Configuring Layer 3 Interfaces

About Layer 3 Interfaces

Layer 3 interfaces forward IPv4 packets to another device using static or dynamic routing protocols. You can use Layer 3 interfaces for IP routing and inter-VLAN routing of Layer 2 traffic.

Routed Interfaces

You can configure a port as a Layer 2 interface or a Layer 3 interface. A routed interface is a physical port that can route IP traffic to another device. A routed interface is a Layer 3 interface only and does not support Layer 2 protocols, such as the Spanning Tree Protocol (STP).

All Ethernet ports are routed interfaces by default. You can change this default behavior with the CLI setup script.

Note The default mode for the Cisco Nexus® 3550-T switch interface is Layer 3.

You can assign an IP address to the port, enable routing, and assign routing protocol characteristics to this routed interface.

You can also create a Layer 3 port channel from routed interfaces. For more information about port channels, see the *Configuring Port Channels* section.

Routed interfaces support exponentially decayed rate counters. Cisco NX-OS tracks the following statistics with these averaging counters:

- Input packets/sec
- Output packets/sec

VLAN Interfaces

A VLAN interface, or switch virtual interface (SVI), is a virtual routed interface that connects a VLAN on the device to the Layer 3 router engine on the same device. Only one VLAN interface can be associated with a VLAN, but you need to configure a VLAN interface for a VLAN only when you want to route between VLANs or to provide IP host connectivity to the device through a virtual routing and forwarding (VRF) instance that is not the management VRF. When you enable VLAN interface creation, Cisco NX-OS creates a VLAN interface for the default VLAN (VLAN 1) to permit remote switch administration.

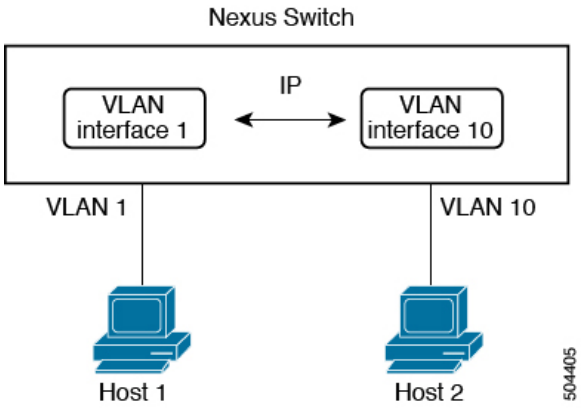
You must enable the VLAN network interface feature before you can see configure it. The system automatically takes a checkpoint prior to disabling the feature, and you can roll back to this checkpoint. See the *Cisco Nexus® 3550-T System Management Configuration* section for information on rollbacks and checkpoints.

Note You cannot delete the VLAN interface for VLAN 1.

You can route across VLAN interfaces to provide Layer 3 inter-VLAN routing by configuring a VLAN interface for each VLAN that you want to route traffic to and assigning an IP address on the VLAN interface. For more information about IP addresses and IP routing, see the *Cisco Nexus® 3550-T Unicast Routing Configuration* section.

The following figure shows two hosts connected to two VLANs on a device. You can configure VLAN interfaces for each VLAN that allows Host 1 to communicate with Host 2 using IP routing between the VLANs. VLAN 1 communicates at Layer 3 over VLAN interface 1 and VLAN 10 communicates at Layer 3 over VLAN interface 10.

Figure 1: Connecting Two VLANs with VLAN interfaces



Changing VRF Membership for an Interface

When you enter the **vrf member** command under an interface, you receive an alert regarding the deletion of interface configurations and to notify the clients/listeners (such as CLI-Server) to delete configurations with respect to the interface.

Entering the **system vrf-member-change retain-l3-config** command enables the retention of the Layer 3 configuration when the VRF member changes on the interface. It does this by sending notification to the clients/listeners to store (buffer) the existing configurations, delete the configurations from the old vrf context, and reapply the stored configurations under the new VRF context.

Note When the **system vrf-member-change retain-l3-config** command is enabled, the Layer 3 configuration is not deleted and remains stored (buffered). When this command is not enabled (default mode), the Layer 3 configuration is not retained when the VRF member changes.

You can disable the retention of the Layer 3 configuration with the **no system vrf-member-change retain-l3-config** command. In this mode, the Layer 3 configuration is not retained when the VRF member changes.

Notes About Changing VRF Membership for an Interface

- Momentary traffic loss may occur when changing the VRF name.
- Only the configurations under the interface level are processed when the **system vrf-member-change retain-l3-config** command is enabled. You must manually process any configurations at the router level to accommodate routing protocols after a VRF change.
- The **system vrf-member-change retain-l3-config** command supports interface level configurations with:
  - Layer 3 configurations maintained by the CLI Server, such as **ip address** and all OSPF/ISIS/EIGRP CLIs available under the interface configuration.

Loopback Interfaces

A loopback interface is a virtual interface with a single endpoint that is always up. Any packet transmitted over a loopback interface is immediately received by this interface. Loopback interfaces emulate a physical interface. You can configure up to 1024 loopback interfaces, numbered 0 to 1023.

You can use loopback interfaces for performance analysis, testing, and local communications. Loopback interfaces can act as a termination address for routing protocol sessions. This loopback configuration allows routing protocol sessions to stay up even if some of the outbound interfaces are down.

High Availability

Layer 3 interfaces support stateful and stateless restarts. After the switchover, Cisco NX-OS applies the runtime configuration after the switchover.

See the *Cisco Nexus® 3550-T Unicast Routing Configuration* section for complete information about high availability.

DHCP Client

Cisco NX-OS supports DHCP client for IPv4 and IPv6 addresses on SVIs, physical Ethernet, and management interfaces. You can configure the IP address of a DHCP client by using the **ip address dhcp** or **ipv6 address**

dhcp command. These commands send a request from the DHCP client to the DHCP server soliciting an IPv4 or IPv6 address from the DHCP server. The DHCP client on the Cisco Nexus switch identifies itself to the DHCP server. The DHCP server uses this identifier to send the IP address back to the DHCP client.

When a DHCP client is configured on the SVI with the DHCP server sending router and DNS options, the **ip route** 0.0.0.0/0 *router-ip* and **ip name-server** *dns-ip* commands are configured on the switch automatically.

Limitations for Using DHCP Client on Interfaces

The following are the limitations for using DHCP client on interfaces:

- This feature is supported only on physical Ethernet interfaces, management interfaces, and SVIs.
- This feature is supported on non-default virtual routing and forwarding (VRF) instances.
- The DNS server and default router option-related configurations are saved in the startup configuration when you enter the **copy running-config startup-config** command. When you reload the switch, if this configuration is not applicable, you might have to remove it.
- You can configure a maximum of six DNS servers on the switch, which is a switch limitation. This maximum number includes the DNS servers configured by the DHCP client and the DNS servers configured manually.

  If the number of DNS servers configured on the switch is more than six, and if you get a DHCP offer for an SVI with DNS option set, the IP address is not assigned to the SVI.
- A Cisco Nexus 3550-T switch supports a maximum of 10 IPv4 DHCP clients.
- DHCP relay and DHCP client configurations are incompatible and are not supported on the same switch. You must remove the DHCP relay configuration before configuring the DHCP Client on an interface.
- When DHCP snooping is enabled on the VLAN whose SVI is configured with the DHCP client, the DHCP snooping is not enforced on the SVI DHCP client.
- When configuring the IPv4 DHCP client, you must configure with the **ipv4 address use-link-local-only** command before the **ipv4 address dhcp** command.

Prerequisites for Layer 3 Interfaces

Layer 3 interfaces have the following prerequisites:

- You are familiar with IP addressing and basic configuration. See the *Cisco Nexus® 3550-T Unicast Routing Configuration* section for more information about IP addressing.

Guidelines and Limitations for Layer 3 Interfaces

Layer 3 interfaces have the following configuration guidelines and limitations:

- If you change a Layer 3 interface to a Layer 2 interface, Cisco NX-OS shuts down the interface, reenables the interface, and removes all configuration specific to Layer 3.
- If you change a Layer 2 interface to a Layer 3 interface, Cisco NX-OS shuts down the interface, reenables the interface, and deletes all configuration specific to Layer 2.

- IP unnumbered interfaces are not supported.
- Multicast and/or broadcast counters for SVI are not supported.
- Control plane SVI/SI traffic for SVI counters are not supported.
- **show** commands with the **internal** keyword are not supported.

Note If you are familiar with the Cisco IOS CLI, be aware that the Cisco NX-OS commands for this feature might differ from the Cisco IOS commands that you would use.

Default Settings

The following table lists the default settings for Layer 3 interface parameters.

Table 1: Default Layer 3 Interface Parameters

Parameters	Default
Admin state	Shut

Configuring Layer 3 Interfaces

Configuring a Routed Interface

You can configure any Ethernet port as a routed interface.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters global configuration mode.

Step 2	**interface ethernet** *slot/port*
	Example:
	`switch(config)# interface ethernet 1/2`
	`switch(config-if)#`
		Enters interface configuration mode.

Step 3	**no switchport** **Example:** `switch(config-if)# no switchport`	Configures the interface as a Layer 3 interface.

	Command or Action	Purpose
Step 4	[**ip address**] **Example:** `switch(config-if)# ip address 192.0.2.1/8`	• Configures an IP address for this interface. See the *Cisco Nexus® 3550-T Unicast Routing Configuration* section for more information about IP addresses.
Step 5	**show interfaces** **Example:** `switch(config-if)# show interfaces ethernet 1/2`	(Optional) Displays the Layer 3 interface statistics.

Step 6	**no shutdown**
	Example:
	`switch#`
	`switch(config-if)# int e1/2`
	`switch(config-if)# no shutdown`
		(Optional) Clears the errors on the interfaces where policies correspond with hardware policies. This command allows policy programming to continue and the port to come up. If policies do not correspond, the errors are placed in an error-disabled policy state.

Step 7	**copy running-config startup-config** **Example:** `switch(config)# copy running-config startup-config`	(Optional) Saves the configuration change.

Example

- Use the **switchport** command to convert a Layer 3 interface into a Layer 2 interface.

Command	Purpose
switchport Example: `switch(config-if)# switchport`**`switchport`**	Configures the interface as a Layer 2 interface and deletes any configuration specific to Layer 3 on this interface.

- This example shows how to configure a routed interface:

```
switch# configure terminal
switch(config)# interface ethernet 1/2
switch(config-if)# no switchport
switch(config-if)# ip address 192.0.2.1/8
switch(config-if)# copy running-config startup-config
```

The default setting for interfaces is routed. If you want to configure an interface for Layer 2, enter the **switchport** command. Then, if you change a Layer 2 interface to a routed interface, enter the **no switchport** command.

Configuring a VLAN Interface

You can create VLAN interfaces to provide inter-VLAN routing.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**feature interface-vlan** **Example:** `switch(config)# feature interface-vlan`	Enables VLAN interface mode.

Step 3	**interface vlan** *number*
	Example:
	`switch(config)# interface vlan 10`
	`switch(config-if)#`
		Creates a VLAN interface. The number range is from 1 to 4094.

Step 4	[**ip address** *ip-address/length*] **Example:** `switch(config-if)# ip address 192.0.2.1/8`	• Configures an IP address for this VLAN interface. See the *Cisco Nexus® 3550-T Unicast Routing Configuration* section for more information on IP addresses.
Step 5	**show interface vlan** *number* **Example:** `switch(config-if)# show interface vlan 10`	(Optional) Displays the Layer 3 interface statistics.

Step 6	**no shutdown**
	Example:
	`switch(config)# int e1/3`
	`switch(config)# no shutdown`
		(Optional) Clears the errors on the interfaces where policies correspond with hardware policies. This command allows policy programming to continue and the port to come up. If policies do not correspond, the errors are placed in an error-disabled policy state.

Step 7	**copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	(Optional) Saves the configuration change.

Example

This example shows how to create a VLAN interface:

```
switch# configure terminal
switch(config)# feature interface-vlan
switch(config)# interface vlan 10
switch(config-if)# ip address 192.0.2.1/8
switch(config-if)# copy running-config startup-config
```

Enabling Layer 3 Retention During VRF Membership Change

The following steps enable the retention of the Layer 3 configuration when changing the VRF membership on the interface.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**system vrf-member-change retain-l3-config**
	Example:
	`switch(config)# system vrf-member-change retain-l3-config`
	`Warning: Will retain L3 configuration when vrf member change on interface.`
		Enables Layer 3 configuration retention during VRF membership change.
		Note
		To disable the retention of the Layer 3 configuration, use the **no system vrf-member-change retain-l3-config** command.

Configuring a Loopback Interface

You can configure a loopback interface to create a virtual interface that is always up.

Before you begin

Ensure that the IP address of the loopback interface is unique across all routers on the network.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**interface loopback** *instance*
	Example:
	`switch(config)# interface loopback 0`
	`switch(config-if)#`
		Creates a loopback interface. The range is from 0 to 1023.

Step 3	[**ip address** *ip-address/length*] **Example:** `switch(config-if)# ip address 192.0.2.1/8`	• Configures an IP address for this interface. See the *Cisco Nexus® 3550-T Unicast Routing Configuration* section for more information about IP addresses.

	Command or Action	Purpose
Step 4	**show interface loopback** *instance* **Example:** `switch(config-if)# show interface loopback 0`	(Optional) Displays the loopback interface statistics.
Step 5	**copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	(Optional) Saves the configuration change.

Example

This example shows how to create a loopback interface:

```
switch# configure terminal
switch(config)# interface loopback 0
switch(config-if)# ip address 192.0.2.1/8
switch(config-if)# copy running-config startup-config
```

Assigning an Interface to a VRF

You can add a Layer 3 interface to a VRF.

Procedure

	Command or Action	Purpose

Step 1	**configure terminal**
	Example:
	`switch# configure terminal`
	`switch(config)#`
		Enters configuration mode.

Step 2	**interface** *interface-type number*
	Example:
	`switch(config)# interface loopback 0`
	`switch(config-if)#`
		Enters interface configuration mode.

Step 3	**vrf member** *vrf-name* **Example:** `switch(config-if)# vrf member RemoteOfficeVRF`	Adds this interface to a VRF.
Step 4	**ip address** *ip-prefix/length* **Example:** `switch(config-if)# ip address 192.0.2.1/16`	Configures an IP address for this interface. You must do this step after you assign this interface to a VRF.

	Command or Action	Purpose
Step 5	**show vrf** [*vrf-name*] **interface** *interface-type number* **Example:** `switch(config-vrf)# show vrf Enterprise interface loopback 0`	(Optional) Displays VRF information.
Step 6	**copy running-config startup-config** **Example:** `switch(config-if)# copy running-config startup-config`	(Optional) Saves the configuration change.

Example

This example shows how to add a Layer 3 interface to the VRF:

```
switch# configure terminal
switch(config)# interface loopback 0
switch(config-if)# vrf member RemoteOfficeVRF
switch(config-if)# ip address 209.0.2.1/16
switch(config-if)# copy running-config startup-config
```

Configuring a DHCP Client on an Interface

You can configure the DHCP client on a management interface, for IPv4 address.

Procedure

	Command or Action	Purpose
Step 1	switch# **configure terminal**	Enters global configuration mode.
Step 2	switch(config)# **interface ethernet** *type slot/port* | **mgmt** *mgmt-interface-number* |	Creates a physical Ethernet interface, a management interface.
Step 3	switch(config-if)# [**no**] [**ip** | **ipv4] address dhcp**	Requests the DHCP server for an IPv4 address. The **no** form of this command removes any address that was acquired.
Step 4	Save the configuration.	

Verifying the Layer 3 Interfaces Configuration

To display the Layer 3 configuration, perform one of the following tasks:

Command	Purpose
show interface ethernet *slot/port*	Displays the Layer 3 interface configuration, status, and counters (including the 5-minute exponentially decayed moving average of inbound and outbound packet and byte rates).
show interface ethernet *slot/port* **brief**	Displays the Layer 3 interface operational status.
show interface ethernet *slot/port* **capabilities**	Displays the Layer 3 interface capabilities, including port type, speed, and duplex.
show interface ethernet *slot/port* **description**	Displays the Layer 3 interface description.
show interface ethernet *slot/port* **status**	Displays the Layer 3 interface administrative status, port mode, speed, and duplex.
show interface ethernet *slot/port.number*	Displays the subinterface configuration, status, and counters (including the f-minute exponentially decayed moving average of inbound and outbound packet and byte rates).
show interface port-channel *channel-id.number*	Displays the port-channel subinterface configuration, status, and counters (including the 5-minute exponentially decayed moving average of inbound and outbound packet and byte rates).
show interface loopback *number*	Displays the loopback interface configuration, status, and counters.
show interface loopback *number* **brief**	Displays the loopback interface operational status.
show interface loopback *number* **description**	Displays the loopback interface description.
show interface loopback *number* **status**	Displays the loopback interface administrative status and protocol status.
show interface vlan *number*	Displays the VLAN interface configuration, status, and counters.
show interface vlan *number* **brief**	Displays the VLAN interface operational status.
show interface vlan *number* **description**	Displays the VLAN interface description.
show interface vlan *number* **status**	Displays the VLAN interface administrative status and protocol status.
show ip interface brief	Displays interface address and interface status (numbered/unnumbered).
show ip route	Displays routes learned via OSPF or ISIS. (Includes addresses for best unicast and multicast next-hop.)

Monitoring the Layer 3 Interfaces

Use the following commands to display Layer 3 statistics:

Command	Purpose
show interface ethernet *slot/port* **counters**	Displays the Layer 3 interface statistics (unicast, multicast, and broadcast).
show interface ethernet *slot/port* **counters brief**	Displays the Layer 3 interface input and output counters.
show interface ethernet errors *slot/port* **detailed** [**all**]	Displays the Layer 3 interface statistics. You can optionally include all 32-bit and 64-bit packet and byte counters (including errors).
show interface ethernet errors *slot/port* **counters errors**	Displays the Layer 3 interface input and output errors.
show interface ethernet errors *slot/port* **counters snmp**	Displays the Layer 3 interface counters reported by SNMP MIBs.
show interface loopback *number* **detailed** [**all**]	Displays the loopback interface statistics. You can optionally include all 32-bit and 64-bit packet and byte counters (including errors).
show interface vlan *number* **counters detailed** [**all**]	Displays the VLAN interface statistics. You can optionally include all Layer 3 packet and byte counters (unicast and multicast).
show interface vlan *number* **counters snmp**	Displays the VLAN interface counters reported by SNMP MIBs.

Configuration Examples for Layer 3 Interfaces

This example shows how to configure a loopback interface:

```
interface loopback 3
ip address 192.0.2.2/32
```

Example of Changing VRF Membership for an Interface

- Enable Layer 3 configuration retention when changing VRF membership.

```
switch# configure terminal
switch(config)# system vrf-member-change retain-l3-config

Warning: Will retain L3 configuration when vrf member change on interface.
```

- Verify Layer 3 retention.

```
switch# show running-config | include vrf-member-change

system vrf-member-change retain-l3-config
```

- Configure the SVI interface with Layer 3 configuration as VRF "blue".

```
switch# configure terminal
switch(config)# show running-config interface vlan 2002

interface Vlan2002
description TESTSVI
no shutdown
vrf member blue
no ip redirects
ip address 192.168.211.2/27
ip router ospf 1 area 0.0.0.0
preempt delay minimum 300 reload 600
priority 110 forwarding-threshold lower 1 upper 110
ip 192.168.211.1
preempt delay minimum 300 reload 600
priority 110 forwarding-threshold lower 1 upper 110
```

- Verify SVI interface after VRF change.

```
switch# configure terminal
switch(config)# show running-config interface vlan 2002

interface Vlan2002
description TESTSVI
no shutdown
vrf member red
no ip redirects
ip address 192.168.211.2/27
ip router ospf 1 area 0.0.0.0
preempt delay minimum 300 reload 600
priority 110 forwarding-threshold lower 1 upper 110
ip 192.168.211.1
preempt delay minimum 300 reload 600
priority 110 forwarding-threshold lower 1 upper 110
```

Note

- When changing the VRF, the Layer 3 configuration retention affects:
  - Physical Interface
  - Loopback Interface
  - SVI Interface
  - Port-Channel
- When changing the VRF, the existing Layer 3 configuration is deleted and reapplied. All routing protocols, such as OSPF/ISIS/EIGRP, go down in the old VRF and come up in the new VRF.
- Direct/Local IPv4 addresses are removed from the old VRF and installed in the new VRF.
- Some traffic loss might occur during the VRF change.

Related Documents

Related Documents	Document Title
IP	*Cisco Nexus® 3550-T Unicast Routing Configuration* section
VLANs	*Cisco Nexus® 3550-T Layer 2 Switching Configuration* section