show port-channel** command.

```
nfvis# show port-channel

----bond-egroup----
bond_mode: balance-tcp
bond may use recirculation: yes, Recirc-ID : 1
bond-hash-basis: 0
updelay: 0 ms
downdelay: 0 ms
next rebalance: 6921 ms
lacp_status: negotiated >>>this should be negotiated to indicate port channel is active
lacp_fallback_ab: false
active slave mac: 38:90:a5:1b:fe:0d(GE0-1)>>should indicate active slave mac address
```

```
slave GE0-0: enabled
may_enable: true

slave GE0-1: enabled
active slave >>>active slaveport should show active
may_enable: true
```

Port Channel APIs and Commands

APIs	Commands
/api/config/pnics /api/config/pnics/pnic/<pnic_name>/member_of /api/config/pnics/pnic/<pnic_name>/bond_mode /api/config/pnics/pnic/<pnic_name>/trunks	pnic <port_channel_name> type port_channel pnic <pnic_name> member_of <portchannel_name> show port-channel

Promiscuous mode

Starting from NFVIS 4.1.1 release, NFVIS allows enabling promiscuous mode on interfaces. Enabling promiscuous mode on an interface can be used to monitor all incoming packets on the interface.

To enable promiscuous mode:

```
nfvis# config terminal
nfvis(config)# pnic GE0-0 promiscuous enabled
nfvis(config-pnic-GE0-0)# commit
```

Use the **show pnic GE0-0 operational-promiscuous** command to verify if promiscuous mode has been enabled.

Note When an interface is connected to a bridge, NFVIS enables promiscuous mode on the interface.

Dynamic SR-IOV

Dynamic Single-root input/output virtualization (SR-IOV) allows you to enable or disable SR-IOV on a Physical Network Interface Controller (PNIC). To disable SR-IOV on a PNIC, set the SR-IOV value to 0. To enable SR-IOV on a PNIC, set the SR-IOV value between 1 and the maximum number of virtual functions (maxvfs) supported on that PNIC. You can also create and delete SR-IOV networks based on the number of virtual functions (numvfs) set on that PNIC while enabling SR-IOV. The existing fresh installation behavior has not changed. Each PNIC has a number of VFs and SR-IOV networks created by default. You can use CLI, API, or the GUI to enable and disable SR-IOV on a PNIC and to create and delete SR-IOV networks.

Note The number of SR-IOV networks, numvfs or inusevfs, created per PNIC on fresh installation of NFVIS depends on the link speed of that particular pnic.

Restrictions and Limitations

- The supported platforms are CSP-2100, CSP-5228, CSP-5436, CSP-5444 (Beta), Cisco Catalyst 8200 UCPE, UCSC-C220-M5X, and UCS-E-M3.

  Dynamic SR-IOV is not supported on ENCS 5000 series.

- Dynamic SR-IOV is not supported on certain PNICs:
  - PNIC with driver i40e

Note PNIC with driver i40e is supported on default SR-IOV.

  - PNIC that does not support SR-IOV

- NFVIS release 3.12.1 supports Virtual Ethernet Bridge (VEB) in switch mode only.
- Resizing the number of virtual functions is not supported. SR-IOV should be disabled and then enabled with desired number of virtual functions.

Disable SR-IOV on a PNIC

To disable SR-IOV on a PNIC, ensure that:

- All SR-IOV networks on a PNIC are deleted.
- The PNIC is not attached to a bridge.

```
configure terminal
no pnic eth0-1 sriov
commit
```

Enable SR-IOV on a PNIC

To enable SR-IOV on a PNIC, ensure that:

- The PNIC supports SR-IOV.
- The numvfs field is populated with a value that is less than the maximum number of virtual functions (maxvfs) supported on that PNIC.
- The PNIC is not attached to a bridge.

```
configure terminal
pnic eth0-1 sriov numvfs 20
commit
```

To display the SR-IOV status of all PNICs, use the **show pnic sriov** command. To display the SR-IOV state of an individual PNIC use the **show pnic eth0-1 sriov** command.

Create SR-IOV Networks

To create SR-IOV networks, the PNIC must have SR-IOV enabled and configured with numvfs. The SR-IOV network name must have the following format: <pnic_name>-SRIOV-<num> where <pnic_name> is a valid PNIC name and <num> is a value that is greater than 0 and less than the number of VFs (numvfs).

To create an SR-IOV network in trunk mode:

```
configure terminal
networks network eth0-1-SRIOV-1 sriov true
commit
```

To create an SR-IOV network in access mode:

```
configure terminal
networks network eth0-1-SRIOV-1 sriov true trunk false vlan 30
commit
```

Delete SR-IOV Networks

To delete an SR-IOV network, ensure that no VMs are attached to the network.

```
configure terminal
no networks network eth0-1-SRIOV-1
commit
```

To verify the system networks, use the **show system networks** command.

System Routes

You can configure static system routes along with the default routes in the system. Static routes are used for traffic that should not go through the default gateway. When certain destinations are not reachable through the default routes, this configuration is effective. Also the configured static routes updates the system routing table.

You can create a route by providing the destination and prefix length, but a valid route requires a specified device, a gateway or both. The gateway input represents the address of the nexthop router in the address family. The dev input is the name of the outbound interface for the static route.

Configuring System Routes

The following example shows how to configure additional static routes:

```
configure terminal
system routes route 172.25.222.024 gateway 172.25.221.1
system routes route 172.25.223.024 dev wan-br
commit
```

To verify the system routes configuration, use the **show system routes** command.

```
nfvis# show system routes

DESTINATION    PREFIXLEN       STATUS
---------------------------------------
172.25.222.0      24           Success
172.25.223.0      24           Success
```

System Routes APIs and Commands

System Routes APIs	System Routes Commands
/api/config/system/routes /api/config/system/routes/route/<host destination,netmask>	system routes route show system routes

Troubleshooting

To troubleshoot errors in configured routes, use the **show system routes** command to identify the failed route. The following example shows common failures with system routes:

```
nfvis# show system routes

DESTINATION      PREFIXLEN       STATUS
-----------------------------------------
172.25.222.0        24          Failure(1)
172.25.223.1        24          Failure(2)
```

You can find the cause for each error in the *nfvos-confd* log.

```
Failure 1) result=RTNETLINK answers: Network is unreachable
```

The example above indicates that the failure is caused because the network is unreachable. To resolve this issue you can either reconfigure the route with a reachable gateway or identify network connectivity issue.

```
Failure 2)result=RTNETLINK answers: Invalid argument
```

This failure is caused due to a mismatch between the subnet address and the prefix length. To resolve this issue you can reconfigure the route with the correct subnet address (in this case 172.25.223.0 for prefix length of 24).

Cisco Network Plug-n-Play Support

Note Starting from 3.10.1 release, NFVIS is integrated with PnP 1.8.

The Cisco Network Plug and Play (Cisco Network PnP) solution provides a simple, secure, unified, and integrated offering for enterprise network customers to ease new branch or campus device rollouts, or for provisioning updates to an existing network. The solution provides a unified approach to provision enterprise networks comprising Cisco routers, switches, and wireless devices with a near zero touch deployment experience. This solution uses Cisco Application Policy Infrastructure Controller Enterprise Module (APIC-EM) to centrally manage remote device deployments.

Currently, you can use the Cisco Network Plug and Play client to:

- Auto discover the server
- Provide device information to the server
- Bulk provisioning of user credentials

Note NFVIS SD-Branch Zero Touch Provisioning (ZTP) PnP redirect fails if the WAN DHCP IP address is in the same subnet as management IP address 192.168.1.0/24. For a successful PnP redirect, you can change the DHCP pool to a different subnet or manually change the management IP address to a different subnet.

Bulk Provisioning of User Credentials

You can change the default user name and password of the devices using the Cisco Network PnP client. The Cisco Network PnP server sends the configuration file to Cisco Network PnP clients residing on multiple devices in the network, and the new configuration is automatically applied to all the devices.

Note For bulk provisioning of user credentials, ensure that you have the necessary configuration file uploaded to the Cisco APIC-EM. The following are the supported configuration formats:

Sample Format 1

```
<config xmlns="http://tail-f.com/ns/config/1.0">
  <rbac xmlns="http://www.cisco.com/nfv/rbac">
    <authentication>
      <users>
        <user>
          <name>admin</name>
          <password>Cisco123#</password>
          <role>administrators</role>
        </user>
        <user>
          <name>test1</name>
          <password>Test1239#</password>
          <role>administrators</role>
        </user>
        <user>
          <name>test2</name>
          <password>Test2985#</password>
          <role>operators</role>
        </user>
      </users>
    </authentication>
  </rbac>
</config>
```

Sample Format 2

If you use format 2, the system will internally convert this format into format 1.

```
<aaa xmlns="http://tail-f.com/ns/aaa/1.1">
    <authentication>
      <users>
        <user>
          <name>admin</name>
          <password>User123#</password>
         </user>
      </users>
    </authentication>
```

```
</aaa>
```

PnP Discovery Methods

When a device is powered on for the first time, the Cisco Network PnP agent discovery process, which is embedded in the device, starts in the absence of the startup configuration file, and discovers the IP address of the Cisco Network PnP server located in the Cisco APIC-EM. The Cisco Network PnP agent uses the following discovery methods:

- Static IP address—The IP address of the Cisco Network PnP server is specified using the **set pnp static ip-address** command.
- DHCP with option 43—The Cisco PnP agent automatically discovers the IP address of the Cisco Network PnP server specified in the DHCP option 43 string. For more details on how to configure DHCP for PnP server auto-discovery, see the Solution Guide for Cisco Network Plug and Play
- Domain Name System (DNS) lookup—If DHCP discovery fails to get the IP address of the PnP server, for example, because option 43 is not configured, the Cisco Plug and Play Agent falls back on a DNS lookup method. Based on the network domain name returned by the DHCP server, it constructs a fully qualified domain name (FQDN) for the PnP server, using the preset hostname "pnpserver". For more details on how to configure DNS for PnP server auto-discovery, see the Solution Guide for Cisco Network Plug and Play.

Note DNS FQDN Only lookup method is supported since 3.10.1 release.

- Cloud Redirection—This method uses the Cisco Cloud Device Redirect tool available in the Cisco Software Central.The Cisco Plug and Play Agent falls back on the Cloud Redirection method if DNS lookup is not successful.

Configuring PnP Discovery Methods

To enable static mode for PnP discovery using IPv4:

```
configure terminal
pnp automatic dhcp disable dhcp-ipv6 disable dns disable dns-ipv6 disable cco disable
cco-ipv6 disable
pnp static ip-address 192.0.2.8 port 80 transport http
commit
pnp action command restart
```

To enable static mode for PnP discovery using IPv6:

```
configure terminal
pnp automatic dhcp disable dhcp-ipv6 disable dns disable dns-ipv6 disable cco disable
cco-ipv6 disable
pnp static ipv6-address 0:0:0:0:0:ffff:c000:208 port 80 transport http
commit
pnp action command restart
```

Note Either IPv4 or IPv6 can be enabled at a time.

To enable static mode for PnP discovery using FQDN:

```
configure terminal
pnp static ip-address apic-em-fqdn.cisco.com port 80 transport http
commit
```

Note In FQDN support for PnP, domain names can be specified as an input. FQDN that is configured with IPv6 on a DNS server is not supported.

To enable automatic mode for PnP discovery using IPv4:

```
configure terminal
pnp automatic dhcp enable
pnp automatic dns enable
pnp automatic cco enable
pnp automatic timeout 100
commit
```

Note By default, the automatic discovery mode for DHCP, DNS, and CCO is enabled. You can enable or disable the options as required. For example, you can enable all options or keep one enabled, and the rest disabled.

To enable automatic mode for PnP discovery using IPv6:

```
configure terminal
pnp automatic dhcp-ipv6 enable
pnp automatic dns-ipv6 enable
pnp automatic cco-ipv6 enable
pnp automatic timeout 30
commit
```

Note You cannot disable both static and automatic PnP discovery modes at the same time. You must restart PnP action every time you make changes to the PnP discovery configuration. You can do this using the **pnp action command restart**.

Verifying the PnP Status

Use the **show pnp** command in privileged EXEC mode to verify the configuration of PnP discovery methods. The following sample output shows that the static discovery mode is enabled, and the automatic discovery mode is disabled.

```
nfvis# show pnp
pnp status response "PnP Agent is running\n"
```

```
pnp status ip-address 192.0.2.8
pnp status ipv6-address ""
pnp status port 80
pnp status transport http
pnp status cafile ""
pnp status created_by user
pnp status dhcp_opt43 0
pnp status dns_discovery 0
pnp status cco_discovery 0
pnp status dhcp-ipv6 0
pnp status dns-ipv6 0
pnp status cco-ipv6 0
pnp status timeout 100
nfvis#
```

FQDN

```
nfvis# show pnp
pnp status response "PnP Agent is running\nserver-connection\n    status: Success\n    time:
 06:23:11 Jun 17\ndevice-info\n    status: Success\n    time: 06:23:06 Jun 17\nbackoff\n
  status: Success\n    time: 06:23:11 Jun 17\ncertificate-install\n    status: Success\n
  time: 06:21:38 Jun 17\ncli-exec\n    status: Success\n    time: 06:22:50 Jun 17\ntopology\n
    status: Success\n    time: 06:23:00 Jun 17\n"
pnp status ip-address apic-em-fqdn.cisco.com
pnp status ipv6-address ""
pnp status port 443
pnp status transport https
pnp status cafile /etc/pnp/certs/trustpoint/pnplabel
pnp status created_by user
pnp status dhcp_opt43 0
pnp status dns_discovery 0
pnp status cco_discovery 0
pnp status dhcp-ipv6 0
pnp status dns-ipv6 0
pnp status cco-ipv6 0
pnp status timeout 0
nfvis#
```

The following sample output shows that the static discovery mode is disabled, and the automatic discovery mode is enabled for DHCP, DNS, and CCO:

DHCP:

```
nfvis# show pnp
pnp status response "PnP Agent is running\nserver-connection\n    status: Success\n    time:
 05:05:59 Jun 17\ninterface-info\n    status: Success\n    time: 05:05:56 Jun
17\ndevice-info\n    status: Success\n    time: 05:05:38 Jun 17\nbackoff\n    status:
Success\n    time: 05:05:59 Jun 17\ncapability\n    status: Success\n    time: 05:05:44 Jun
 17\ncertificate-install\n    status: Success\n    time: 05:01:19 Jun 17\ncli-exec\n
status: Success\n    time: 04:58:29 Jun 17\ntopology\n    status: Success\n    time: 05:05:49
 Jun 17\n"
pnp status ip-address 192.0.2.8
pnp status ipv6-address ""
pnp status port 443
pnp status transport https
pnp status cafile /etc/pnp/certs/trustpoint/pnplabel
pnp status created_by dhcp_discovery
pnp status dhcp_opt43 1
pnp status dns_discovery 1
pnp status cco_discovery 1
pnp status dhcp-ipv6 1
pnp status dns-ipv6 1
pnp status cco-ipv6 1
pnp status timeout 60
```

DNS:

```
nfvis# show pnp
pnp status response "PnP Agent is running\nserver-connection\n    status: Success\n    time:
 05:13:55 Jun 17\ndevice-info\n    status: Success\n    time: 05:13:49 Jun 17\nbackoff\n
  status: Success\n    time: 05:13:55 Jun 17\ncertificate-install\n    status: Success\n
  time: 05:12:26 Jun 17\ncli-exec\n    status: Success\n    time: 05:13:34 Jun 17\ntopology\n
    status: Success\n    time: 05:13:45 Jun 17\n"
pnp status ip-address pnpserver.apic-em-fqdn.cisco.com
pnp status ipv6-address ""
pnp status port 443
pnp status transport https
pnp status cafile /etc/pnp/certs/trustpoint/pnplabel
pnp status created_by dns_discovery
pnp status dhcp_opt43 1
pnp status dns_discovery 1
pnp status cco_discovery 1
pnp status dhcp-ipv6 1
pnp status dns-ipv6 1
pnp status cco-ipv6 1
pnp status timeout 60
```

CCO:

```
nfvis# show pnp
pnp status response "PnP Agent is running\nserver-connection\n    status: Success\n    time:
 05:24:25 Jun 17\ninterface-info\n    status: Success\n    time: 05:23:13 Jun
17\ndevice-info\n    status: Success\n    time: 05:23:01 Jun 17\nbackoff\n    status:
Success\n    time: 05:24:25 Jun 17\ncapability\n    status: Success\n    time: 05:23:06 Jun
 17\nredirection\n    status: Success\n    time: 05:09:43 Jun 17\ncli-exec\n    status:
Success\n    time: 05:09:53 Jun 17\ncertificate-install\n    status: Success\n    time:
05:18:43 Jun 17\ntopology\n    status: Success\n    time: 05:23:10 Jun 17\n"
pnp status ip-address 192.0.2.8
pnp status ipv6-address ""
pnp status port 443
pnp status transport https
pnp status cafile /etc/pnp/certs/trustpoint/pnplabel
pnp status created_by cco_discovery
pnp status dhcp_opt43 1
pnp status dns_discovery 1
pnp status cco_discovery 1
pnp status dhcp-ipv6 1
pnp status dns-ipv6 1
pnp status cco-ipv6 1
pnp status timeout 60
```

PnP Server APIs and Commands

PnP Server APIs	PnP Server Commands
• /api/config/pnp • /api/config/pnp?deep	• pnp static ip-address • pnp automatic • show pnp

Certificate for Static PnP discovery

Table 8: Feature History

Feature Name	Release Information	Description
Command for PnP certificates	NFVIS 4.2.1	A certificate can be used as a PnP root certificate through Command Line Interface (CLI).

Starting from NFVIS 4.2.1 release, a certificate can be used as a PnP root certificate through Command Line Interface (CLI). The following command is used to upload a certificate:

```
system certificate input filepath <filepath> pem-data <certificate contents>
```

- The file containing the certificate information is created inside /data/intdatastore/uploads directory.
- The certificate should be in PEM encoding. Any invalid content or format is rejected with an error message.
- Multiple certificates can also be added to form a certificate chain and they should be separated by a new line.
- The certificate content must have:
  - Maximum size of base64 content in each certificate limited to 6144 bytes,
  - Maximum number of certificates allowed in a certificate chain input as 10.
- For both single certificate and a chain of certificates, the input should end with a new line.
- If a file with the same name as the certificate file name already exists inside /data/intdatastore/uploads directory, the user gets an appropriate error message.

The following are examples to show how to upload certificates:

```
nfvis# system certificate input filepath intdatastore:uploads/apic_em_oneline_02.pem pem-data
 "-----BEGIN
[redacted]
 CERTIFICATE-----\n-----BEGIN
[redacted]
 CERTIFICATE-----\n"
nfvis#


nfvis# system certificate input filepath
Value for 'filepath' (<string>): intdatastore:uploads/test_cert.pem
Value for 'pem-data' (<string>):
[Multiline mode, exit with ctrl-D.]
> -----BEGIN CERTIFICATE-----
> MIIDvzCCAqegAwIBAgIUKBZWJ4U2c1gBYJFBFWNlNQSVd2MwDQYJKoZIhvcNAQEL
> BQAwgYgxLTArBgNVBAMTJDEyYjQ0ZDhmLWRhZWItNGIxNi1iYWZhLWRiYTQxZGRk
> MWY3MzELMAkGA1UEBhMCVVMxEzARBgNVBAgTCkNhbGlmb3JuaWExEDAOBgNVBAcT
> B1Nhbkpvc2UxEzARBgNVBAsTCkFQSUNFTS1TRE4xDjAMBgNVBAoTBUNpc2NvMB4X
> DTE4MDcyMTIwNDMyN1oXDTIzMDcyMDIwNDMyN1owXjEVMBMGA1UEAxMMMTcyLjI1
> LjIxNy44MRMwEQYDVQQIEwpDYWxpZm9ybmlhMQswCQYDVQQGEwJVUzEOMAwGA1UE
> ChMFQ2lzY28xEzARBgNVBAsTCkFQSUNFTS1TRE4wggEiMA0GCSqGSIb3DQEBAQUA
> A4IBDwAwggEKAoIBAQDD616jSBX+DfxI5kGT3JCmcIgOHYDDhJJd1L8qhxDAOM7P
> qLjLEdUCOTap8Lu/dKpVClN+hE0LNr9HyQSZ7Mn8+UrM7wQqTKEA6p3dw323wWbp
```

```
> ia/XSgByznj4JEY3xW8/trKGkoxfZ7D2JA/cLTf7hK3v44Nev4ONdKtnwNXV32ms
> E7Mpx/Wb/110hYn37DJ9sN5+o34F1KkF1quaXPOgmQA8PMH2Y1LMOh/Z3g3afali
> uOsbPpeGxawEWgfc5pK5EJbziWy1JUSh/c2DaqrfvnKnlprM/HfjZLgzit9FnLyL
> 0lxW54U77AMDRcNALtSq0G3YDX12pdb+ateFWznFAgMBAAGjSjBIMAkGA1UdEwQC
> MAAwCwYDVR0PBAQDAgWgMB0GA1UdJQQWMBQGCCsGAQUFBwMBBggrBgEFBQcDAjAP
> BgNVHREECDAGhwSsGdkIMA0GCSqGSIb3DQEBCwUAA4IBAQAiD3XiYgUTFK0MuxuB
> DYanVIuAPBImqULdidh3uDlnoTUlzDFU+feYug+XHjAPk7rczZ1Yoc5Hvo90/gQU
> WQUd9TftJygftRn4vG4MMb4fjDPqoh7rxj0P51NRJIA64ro6/gvbQn+T70a62/Wt
> sDGIdXhp8MUTzA/R99vxYUS9YfTMFVAEv5KAW9ZRwC+CTPT+YeN0B+iNO3cXmZ3A
> C0YDXgN27yfF/+1Lna1aOMCTXdTFzNCplOIhhWKulM74Re9QN0Lwvkt9PDim3rX+
> GaDvd4nINMcIXRXy40ieQOOv0W9xnYnvgFD3xjhKQhzDEXX1BStXVJwaqAwWlDlY
> 8EdE
> -----END CERTIFICATE-----
> -----BEGIN CERTIFICATE-----
> MIIDrzCCApegAwIBAgIGCMgojJNOMA0GCSqGSIb3DQEBCwUAMIGIMS0wKwYDVQQD
> EyQxMmI0NGQ4Zi1kYWViLTRiMTYtYmFmYS1kYmE0MWRkZDFmNzMxCzAJBgNVBAYT
> AlVTMRMwEQYDVQQIEwpDYWxpZm9ybmlhMRAwDgYDVQQHEwdTYW5Kb3NlMRMwEQYD
> VQQLEwpBUElDRU0tU0ROMQ4wDAYDVQQKEwVDaXNjbzAeFw0xODA3MjEyMDQzMjVa
> Fw00ODA3MTMyMDQzMjVaMIGIMS0wKwYDVQQDEyQxMmI0NGQ4Zi1kYWViLTRiMTYt
> YmFmYS1kYmE0MWRkZDFmNzMxCzAJBgNVBAYTAlVTMRMwEQYDVQQIEwpDYWxpZm9y
> bmlhMRAwDgYDVQQHEwdTYW5Kb3NlMRMwEQYDVQQLEwpBUElDRU0tU0ROMQ4wDAYD
> VQQKEwVDaXNjbzCCASIwDQYJKoZIhvcNAQEBBQADggEPADCCAQoCggEBALd/HK9i
> 6H45KJ42G3awGiehp5ZJWeUNqbmnkD0eiR6PNJIVNGBGMV3k+SW0kIfTjxIDkqSc
> K+K5tfEtTRc0R+WmgtdT+asDhPOmfmL73POqIXLr2RE98J0FLkcdhpRU2K1/tDu3
> 4+7WBA1OT/uIb9LVkVrk1pwolVKAWfgwBgCfmLmebtNfvexI3hvk2awcl4fmVb+d
> CMGVXHBw+yQW2AE3RH66VebS/E6bc3ifAvXHlWYWMt/tPRQRftH+0ZrgXt/dar5o
> 24Qq8taPwY1UIse41Nnnp1Q+FuoE9elLVmLidVaJ7qraDw5Yi6ZSQNGud813lU8s
> 6RtbNS48SSB3U0MCAwEAAaMdMBswDAYDVR0TBAUwAwEB/zALBgNVHQ8EBAMCAQYw
> DQYJKoZIhvcNAQELBQADggEBAHUddWTSeJR7QLxud9aaoIYzbL8lwJx7Ot49K5So
> RrymEKbrUSGtZaBp+hdam3l2ByDS44OmwDolelMsdIN61hV5o8DgpaJLwMhoY8gS
> HXyUTdpiLQD6RoxNWim6wGJGDTiMZFYaiaz5oFeazzOG7D8qu9agQ+/7Ky0RVkUK
> 6IoZZPSQ4BgBnsKg3OdBSPUWSIB7+rMz6ww5ELNOBIDo+yo0wCNgvmy19QgabM0/
> 5SJc2pMyidQy2yj3h1+DpMlZ6nWPqF+9IZlzoErKYABySH/Stho4l2kMXY5libCi
> AEqsyhYpxeO9S466uzcujQwJFARog2GGO0vJEDICqKm+lDI=
> -----END CERTIFICATE-----
>
nfvis#


nfvis#
nfvis# system certificate input filepath intdatastore:uploads/pnp_cert7.pem
Value for 'pem-data' (<string>):
[Multiline mode, exit with ctrl-D.]
> -----BEGIN CERTIFICATE-----
> MIICLDCCAdKgAwIBAgIBADAKBggqhkjOPQQDAjB9MQswCQYDVQQGEwJCRTEPMA0G
> A1UEChMGR251VExTMSUwIwYDVQQLExxHbnVUTFMgY2VydGlmaWNhdGUgYXV0aG9y
> aXR5MQ8wDQYDVQQIEwZMZXV2ZW4xJTAjBgNVBAMTHEdudVRMUyBjZXJ0aWZpY2F0
> ZSBhdXRob3JpdHkwHhcNMTEwNTIzMjAzODIxWhcNMTIxMjIyMDc0MTUxWjB9MQsw
> CQYDVQQGEwJCRTEPMA0GA1UEChMGR251VExTMSUwIwYDVQQLExxHbnVUTFMgY2Vy
> dGlmaWNhdGUgYXV0aG9yaXR5MQ8wDQYDVQQIEwZMZXV2ZW4xJTAjBgNVBAMTHEdu
> dVRMUyBjZXJ0aWZpY2F0ZSBhdXRob3JpdHkwWTATBgcqhkjOPQIBBggqhkjOPQMB
> BwNCAARS2I0jiuNn14Y2sSALCX3IybqiIJUvxUpj+oNfzngvj/Niyv2394BWnW4X
> uQ4RTEiywK87WRcWMGgJB5kX/t2no0MwQTAPBgNVHRMBAf8EBTADAQH/MA8GA1Ud
> DwEB/wQFAwMHBgAwHQYDVR0OBBYEFPC0gf6YEr+1KLlkQAPLzB9mTigDMAoGCCqG
> SM49BAMCA0gAMEUCIDGuwD1KPyG+hRf88MeyMQcqOFZD0TbVleF+UsAGQ4enAiEA
> l4wOuDwKQa+upc8GftXE2C//4mKANBC6It01gUaTIpo=
> -----END CERTIFICATE-----
>
nfvis# config
Entering configuration mode terminal
nfvis(config)# pnp automatic cco disable
nfvis(config)# pnp automatic cco-ipv6 disable
nfvis(config)# pnp automatic dns disable
nfvis(config)# pnp automatic dns-ipv6 disable
nfvis(config)# pnp automatic dhcp disable
```

```
nfvis(config)# pnp automatic dhcp-ipv6 disable
nfvis(config)# commit
Commit complete.
nfvis(config)# pnp static ip-address 10.0.0.7 port 443 transport https cafile
/data/intdatastore/uploads/pnp_cert7.pem
nfvis(config)# commit
Commit complete.
nfvis(config)# end
nfvis# exit
```

PnP Action

You can start, stop, and restart any PnP action using the PnP action command or API.

PnP Action API and Command

PnP Action API	PnP Action Command
• /api/operations/pnp/action	• pnp action command

DPDK Support on NFVIS

Data Plane Development Kit (DPDK) support on NFVIS increases network throughput. DPDK allows applications to pull data directly from the Network Interface Card (NIC) without involving the kernel, therefore delivering high-performance user-space network I/O. DPDK support on NFVIS allows network traffic to bypass NFVIS kernel and directly reach deployed VNFs and service chains. For DPDK adoption NFVIS reserves additional cores and memory to enhance system performance.

DPDK support on NFVIS was first introduced in NFVIS 3.10.1 release and enhancements were added in subsequent releases:

- NFVIS 3.10.1 – DPDK support only for service bridges. DPDK support can be enabled only when the device is in the factory default state. DPDK support is supported only on ENCS 5400 series devices.
- NFVIS 3.11.1 – DPDK support can be enabled at any time. All Virtual NICs connected to service bridges for all VNFs are upgraded to DPDK support. DPDK support is supported only on ENCS 5400 series devices.
- NFVIS 3.12.1 – DPDK support is extended to all supported platforms. Physical NICs can also use DPDK.

DPDK support on NFVIS includes:

- Upgrading existing bridges to enable DPDK
- Upgrading virtual NICs attached to VNFs to enable DPDK
- Upgrading physical NICs to enable DPDK

Note NICs and WAN side are not upgraded as they are configured with SR-IOV.

Once DPDK support is successfully enabled, you can disable DPDK only by resetting NFVIS to factory settings.

Restrictions

- You must enable DPDK using the **system settings dpdk enable** command before you commit any other configurations.
- Starting from Cisco NFVIS Release 4.12.1, you can employ DPDK with port-channels.
- DPDK does not support wan-br and wan2-br on ENCS 5400 devices.
- SR-IOV interfaces and DPDK support:

  To enable DPDK, every device driver must be supported by DPDK. NFVIS does not support SR-IOV interface upgrade to enable DPDK because SR-IOV device drivers are not supported by DPDK. If any SR-IOV network has been configured on an interface, that interface will not support DPDK. Also if an SR-IOV interface is attached to a bridge, the bridge does not support DPDK and if a bridge supports DPDK, no SR-IOV interface can be attached to it.

Note This restriction does not apply to ENCS 5000 series devices.

- VNF downtime:

  When DPDK support is enabled on a system, NFVIS upgrades virtual NICs attached to the VNFs. The VNFs are powered down causing a downtime for the VNF service for a short duration of time. After the upgrade is complete, all VNFs are powered up again.

System Requirements

DPDK support optimizes the performance by utilizing additional resources such as CPU and memory. If NFVIS is not able to acquire additional processing or memory, DPDK support can not be enabled.

Enabling DPDK support requires an additional core from each socket available in the system. Depending upon the number of sockets present in the system, NFVIS acquires an additional core for DPDK support.

Configuring DPDK Support on NFVIS

Configuring DPDK support takes up to a minute and network changes can be observed during the process. NFVIS provides an operational status for DPDK support which indicates if DPDK support is enabled or not. The different values for operational status are listed in the table below.

DPDK Status	Description
disabled	The system is not using DPDK.
enabled	DPDK support is successfully enabled on the system. Additional CPU and memory resources are reserved for DPDK.
enabling	The system is in the process of enabling DPDK.

DPDK Status	Description
error	The system is unable to acquire the required resources to support DPDK. All of the resources that were acquired by DPDK are released again.

If DPDK status is in error state, DPDK support can be manually disabled. Before enabling DPDK again, reboot the system to defragment the system memory and increase the chance of resource allocation for a successful configuration.

After enabling DPDK, physical NICs configured with SR-IOV will not be able to interact with DPDK bridges. To add a physical NIC to a DPDK bridge, all SR-IOV networks created on the interface should be removed first. NFVIS will not allow adding an SR-IOV configured interface to a DPDK bridge. For more information, see Dynamic SR-IOV, on page 43.

To enable DPDK support:

```
config terminal
system setting dpdk enable
commit
```

To display the operational status that indicates DPDK support, use **show system native settings** command.

```
nfvis# show system settings-native dpdk-status
system settings-native dpdk-status enabled
```

If NFVIS is unable to acquire sufficient resources, it shows an error state, and DPDK configuration can be removed. After removing the configuration, DPDK can be enabled again.

```
nfvis# show system settings-native dpdk-status
system settings-native dpdk-status error

config terminal
no system settings dpdk
commit

nfvis# show system setting-native dpdk-status
system settings-native dpdk-status disabled
```

Storage Access

Network File System Support

Network File System (NFS) is an application where you can view, store, and update the files on a remote device. NFS allows you to mount all or a part of a file system on a server. NFS uses Remote Procedure Calls (RPC) to route requests between the users and servers.

Mount and Unmount NFS

The following example shows how to mount NFS:

```
configure terminal
```

```
system storage nfs_storage
nfs
100
10.29.173.131
/export/vm/amol
commit
```

To unmount NFS use the **no system storage nfs_storage** command.

Image Registration on NFS

Images in tar.gz, ISO and qcow2 formats, remote images and images on mounted NFS can be registered on NFS.

To register tar.gz images on NFS:

```
configure terminal
vm_lifecycle images image myas10 src file:///data/mount/nfs_storage/repository/asav961.tar.gz
properties property placement value nfs_storage
commit
```

Similar configuration can be used for the various images formats.

To unregister an image from NFS use **no vm_lifecycle images** command.

Deploy VM on NFS

To deploy a VM on NFS, under deployment vm group, use the **placement type zone_host host nfs_storage** command.

Host System Operations

This section describes operations that can be performed on the NFVIS host.

Power Cycle System

To power cycle NFVIS, use the following command:

```
nfvis# hostaction powercycle
```

A notification and syslog are sent to indicate that a power cycle was performed.

Reboot System

To reboot NFVIS, use the following command:

```
nfvis# hostaction reboot
```

A notification and syslog are sent to indicate the system reboot.

Shut down System

To shut down NFVIS, use the following command:

```
nfvis# hostaction shutdown
```

A notification and syslog will be sent to indicate that the system was shutdown.

System file-list

To view a list of files on the system, use the **show system file-list** command.

```
nfvis# show system file-list [disk [local | nfs | usb] ]
```

Disk Type	Files
local	Files present in the internal datastore and external datastores
nfs	Files on NFS
usb	Files on the mounted USB drive

System file-copy

To copy a file from the USB drive to the /data/intdatastore/uploads directory, use the **system file-copy** command. To copy a VM image from the USB drive:

```
configure terminal
system usb-mount mount active
system file-copy usb file name usb1/package/isrv-universalk9.16.03.01.tar.gz
commit
```

The **system file-copy** command can also be used to copy a file from the given source path to the given destination path. The allowed directories for source path and destination path are:

- /data/intdatastore
- /mnt/extdatastore1
- /mnt/extdatastore2
- /data/mount

```
nfvis# system file-copy source <path-to-source-file> destination <path-to-destination-file>
```

System file-delete

The **system file-delete** command is used to delete a file from one of these directories: /data/intdatastore, /mnt/extdatastore1, /mnt/extdatastore2, /mnt-usb/ or /data/mount

```
nfvis# system file-delete file name
/data/intdatastore/uploads/isrv-universalk9.16.03.01.tar.gz
```

Secure Copy

The secure copy (**scp**) command allows only the admin user to securely copy files from NFVIS to an external system, or from an external system to NFVIS. For example, this command can be used to copy an upgrade package to NFVIS.

The syntax for this command is:

scp *<source> <destination>*

Note For detailed information about how to use the **scp** command to copy to or from supported locations, see the **scp** section in Cisco Enterprise Network Function Virtualization Infrastructure Software Command Reference.

SCP between two NFVIS devices is not supported.

Examples

The following example copies the sample.txt file from intdatastore to an external system.

```
nfvis# scp intdatastore:sample.txt user@203.0.113.2:/Users/user/Desktop/sample.txt
```

The following example copies the test.txt file from an external system to intdatastore.

```
nfvis# scp user@203.0.113.2:/Users/user/Desktop/test.txt intdatastore:test_file.txt
```

The following example copies the test.txt file from an external system to USB.

```
nfvis# scp user@203.0.113.2:/user/Desktop/my_test.txt usb:usb1/test.txt
```

The following example copies the sample.txt file to an NFS location.

```
nfvis# scp user@203.0.113.2:/user/Desktop/sample.txt nfs:nfs_test/sample.txt
```

The following example copies the sample.txt file from an external system with IPv6 address.

```
nfvis# scp user@[2001:DB8:0:ABCD::1]:/user/Desktop/sample.txt intdatastore:sample.txt
```

The following example copies the nfvis_scp.log file to an external system.

```
nfvis# scp logs:nfvis_scp.log user@203.0.113.2:/Users/user/Desktop/copied_nfvis_scp.log
```

The following example shows how to secure copy from techsupport as source:

```
nfvis# scp logs:nfvis_techsupport.tar.gz
user@203.0.113.2:/Users/user/Desktop/copied_techsupport.tar.gz
```

Change BIOS Password

This command is applicable only to the ENCS platform. It allows the user to change the BIOS password. A notification and syslog are sent regarding the password change.

To change the BIOS password:

```
nfvis# hostaction change-bios-password <new-password>
```

There is a strong password check enforced for the new BIOS password. The new password should contain:

- At least one lowercase character
- At least one uppercase character
- At least one number
- At least one special character from #, @ or _
- Password length should be between 7 and 20 characters

- The first character cannot be a #

Change CIMC Password

This command is applicable only to the ENCS platform. It allows the user to change the CIMC password. A notification and syslog are sent regarding the password change.

To change CIMC password:

```
nfvis# hostaction change-cimc-password <new-password>
```

There is a strong password check enforced for the new CIMC password. The new password should contain:

- At least one lowercase character
- At least one uppercase character
- At least one number
- At least one special character from #, @ or _
- Password length should be between 8 and 20 characters

Backup and Restore NFVIS and VM Configurations

Table 9: Feature History

Feature Name	Release Information	Description
Enhancements to backup and restore of configurations	NFVIS 4.2.1	New commands are introduced to view the overall status of backup and restore process. Enhancements to backup file location and factory default options are introduced. Information on how to troubleshoot failure to restore NFVIS configurations is added.

Starting from NFVIS 3.10.1 release, you can backup and restore NFVIS configurations and VMs. You can also restore a backup from one NFVIS device to another if they are running on the same version of NFVIS and have the same platform.

Note

- To backup and restore a single VM, use vmExportAction (for VM backup) and vmImportAction (for VM restore) APIs.
- Perform the following hostaction backup that avoids loss of VMs during hostaction restore due to insufficient disk space:
  1. Stop the functioning of the VMs that are associated with Cisco NFVIS.
  2. Perform individual image backups of the VMs using the **vmExportAction** command.
  3. Once the backup is successful, delete the VMs and the images from Cisco NFVIS.
  4. When you delete the VMs and the images, perform a host level backup with configurations-only option using the command **hostaction backup configuration-only file-path** *extdatastore2:sample-dir/sample*.
  5. Copy the backup files to a file server.
  6. Perform a factory reset using the **factory-default-reset** command.
  7. Paste the backup copied to a file server and restore the host level backup file using the **hostaction restore** *file-path extdatastore2:sample-dir/sample.bkup* command.
  8. When the restore fails due to disk storage issues, restore the configurations-only backup. When the restore is successful, restore the VMs and their images using the **vmImportAction** *importPath /mnt/extdatastore1/tiny_backup.vmbkp* command.

Restrictions for Backup and Restore on NFVIS

- The backup includes all deployed VMs and the registered images except uploaded files.
- VM restore using hostaction restore and vmImportAction requires original registered image to be on the system, on the same datastore. Missing registered image or image registered in a different datastore results in VM restore failure.

  For NFVIS 4.2 release, onlyVM restore using hostaction restore does not require original registered images on the system.
- For NFVIS 4.1 and earlier releases, NFVIS VM backup does not support differential disk backup and every backup is a full VM backup.
- For NFVIS 4.1 and earlier releases, in case of multiple deployments based on a single registered image, every VM backup includes the registered image disk.
- The time taken to backup a VM depends on the option you choose:
  - *configuration-only* - within 1 min.
  - *configuration-and-vms* - depends on the number of VM deployments on your system, system disk write speed, and compress the VM disks into one bundle.
- You can either backup all the VMs or none.

- The final backup is a compressed file which requires temporary disk space to create the VM backup file. If the system has only one datastore, the maximum deployment backups in a single file is around one-third to half of the datastore disk space. If the deployments occupies more disk space, use *vmExportAction* to backup an individual VM instead of relying on host backup for all VM deployments.
- NFVIS only supports backup or restore on the same release. For example, backup created in NFVIS 4.1.1 cannot be used to restore on NFVIS 4.2.1.
- Starting from NFVIS 4.5 release, secure-overlay configuration with EAP authentication is supported. However, it will be discarded if restored on a different box or on the same box after fresh-install because of encrypted password.
- Starting from NFVIS 4.5 release, single ip configuration is supported. However, it will be discarded if restored on a different box because the single ip bootstrap is tailored towards a particular box.

Feature Comparison Table for Backup and Restore

Backup using hostaction backup:

Feature	NFVIS 4.1.1 and Earlier Releases	NFVIS 4.2.1 Release
Default file location for backup	/data/intdatastore/uploads/backup.bkup /mnt/extdatastore1/uploads/backup.bkup /mnt/extdatastore2/uploads/backup.bkup	/data/intdatastore/backup.bkup /mnt/extdatastore1/backup.bkup /mnt/extdatastore2/backup.bkup
VM backup format	Full backup	Diff disk backup
Registered Image and Flavors	No	Yes
Status monitoring	No	Yes
Check disk space before backup	No	Yes

Restore using hostaction restore:

Feature	NFVIS 4.1.1 and Earlier Releases	NFVIS 4.2.1 Release
Default file location for backup	/data/intdatastore/uploads/backup.bkup /mnt/extdatastore1/uploads/backup.bkup /mnt/extdatastore2/uploads/backup.bkup	/data/intdatastore/backup.bkup /mnt/extdatastore1/backup.bkup /mnt/extdatastore2/backup.bkup
Restore images and flavors	No	Yes
Unique Mac Uid for VM	No for NFVIS 3.12.3 and earlier release	Yes
Status monitoring	No	Yes

Feature	NFVIS 4.1.1 and Earlier Releases	NFVIS 4.2.1 Release
SNMP v3 user/passphrase restore (with uniqMacUid)	v3 user/passphrase restore	If system engine ID is the same as backup, restore all v3 users. If system engine ID is different from backup, ignore v3 users restoration.
SNMP engine ID restore on different system	No	Engine ID changed to same as backup bundle

VM backup using vmExportAction:

Feature	NFVIS 4.1.1 and Earlier Releases	NFVIS 4.2.1 Release
VM backup format	Full backup	Diff disk backup

Backup and Restore

To backup and save NFVIS and all VM configurations use **configuration-only** option. To backup and save VM disks, NFVIS and VM configurations use **configuration-and-vms** option.

You can only create a backup and save into datastore, or mounted USB storage device. Without specifying, the backup file will have *.bkup* extension.

	Backup configuration-only	Backup configuration-and-vms
Save system configurations	Yes	Yes
Save system upgrade configurations	Yes	Yes
Save system upgrade file	No	No
Save images and flavors configurations	Yes	Yes
Save image disks	No	Yes
Save deployments configurations	Yes	Yes
Save deployments disks	No	Yes

The following examples shows the backup options:

```
nfvis# hostaction backup configuration-and-vms file-path intdatastore:sample
```

```
nfvis# hostaction backup configuration-only file-path extdatastore2:sample-dir/sample
```

The following example shows the backup stored on a USB:

```
nfvis# hostaction backup configuration-only file-path usb:usb1/sample
```

Use the **hostaction backup force-stop** command to stop the running backup.

Starting from NFVIS 4.2 release, use the **show hostaction backup status** command to view the status of the overall backup process and each components like system, image and flavors, vm and so on. The following is an example of the show command output after the backup process is complete:

```
nfvis# show hostaction backup status
hostaction backup status 2020-07-16T07:02:44-00:00
destination intdatastore:backup_20200704.bkup
status      BACKUP-SUCCESS
size        "2798.0 MB"
components FIREWALL
  status      BACKUP-SUCCESS
  last update 2020-07-16T07:07:38-00:00
  size        "20.49 MB"
  details     ""
components Linux
  status      BACKUP-SUCCESS
  last update 2020-07-16T07:07:36-00:00
  size        "0.01 MB"
  details     ""
components NFS
  status      BACKUP-SUCCESS
  last update 2020-07-16T07:06:44-00:00
  size        "0.01 MB"
  details     ""
components NFVIS
  status      BACKUP-SUCCESS
  last update 2020-07-16T07:02:48-00:00
  size        "0.72 MB"
  details     ""
components ROUTER
  status      BACKUP-SUCCESS
  last update 2020-07-16T07:07:35-00:00
  size        "579.89 MB"
  details     ""
components VM_Images_Flavors
  status      BACKUP-SUCCESS
  last update 2020-07-16T07:06:45-00:00
  size        "2197.73 MB"
  details     ""
nfvis#
```

To restore a previous backup on an existing NFVIS setup or on a new NFVIS setup use except-connectivity option which preserves connectivity of the NFVIS and restores everything else from backup.

The restore is based on the system condition created during backup.

	Restore configuration-only	Restore configuration-and-vms
Restore system configurations	Yes	Yes

	Restore configuration-only	Restore configuration-and-vms
Restore upgrade configurations	yes, requires same upgrade files in system if the host backup was taken has such upgrade files. No, if host where backup was taken did not have any upgrade files registered. Restoree will fail.	Yes, requires same upgrade files in system if the host backup was taken has such upgrade files. No, if host where backup was taken did not have any upgrade files registered. Restore will fail.
Restore registered images and flavors	Yes, if images sources are still available (URL link is still valid, or uploaded files are still in the same locations). No, if images sources are not available (URL link is invalid, upload files are deleted or moved to new location). The restore process will fail.	Yes, restore from backup file.
Restore deployments	No	Yes, restore from backup file.

Note This means if there are upgrade files registered in the NFVIS. The backup create on this host will contain those information. If using this backup on new host or same host after factory-default-reset, the restore will fail.

	dpdk-disabled while backup	dpdk-enable while backup
dpdk-disabled while restore	Yes (system is dpdk-disabled)	Yes (system will beconverted to dpdk enabled, and VM vnic will be convereted inf needed)
dpdk-enabled while restore	No support	Yes (system is dpdk-enabled)

Note In hostaction restore process, the full file name (with *.bkup* extension) is required in the CLI.

```
nfvis# hostaction restore file-path intdatastore:sample.bkup
```

The following example shows how to restore a backup on a different NFVIS device:

```
nfvis# hostaction restore except-connectivity file-path extdatastore2:sample-dir/sample.bkup
```

Starting from NFVIS 4.2 release, use the **show hostaction restore-status** command to view the status of the overall restore process and each components like system, image and flavors, vm and so on. The following is an example of the show command output after the restore process is complete:

```
nfvis# show hostaction restore-status
hostaction restore-status 2020-07-16T07:18:54-00:00
source intdatastore:backup_20200704.bkup
status RESTORE-SUCCESS
components FIREWALL.vmbkp
  status      RESTORE-SUCCESS
  last update 2020-07-16T07:26:34-00:00
  details     ""
components Linux.vmbkp
  status      RESTORE-SUCCESS
  last update 2020-07-16T07:26:03-00:00
  details     ""
components NFS.vmbkp
  status      RESTORE-SUCCESS
  last update 2020-07-16T07:25:36-00:00
  details     ""
components NFVIS
  status      RESTORE-SUCCESS
  last update 2020-07-16T07:22:03-00:00
  details     ""
components ROUTER.vmbkp
  status      RESTORE-SUCCESS
  last update 2020-07-16T07:26:55-00:00
  details     ""
components VM_Images_Flavors
  status      RESTORE-SUCCESS
  last update 2020-07-16T07:26:01-00:00
  details     ""
components intdatastore:backup_20200704.bkup
  status      VERIFICATION-SUCCESS
  last update 2020-07-16T07:18:54-00:00
  details     ""
nfvis#
```

Starting from NFVIS 4.2 release, you can backup registered images and flavors into backup package and restore these images and flavors into the system. The new system does not require a pre-registered image before system restore. If the system has existing images, flavors or deployments, the system restore erases them all and restores from its own backup. VM backup is now faster and uses less disk space compared to NFVIS 4.1 release, but it also takes up additional process, time or disk space to backup registered images and flavors.

Backup, Restore, and Factory-Default-Reset

To perform **hostaction backup** -> **factory-default-reset** -> **hostaction restore** on the same box without any external storage (like USB or NFS mount), check the following issues:

	NFVIS 4.1.x and earlier releases	NFVIS 4.2.x and later releases
Backup file location	• The system backup bundle is saved under */datastore/uploads/* by default. • Factory-default-reset cleans up all files under */datastore/uploads/*, but leave files under */datastore/* intact. • **hostaction restore** requires backup bundle saved under */datastore/uploads/*. The restore process will not start if the backup bundle is saved in another location (bundle saved on USB or NFS should be copied to *datastore/uploads/ folder*).	• The system backup bundle is saved under */datastore/* by default.
System requirements if system backup bundle contains VM backups	• VM restoration requires the original image or template registered in NFVIS. • Factory-default-reset all clean ups all registered images and uploaded files. You need to configure minimum setup, like host connection and upload registered images to the same datastore.	• The backup package includes original registered images.

	NFVIS 4.1.x and earlier releases	NFVIS 4.2.x and later releases

Prevent backup bundle from deleting with factory-default-reset	• Save the backup bundle in remote locations. Then restore the connectivity and upload the backup bundle after reset.
	• Save backup bundle in local */datastore/* and not in */datastore/uploads/* or copy backup bundle from */datastore/uploads/* to */datastore/*:
	`# Backup & Restore on the same NFVIS box without NFS & USB`
	`# [[ BACKUP ]]`
	`# before executing factory-default-reset`
	`nfvis# nfvis# hostaction backup configuration-only file-path extdatastore1:configBackup-01.bkup`
	`nfvis# system file-copy source /mnt/extdatastore1/uploads/configBackup-01.bkup destination /mnt/extdatastore2/`
	`# after factory-default-reset all-except-images or all-except-images-connnectivity,`
	`# file /mnt/extdatastore1/uploads/configBackup-01.bkup will be deleted`
	`# but /mnt/extdatastore2/configBackup-01.bkup won't.`
	`# [[RESTORE]]`
	`# after NFVIS rebooted and login to console, copy file to uploads/ directory`
	`nfvis# system file-copy source /mnt/extdatastore2/configBackup-01.bkup destination /mnt/extdatastore2/uploads/`
	`nfvis# hostaction restore file-path extdatastore2:configBackup-01.bkup`
		• Save backup bundle in local */intdatastore/* and not in */intdatastore/uploads/* or copy backup bundle from */datastore/uploads/* to */datastore/*

You can copy backup file to intdatastore/ if there is sufficient storage space. If the backup is larger than free disk space in intdatastore/, you can copy to a remote server like scp or NFVIS web portal.

The following table lists the data erased and retained upon using NFVIS factory default reset options:

	Factory-default-reset all	Factory-default-reset all-except-images	Factory-default-reset all-except-images-connectivity
files under intdatastore	Retain	Retain	Retain
files under intdatastore/uploads/	Delete	Delete	Delete

	Factory-default-reset all	Factory-default-reset all-except-images	Factory-default-reset all-except-images-connectivity
files under extdatastore${1,2}	Delete	Retain	Retain
files under extdatastore${1,2}/uploads/	Delete	Delete	Delete
files under USB	Retain	Retain	Retain
files under NFS mounted datastore	Retain	Retain	Retain
Deployments	Delete	Delete	Delete
Registered Images and Flavors	Delete	Retain	Retain

Failure to Restore

NFVIS configurations fails to restore if:

- There is no sufficient disk space. Restore requires temporary disk space to save un-compressed files. You can move, copy or upload the backup file to a larger datastore and run system restore.

```
nfvis# show hostaction restore-status
hostaction restore-status 2020-07-16T21:29:08-00:00
source intdatastore:encs07-configVms-dpdk-2020-07101600.bkup
status RESTORE-ERROR
components intdatastore:encs07-configVms-dpdk-2020-07101600.bkup
  status      VERIFICATION-ERROR
  last update 2020-07-16T21:49:18-00:00
  details     "Backup package could not be inflated. No space left on device"
nfvis#
```

- The application communication fails. You can see this error after the first restore attempt has failed, and when you try to restore for the second time. You can reboot NFVIS before you attempt restore again.

```
nfvis# hostaction restore file-path extdatastore2:backup_20200704.bkup
Error: application communication failure
```

APC UPS Support and Monitoring

Note This feature is supported only on ENCS 5400.

This feature provides support for monitoring battery status for an APC UPS connected to the ENCS box through a USB cable. NFVIS gracefully shuts down when the UPS battery reaches 5% and boots up again when the battery reaches 15%. This feature is available only through NFVIS CLI and is disabled by default.

In case of a prolonged power outage that drains the UPS battery completely, the box is powered off. When power is restored to the UPS, CIMC boots up which in turn boots up the NFVIS.

To enable APC UPS:

```
apcups enable
```

To disable APC UPS:

```
apcups disable
```

To check the battery status of an APC UPS:

```
apcups battery-status
```

Resetting to Factory Default

Factory default reset is available on all NFVIS supported hardware platforms.

You can reset the host server to factory default with the following options:

- Reset all—Deletes VMs and volumes, files including logs, images, and certificates. Erases all configuration. Connectivity will be lost, and the admin password will be changed to factory default password.
- Reset all-except-images—Delete VMs and volumes, files including logs, user uploaded files and certificates. Erases all configuration except registered images. Connectivity will be lost, and the admin password will be changed to factory default password.
- Reset all-except-images-connectivity—Deletes VMs and volumes, files including logs and certificates. Erases all configuration except images, network, and connectivity.

Note Factory default reset must be used only for troubleshooting purpose. We recommend you contact Cisco Technical Support before performing factory default reset. This feature will reboot the system. Do not perform any operations until the system reboots successfully.

To reset to factory default:

```
nfvis#factory-default-resetall|all-except-images|all-except-images-connectivity
```

Note Enter **Yes** when you are prompted with the factory default warning message or **no** to cancel.

Factory Default APIs and Commands

Factory Default APIs	Factory Default Commands
• /api/operations/factory-default-reset/all • /api/operations/factory-default-reset/all-except-images • /api/operations/factory-default-reset /all-except-images-connectivity	• factory-default-reset

Configure Banner, Message of the day and System Time

Configuring Your Banner and Message of the Day

Cisco Enterprise NFVIS supports two types of banners: system-defined and user-defined banners. You cannot edit or delete the system-defined banner, which provides copyright information about the application. Banners are displayed on the login page of the portal.

You can post messages using the Message of the Day option. The message is displayed on the portal's home page when you log into the portal.

To configure your banner and message:

```
configure terminal
banner-motd banner "This is a banner" motd "This is the message of the day"
commit
```

Note Currently, you can create banners and messages in English only. You can view the system-defined banner using the **show banner-motd** command. This command does not display the user-defined banner or message.

Banner and Message APIs and Commands

Banner and Message APIs	Banner and Message Commands
• /api/config/banner-motd • /api/operational/banner-motd	• banner-motd • show banner-motd

Setting the System Time Manually or With NTP

You can configure the Cisco Enterprise NFVIS system time manually or synchronise with an external time server using Network Time Protocol (NTP).

To set the system time manually:

```
configure terminal
```

```
system set-manual-time 2017-01-01T00:00:00
commit
```

Note NTP is automatically disabled when the time clock is set manually.

To set the system time using NTP IPv4:

```
configure terminal
system time  ntp preferred_server 209.165.201.20 backup_server 1.ntp.esl.cisco.com
commit
```

To set the system time using NTP IPv6:

```
configure terminal
system time  ntp-ipv6 2001:420:30d:201:ffff:ffff:fff4:35
commit
```

Verifying the System Time Configuration

To verify all system time configuration details, use the **show system time** command in privileged EXEC mode as shown below:

```
nfvis# show system time

system time current-time 2017-01-01T17:35:39+00:00

system time current-timezone "UTC (UTC, +0000)"

REMOTE               REFID   ST    T          WHEN       POLL       REACH          DELAY
     OFFSET        JITTER
==============================================================================

*calo-timeserver     .GPS.    1          u           4   64           1         69.423
     2749736        0.000

* sys.peer and synced, o pps.peer, # selected, + candidate,

- outlyer, . excess, x falseticker, space reject
```

If the NTP server is invalid, it will not be displayed in the table. Also, when an NTP server is queried, if a response is not received before the timeout, the NTP server is not displayed in the table.

System Time APIs and Commands

APIs	Commands
• /api/operations/system/set-manual-time • /api/config/system/time/ntp/preferred_server • /api/config/system/time/ntp/backup_server • /api/config/system/time/timezone • /api/operational/system/time?deep	• system time • show system time • system set-manual-time

Configure DNS Name Servers

Table 10: Feature History

Feature Name	Release Information	Description
DNS Name Server Configuration Enhancement	NFVIS 4.4.1	You can now configure up to three name servers, which the DNS resolvers can use in the order you specify. New command introduced to configure DNS nameservers: **system settings name-server**.
Use **system settings name-server** command	NFVIS 4.10.1	Starting from Cisco NFVIS Release 4.10.1, the command **dns-server** is no longer supported. We recommend that you use **system settings name-server** command instead.

Restrictions

- In NFVIS 4.4 release, only **system settings name-server** command can be used for the configuration of DNS name servers at a given time.

This example shows how to configure name servers:

```
config terminal
system settings name-server 209.165.201.24 209.165.201.23 2001:420:30d:201:ffff:ffff:fff4:36
commit
```

This example shows how to unconfigure name servers:

```
config terminal
no system settings name-server
commit
```

This example shows how to update name servers:

```
config terminal
no system settings name-server
system settings name-server 209.165.201.23 2001:420:30d:201:ffff:ffff:fff4:33 209.165.201.27
commit
```

DNS name servers configured using the **system settings name-server** command is prepended to DNS name servers provided by a DHCP server automatically. To view the list of configured name servers, use the **show system settings-native dns** command.

To unconfigure name servers:

```
config terminal
no system settings name-server
commit
```

DNS Server APIs and Commands

DNS nameservers APIs	DNS nameserver commands
/api/config/system/settings/name-server	system settings name-server
/api/operational/system:system/settings-native/dns	show system settings-native dns

Configuring IP Host

NFVIS IP host feature allows you to specify static mapping of host name and IP addresses.

To configure IP host mapping:

```
configure terminal
ip host test2.com 2.2.2.3 2.2.2.1
```

IP Host APIs and Commands

APIs	CLI Commands
/api/config/ip/host	ip host