



# Configuring Layer 3 Interfaces

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## About Layer 3 Interfaces

Layer 3 interfaces forward IPv4 and IPv6 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.



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**Note** The default behavior varies based on the type of switch (Cisco Nexus 9300, Cisco Nexus 9500, or Cisco Nexus 3164).

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**Note** Cisco Nexus 9300 Series switches (except Cisco Nexus 9332 switch) have a Layer 2 default mode.

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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
- Input bytes/sec
- Output bytes/sec

## Subinterfaces

You can create virtual subinterfaces on a parent interface configured as a Layer 3 interface. A parent interface can be a physical port.

Subinterfaces divide the parent interface into two or more virtual interfaces on which you can assign unique Layer 3 parameters such as IP addresses and dynamic routing protocols. The IP address for each subinterface should be in a different subnet from any other subinterface on the parent interface.

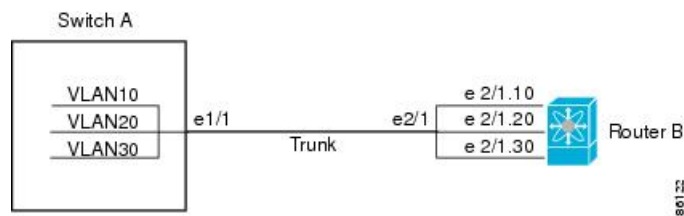
You create a subinterface with a name that consists of the parent interface name (for example, Ethernet 2/1) followed by a period and then by a number that is unique for that subinterface. For example, you could create a subinterface for Ethernet interface 2/1 named Ethernet 2/1.1 where .1 indicates the subinterface.

Cisco NX-OS enables subinterfaces when the parent interface is enabled. You can shut down a subinterface independent of shutting down the parent interface. If you shut down the parent interface, Cisco NX-OS shuts down all associated subinterfaces as well.

One use of subinterfaces is to provide unique Layer 3 interfaces to each virtual local area network (VLAN) supported by the parent interface. In this scenario, the parent interface connects to a Layer 2 trunking port on another device. You configure a subinterface and associate the subinterface to a VLAN ID using 802.1Q trunking.

The following figure shows a trunking port from a switch that connects to router B on interface E 2/1. This interface contains three subinterfaces that are associated with each of the three VLANs carried by the trunking port.

**Figure 1: Subinterfaces for VLANs**



For more information about VLANs, see the [Cisco Nexus 9000 Series NX-OS Layer 2 Switching Configuration Guide](#).

## Limitations for Subinterfaces

The following are the limitations for subinterfaces:

- Statistics for subinterfaces are not supported.

## 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 9000 Series NX-OS System Management Configuration Guide](#) for information on rollbacks and checkpoints.

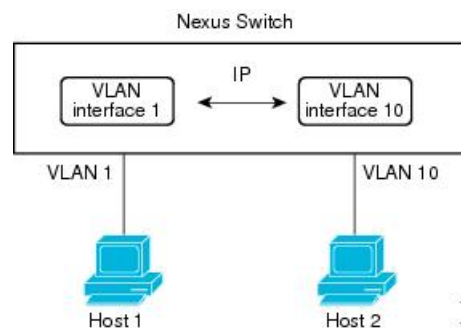


**Note** You cannot delete the VLAN interface for VLAN 1.

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 9000 Series NX-OS Unicast Routing Configuration Guide](#).

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 2: 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 (7.0(3)I4(1) and later) 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 **ipv6 address** (secondary) and all OSPF/ISIS/EIGRP CLIs available under the interface configuration.
  - HSRP
  - DHCP Relay Agent CLIs, such as **ip dhcp relay address [use-vrf]** and **ipv6 dhcp relay address [use-vrf]**.
- For DHCP:
  - As a best practice, the client and server interface VRF should be changed one at a time. Otherwise, the DHCP packets cannot be exchanged on the relay agent.
  - When the client and server are in different VRFs, use the **ip dhcp relay address [use-vrf]** command to exchange the DHCP packets in the relay agent over the different VRFs.

## 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.

## IP Unnumbered

The IP unnumbered feature enables the processing of IP packets on a point to point (p2p) interface without explicitly configuring a unique IP address on it. This approach borrows an IP address from another interface and conserves address space on point to point links.

Any interface which conforms to the point to point mode can be used as an IP unnumbered interface. For 7.0(3)I3(1) and later, the IP unnumbered feature is supported only on Ethernet interfaces and sub-interfaces. The borrowed interface can only be a loopback interface and is known as the numbered interface.

A loopback interface is ideal as a numbered interface in that it is always functionally up. However, because loopback interfaces are local to a switch/router, the reachability of unnumbered interfaces first needs to be established through static routes or by using an interior gateway protocol, such as OSPF or ISIS.

Beginning with Cisco NX-OS Release 7.0(3)I6(1), configuring IP unnumbered interfaces for port channels is supported on all Cisco Nexus 9000 Series switches.

## MAC-Embedded IPv6 Address

BGP allows an IPv4 prefix to be carried over an IPv6 next hop. The IPv6 next hop is leveraged to remove neighbor discovery (ND)-related traffic from the network. To do this (7.0(3)I2(1) and later), the MAC address is embedded in the IPv6 address. Such an address is called a MAC-embedded IPv6 (MEv6) address. The router extracts the MAC address directly from the MEv6 address instead of going through ND. Local interface and next-hop MAC addresses are extracted from the IPv6 addresses.

On MEv6-enabled IPv6 interfaces, the same MEv6-extracted MAC address is used for IPv4 traffic as well. MEv6 is supported on all Layer 3-capable interfaces except switch virtual interfaces (SVIs).



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**Important**

When MEv6 is enabled on an interface, ping6 to the IPv6 link local address, OSPFv3, and BFDv6 are not supported on that interface.

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## 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 9000 Series NX-OS High Availability and Redundancy Guide](#) for complete information about high availability.

## Virtualization Support

Layer 3 interfaces support Virtual Routing and Forwarding instances (VRFs). VRFs exist within virtual device contexts (VDCs). By default, Cisco NX-OS places you in the default VDC and default VRF .



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**Note**

You must assign an interface to a VRF before you configure the IP address for that interface.

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## DHCP Client

Beginning with 7.0(3)I2(1), 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 9000 Series switch supports a maximum of 10 IPv4 and 10 IPv6 DHCP clients (7.0(3)I4(1) and later).
- 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 IPv6 DHCP client, you must configure with the **ipv6 address use-link-local-only** command before the **ipv6 address dhcp** command.

## Licensing Requirements for Layer 3 Interfaces

The following table shows the licensing requirements for this feature:

Product	License Requirement
Cisco NX-OS	Layer 3 interfaces require no license. Any feature not included in a license package is bundled with the Cisco NX-OS image and is provided at no extra charge to you.

# 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 9000 Series NX-OS Unicast Routing Configuration Guide](#) for more information about IP addressing.

## Guidelines and Limitations

Layer 3 interfaces have the following configuration guidelines and limitations:

- **show** commands with the **internal** keyword are not supported.
- Configuring a subinterface on a port-channel interface is not supported. (For 7.0(3)I1(1))
- 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. (7.0(3)I1(2) and later)
- 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. (7.0(3)I1(2) and later)
- The Dynamic Host Configuration Protocol (DHCP) option is not supported when configuring a subinterface on a port-channel interface.
- When an IP unnumbered interface is configured, a loopback interface should be in the same VRF as the IP unnumbered interface. (7.0(3)I3(1) and later)
- An **admin-shutdown** command on a loopback interface that is a numbered interface does not bring down the IP unnumbered interface. This means that the routing protocols running over the IP unnumbered interface continue to be up. (7.0(3)I3(1) and later)
- Static routes running over the IP unnumbered interface should use pinned static routes. (7.0(3)I3(1) and later)



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**Note** The IP unnumbered interface through which the route is resolved needs to be specified.

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- An IP unnumbered interface is supported only on physical and sub-interfaces. (7.0(3)I3(1) and later)
- Only loopback interfaces can use unnumbered interfaces as numbered interfaces. (7.0(3)I3(1) and later)
- OSPF over an IP unnumbered interface is supported. (7.0(3)I3(1) and later)
- ISIS over an IP unnumbered interface is supported. (7.0(3)I3(1) and later)
- BGP over a loopback interface with an IP unnumbered interface as an overlay interface is supported. (7.0(3)I5(1) and later)
- The default and non-default VRF is supported by IP unnumbered interfaces. (7.0(3)I3(1) and later)

- The switch has a limit of 16 user-defined MAC addresses (MEv6/static). Configuring beyond this limit might result in issues documented in [CSCux84428](#).
- Layer 3 routed traffic for missing Layer 2 adjacency information is not flooded back onto VLAN members of ingress units when the source MAC address of routed traffic is a non-VDC (Virtual Device Context) MAC address. This limitation is for hardware flood traffic and can occur when the SVI (Switched Virtual Interface) has a user-configured MAC address.



**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
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> switch# <b>configure terminal</b> switch(config)#	Enters global configuration mode.
<b>Step 2</b>	<b>interface ethernet slot/port</b>  <b>Example:</b> switch(config)# <b>interface ethernet 2/1</b> switch(config-if)#	Enters interface configuration mode.
<b>Step 3</b>	<b>no switchport</b>  <b>Example:</b> switch(config-if)# <b>no switchport</b>	Configures the interface as a Layer 3 interface.

	Command or Action	Purpose
<b>Step 4</b>	<p>[<b>ip address</b> <i>ip-address/length</i>   <b>ipv6 address</b> <i>ipv6-address/length</i>]</p> <p><b>Example:</b></p> <pre>switch(config-if) # ip address 192.0.2.1/8</pre> <p><b>Example:</b></p> <pre>switch(config-if) # ipv6 address 2001:0DB8::1/8</pre>	<ul style="list-style-type: none"> <li>Configures an IP address for this interface. See the <a href="#">Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</a> for more information about IP addresses.</li> <li>Configures an IPv6 address for this interface. See the <a href="#">Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</a> for more information about IPv6 addresses.</li> </ul>
<b>Step 5</b>	<p><b>show interfaces</b></p> <p><b>Example:</b></p> <pre>switch(config-if) # show interfaces ethernet 2/1</pre>	(Optional) Displays the Layer 3 interface statistics.
<b>Step 6</b>	<p><b>no shutdown</b></p> <p><b>Example:</b></p> <pre>switch# switch(config-if) # int e2/1 switch(config-if) # no shutdown</pre>	(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.
<b>Step 7</b>	<p><b>copy running-config startup-config</b></p> <p><b>Example:</b></p> <pre>switch(config) # copy running-config startup-config</pre>	(Optional) Saves the configuration change.

**Example**

- Use the **medium** command to set the interface medium to either point to point or broadcast.

Command	Purpose
<p><b>medium {broadcast   p2p}</b></p> <p>Example:</p> <pre>switch(config-if) # medium p2p medium p2p</pre>	Configures the interface medium as either point to point or broadcast.



**Note** The default setting is **broadcast**, and this setting does not appear in any of the **show** commands. However, if you do change the setting to **p2p**, you will see this setting when you enter the **show running config** command.

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

Command	Purpose
<b>switchport</b> Example: <pre>switch(config-if)# switchportswitchport</pre>	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 2/1
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 Subinterface on a Routed Interface

You can configure one or more subinterfaces on a routed interface made from routed interfaces.

### Before you begin

Configure the parent interface as a routed interface.

See the “Configuring a Routed Interface” section.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
<b>Step 2</b>	<b>interface ethernet <i>slot/port.number</i></b> <b>Example:</b> <pre>switch(config)# interface ethernet 2/1.1 switch(config-subif)#</pre>	Creates a subinterface and enters subinterface configuration mode. The number range is from 1 to 4094.
<b>Step 3</b>	<b>[ip address <i>ip-address/length</i>   ipv6 address <i>ipv6-address/length</i>]</b> <b>Example:</b> <pre>switch(config-subif)# ip address 192.0.2.1/8</pre> <b>Example:</b> <pre>switch(config-subif)# ipv6 address 2001:0DB8::1/8</pre>	<ul style="list-style-type: none"> <li>• Configures an IP address for this subinterface. See the <a href="#">Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</a> for more information on IP addresses.</li> <li>• Configures an IPv6 address for this subinterface. See the <a href="#">Cisco Nexus 9000 Series NX-OS Unicast Routing</a></li> </ul>

	Command or Action	Purpose
		<a href="#">Configuration Guide</a> for more information on IPv6 addresses.
<b>Step 4</b>	<b>encapsulation dot1Q</b> <i>vlan-id</i>  <b>Example:</b> switch(config-subif)# <b>encapsulation dot1Q</b> 33	Configures IEEE 802.1Q VLAN encapsulation on the subinterface. The range is from 2 to 4093.
<b>Step 5</b>	<b>show interfaces</b>  <b>Example:</b> switch(config-subif)# <b>show interfaces</b> <b>ethernet 2/1.1</b>	(Optional) Displays the Layer 3 interface statistics.
<b>Step 6</b>	<b>copy running-config startup-config</b>  <b>Example:</b> switch(config)# <b>copy running-config</b> <b>startup-config</b>	(Optional) Saves the configuration change.

### Example

- This example shows how to create a subinterface:

```
switch# configure terminal
switch(config)# interface ethernet 2/1.1
switch(config-if)# ip address 192.0.2.1/8
switch(config-if)# encapsulation dot1Q 33
switch(config-if)# copy running-config startup-config
```

- The output of the **show interface eth** command is enhanced for the subinterfaces as shown in the following :

```
switch# show interface ethernet 1/2.1
Ethernet1/2.1 is down (Parent Interface Admin down)
admin state is down, Dedicated Interface, [parent interface is Ethernet1/2]
Hardware: 40000 Ethernet, address: 0023.ac67.9bc1 (bia 4055.3926.61d4)
Internet Address is 10.10.10.1/24
MTU 1500 bytes, BW 40000000 Kbit, DLY 10 usec
reliability 255/255, txload 1/255, rxload 1/255
Auto-mdix is turned off
EtherType is 0x8100
L3 in Switched:
  ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes
L3 out Switched:
  ucast: 0 pkts, 0 bytes - mcast: 0 pkts, 0 bytes
```

## Configuring a Subinterface on a Port-Channel Interface

You can configure one or more subinterfaces on a port-channel interface.



**Note** Subinterfaces on a port-channel interface do not support multicast routing, router ACLs, QoS, policy-based routing (PBR), SPAN, or ERSPAN.

### Before you begin

Configure the parent interface as a port-channel interface. (7.0(3)I1(2) and later)

See the “Configuring Port Channels” chapter.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
<b>Step 2</b>	<b>interface port-channel <i>channel-id.number</i></b>  <b>Example:</b> <pre>switch(config)# interface port-channel 100.1 switch(config-subif)#</pre>	Creates a subinterface and enters subinterface configuration mode.
<b>Step 3</b>	<b>[ip address <i>ip-address/length</i>   ipv6 address <i>ipv6-address/length</i>]</b>  <b>Example:</b> <pre>switch(config-subif)# ip address 192.0.2.1/8</pre> <b>Example:</b> <pre>switch(config-subif)# ipv6 address 2001:0DB8::1/8</pre>	<ul style="list-style-type: none"> <li>Configures an IP address for this subinterface. See the <a href="#">Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</a> for more information on IP addresses.</li> <li>Configures an IPv6 address for this subinterface. See the <a href="#">Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</a> for more information on IPv6 addresses.</li> </ul>
<b>Step 4</b>	<b>encapsulation dot1Q <i>vlan-id</i></b>  <b>Example:</b> <pre>switch(config-subif)# encapsulation dot1Q 33</pre>	Configures IEEE 802.1Q VLAN encapsulation on the subinterface. The range is from 2 to 4093.
<b>Step 5</b>	<b>show interfaces</b>  <b>Example:</b> <pre>switch(config-subif)# show interfaces ethernet 2/1.1</pre>	(Optional) Displays the Layer 3 interface statistics.
<b>Step 6</b>	<b>copy running-config startup-config</b>  <b>Example:</b>	(Optional) Saves the configuration change.

	Command or Action	Purpose
	<code>switch(config)# copy running-config startup-config</code>	

**Example**

This example shows how to create a subinterface:

```
switch# configure terminal
switch(config)# interface port-channel 115.3
switch(config-subif)# ip address 141.143.101.2/24
switch(config-subif)# encapsulation dot1q 3
switch(config-subif)# copy running-config startup-config
```

## Configuring a VLAN Interface

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

**Procedure**

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> <code>switch# configure terminal</code> <code>switch(config)#</code>	Enters configuration mode.
<b>Step 2</b>	<b>feature interface-vlan</b>  <b>Example:</b> <code>switch(config)# feature interface-vlan</code>	Enables VLAN interface mode.
<b>Step 3</b>	<b>interface vlan <i>number</i></b>  <b>Example:</b> <code>switch(config)# interface vlan 10</code> <code>switch(config-if)#</code>	Creates a VLAN interface. The number range is from 1 to 4094.
<b>Step 4</b>	<b>[ip address <i>ip-address/length</i>   ipv6 address <i>ipv6-address/length</i>]</b>  <b>Example:</b> <code>switch(config-if)# ip address 192.0.2.1/8</code>  <b>Example:</b> <code>switch(config-if)# ipv6 address 2001:0DB8::1/8</code>	<ul style="list-style-type: none"> <li>• Configures an IP address for this VLAN interface. See the <a href="#">Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</a> for more information on IP addresses.</li> <li>• Configures an IPv6 address for this VLAN interface. See the <a href="#">Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</a> for more information on IPv6 addresses.</li> </ul>

	Command or Action	Purpose
<b>Step 5</b>	<b>show interface vlan</b> <i>number</i> <b>Example:</b> <pre>switch(config-if)# show interface vlan 10</pre>	(Optional) Displays the Layer 3 interface statistics.
<b>Step 6</b>	<b>no shutdown</b> <b>Example:</b> <pre>switch(config)# int e3/1 switch(config)# no shutdown</pre>	(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.
<b>Step 7</b>	<b>copy running-config startup-config</b> <b>Example:</b> <pre>switch(config-if)# copy running-config startup-config</pre>	(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
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters configuration mode.
<b>Step 2</b>	<b>system vrf-member-change retain-l3-config</b> <b>Example:</b> <pre>switch(config)# system vrf-member-change retain-l3-config</pre>	Enables Layer 3 configuration retention during VRF membership change.  <b>Note</b> To disable the retention of the Layer 3 configuration, use the <b>no system vrf-member-change retain-l3-config</b> command.

	Command or Action	Purpose
	Warning: Will retain L3 configuration when vrf member change on interface.	

## 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
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> switch# <b>configure terminal</b> switch(config)#	Enters configuration mode.
<b>Step 2</b>	<b>interface loopback <i>instance</i></b>  <b>Example:</b> switch(config)# <b>interface loopback 0</b> switch(config-if)#	Creates a loopback interface. The range is from 0 to 1023.
<b>Step 3</b>	<b>[ip address <i>ip-address/length</i>   ipv6 address <i>ipv6-address/length</i>]</b>  <b>Example:</b> switch(config-if)# <b>ip address 192.0.2.1/8</b>  <b>Example:</b> switch(config-if)# <b>ipv6 address 2001:0DB8::1/8</b>	<ul style="list-style-type: none"> <li>Configures an IP address for this interface. See the <a href="#">Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</a> for more information about IP addresses.</li> <li>Configures an IPv6 address for this interface. See the <a href="#">Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</a> for more information about IPv6 addresses.</li> </ul>
<b>Step 4</b>	<b>show interface loopback <i>instance</i></b>  <b>Example:</b> switch(config-if)# <b>show interface loopback 0</b>	(Optional) Displays the loopback interface statistics.
<b>Step 5</b>	<b>copy running-config startup-config</b>  <b>Example:</b> switch(config-if)# <b>copy running-config startup-config</b>	(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
```

## Configuring IP Unnumbered on an Ethernet Interface

You can configure the IP unnumbered feature on an ethernet interface.

**Procedure**

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> switch# <b>configure terminal</b> switch(config)#	Enters global configuration mode.
<b>Step 2</b>	<b>interface ethernet <i>slot/port</i></b>  <b>Example:</b> switch(config)# <b>interface ethernet 1/1</b> switch(config-if)#	Enters interface configuration mode.
<b>Step 3</b>	<b>medium p2p</b>  <b>Example:</b> switch(config-if)# <b>medium p2p</b>	Configures the interface medium as point to point.
<b>Step 4</b>	<b>ip unnumbered <i>type number</i></b>  <b>Example:</b> switch(config-if)# <b>ip unnumbered loopback 100</b>	Enables IP processing on an interface without assigning an explicit IP address to the interface.  <i>type</i> and <i>number</i> specify another interface on which the router has an assigned IP address. The interface specified cannot be another unnumbered interface.  <b>Note</b> <i>type</i> is limited to <b>loopback</b> . (7.0(3)I3(1) and later)

## Configuring OSPF for an IP Unnumbered Interface

You can configure OSPF for an IP unnumbered loopback interface.

## Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> switch# <b>configure terminal</b> switch(config)#	Enters global configuration mode.
<b>Step 2</b>	<b>interface ethernet slot/port</b> <b>Example:</b> switch(config)# <b>interface ethernet</b> <b>1/20.1</b> switch(config-if)#	Enters interface configuration mode.
<b>Step 3</b>	<b>encapsulation dot1Q vlan-id</b> <b>Example:</b> switch(config-if)# <b>encapsulation dot1Q</b> <b>100</b>	Configures IEEE 802.1Q VLAN encapsulation on the subinterface. The range is from 2 to 4093.
<b>Step 4</b>	<b>medium p2p</b> <b>Example:</b> switch(config-if)# <b>medium p2p</b>	Configures the interface medium as point to point.
<b>Step 5</b>	<b>ip unnumbered type number</b> <b>Example:</b> switch(config-if)# <b>ip unnumbered</b> <b>loopback 101</b>	Enables IP processing on an interface without assigning an explicit IP address to the interface.  <i>type</i> and <i>number</i> specify another interface on which the router has an assigned IP address. The interface specified cannot be another unnumbered interface.  <b>Note</b> <i>type</i> is limited to <b>loopback</b> . (7.0(3)I3(1) and later)
<b>Step 6</b>	(Optional) <b>ip ospf authentication</b> <b>Example:</b> switch(config-if)# <b>ip ospf</b> <b>authentication</b>	Specifies the authentication type for interface.
<b>Step 7</b>	(Optional) <b>ip ospf authentication-key password</b> <b>Example:</b> switch(config-if)# <b>ip ospf</b> <b>authentication 3 b7bdf15f62bbd250</b>	Specifies the authentication password for OSPF authentication.
<b>Step 8</b>	<b>ip router ospf instance area area-number</b> <b>Example:</b>	Configures routing process for IP on an interface and specifies an area.

	Command or Action	Purpose
	<code>switch(config-if)# ip router ospf 100 area 0.0.0.1</code>	<b>Note</b> The <code>ip router ospf</code> command is required for both the unnumbered and the numbered interface.
<b>Step 9</b>	<b>no shutdown</b> <b>Example:</b> <code>switch(config-if)# no shutdown</code>	Brings up the interface (administratively).
<b>Step 10</b>	<b>interface loopback <i>instance</i></b> <b>Example:</b> <code>switch(config)# interface loopback 101</code>	Creates a loopback interface. The range is from 0 to 1023.
<b>Step 11</b>	<b>ip address <i>ip-address/length</i></b> <b>Example:</b> <code>switch(config-if)# 192.168.101.1/32</code>	Configures an IP address for the interface.
<b>Step 12</b>	<b>ip router ospf <i>instance</i> area <i>area-number</i></b> <b>Example:</b> <code>switch(config-if)# ip router ospf 100 area 0.0.0.1</code>	Configures routing process for IP on an interface and specifies an area. <b>Note</b> The <code>ip router ospf</code> command is required for both the unnumbered and the numbered interface.

## Configuring ISIS for an IP Unnumbered Interface

You can configure ISIS for an IP unnumbered loopback interface.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> <code>switch# configure terminal switch(config)#</code>	Enters global configuration mode.
<b>Step 2</b>	<b>feature isis</b> <b>Example:</b> <code>Switch(config)# feature isis</code>	Enables ISIS.
<b>Step 3</b>	<b>router isis <i>area-tag</i></b> <b>Example:</b> <code>Switch(config)# router isis 100</code>	Assigns a tag to an IS-IS process and enters router configuration mode.
<b>Step 4</b>	<b>net <i>network-entity-title</i></b> <b>Example:</b>	Configures the network entity title (NET) on the device.

	Command or Action	Purpose
	<code>Switch(config-router)# net 49.0001.0100.0100.1001.00</code>	
<b>Step 5</b>	<b>end</b> <b>Example:</b> <code>Switch(config-router)# end</code>	Exit router configuration mode.
<b>Step 6</b>	<b>interface ethernet <i>slot/port</i></b> <b>Example:</b> <code>switch(config)# interface ethernet 1/20.1</code>	Enters interface configuration mode.
<b>Step 7</b>	<b>encapsulation dot1Q <i>vlan-id</i></b> <b>Example:</b> <code>switch(config-subif)# encapsulation dot1Q 100</code>	Configures IEEE 802.1Q VLAN encapsulation on the subinterface. The range is from 2 to 4093.
<b>Step 8</b>	<b>medium p2p</b> <b>Example:</b> <code>switch(config-subif)# medium p2p</code>	Configures the interface medium as point to point.
<b>Step 9</b>	<b>ip unnumbered <i>type number</i></b> <b>Example:</b> <code>switch(config-if)# ip unnumbered loopback 101</code>	Enables IP processing on an interface without assigning an explicit IP address to the interface.  <i>type</i> and <i>number</i> specify another interface on which the router has an assigned IP address. The interface specified cannot be another unnumbered interface.  <b>Note</b> <i>type</i> is limited to <b>loopback</b> . (7.0(3)I3(1) and later)
<b>Step 10</b>	<b>ip router isis <i>area-tag</i></b> <b>Example:</b> <code>switch(config-subif)# ip router isis 100</code>	Enables ISIS on the unnumbered interface.
<b>Step 11</b>	<b>no shutdown</b> <b>Example:</b> <code>switch(config-subif)# no shutdown</code>	Brings up the interface (administratively).

## Configuring PBR on SVI on the Gateway

This procedure configures PBR on the primary SVI interface in the gateway.



**Note** Steps 2 through 6 are needed if you want to configure a PBR policy on the unnumbered Primary/Secondary VLAN interfaces. This is not mandatory for IP unnumbered on the SVI feature.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b> <b>Example:</b> switch# <b>configure terminal</b>	Enter global configuration mode.
<b>Step 2</b>	<b>ip access-list <i>list-name</i></b> <b>Example:</b> switch(config)# <b>ip access-list pbr-sample</b>	Configure access list.
<b>Step 3</b>	<b>permit tcp host <i>ipaddr</i> host <i>ipaddr</i> eq <i>port-number</i></b> <b>Example:</b> switch(config-acl)# <b>permit tcp host 10.1.1.1 host 192.168.2.1 eq 80</b>	Specify the packets to forward on a specific port.
<b>Step 4</b>	<b>exit</b> <b>Example:</b> switch(config-acl)# <b>exit</b>	Exit configuration mode.
<b>Step 5</b>	<b>route-map <i>route-map-name</i></b> <b>Example:</b> switch(config)# <b>route-map pbr-sample</b>	Create a route-map or enter route-map command mode.
<b>Step 6</b>	<b>match ip address <i>access-list-name</i></b> <b>Example:</b> switch(config-route-map)# <b>match ip address pbr-sample</b>	Match values from the routing table.
<b>Step 7</b>	<b>set ip next-hop <i>addr1</i></b> <b>Example:</b> switch(config-route-map)# <b>set ip next-hop 192.168.1.1</b>	Set IP address of the next hop.
<b>Step 8</b>	<b>exit</b> <b>Example:</b> switch(config-route-map)# <b>exit</b>	Exit command mode.

	Command or Action	Purpose
Step 9	<b>interface</b> <i>vlan</i> <i>vlan-id</i> <b>Example:</b> switch(config)# <b>interface</b> <b>vlan</b> 2003	Creates a VLAN interface and enters interface configuration mode. The range is from 1 and 4094. This is the primary VLAN.
Step 10	<b>ip address</b> <i>ip-addr</i> <b>Example:</b> switch(config-if)# <b>ip address</b> 10.0.0.1/8	Configures an IP address for the interface.
Step 11	<b>no ip redirects</b> <b>Example:</b> switch(config-if)# <b>no ip redirects</b>	Needs to be configured on all unnumbered primary and secondary VLAN interfaces.
Step 12	(Optional) <b>ip policy route-map</b> <i>pbr-sample</i> <b>Example:</b> switch(config-if)# <b>ip policy route-map</b> <b>pbr-sample</b>	Enter this command if you want to apply a PBR policy on the unnumbered Primary/Secondary VLAN interface.
Step 13	<b>exit</b> <b>Example:</b> switch(config-if)# <b>exit</b>	Exit command mode.
Step 14	<b>hsrp version</b> 2 <b>Example:</b> switch(config-if)# <b>hsrp version</b> 2	Set the HSRP version.
Step 15	<b>hsrpgroup-num</b> <b>Example:</b> switch(config-if)# <b>hsrp</b> 200	Set the HSRP group number.
Step 16	<b>name</b> <i>name-val</i> <b>Example:</b> switch(config-if-hsrp)# <b>name</b> <b>master</b>	Configure the redundancy name string.
Step 17	<b>ip</b> <i>ip-addr</i> <b>Example:</b> switch(config-if-hsrp)# <b>ip</b> 10.0.0.100	Configures an IP address.
Step 18	<b>no shutdown</b> <b>Example:</b> switch(config-if-hsrp)# <b>no shutdown</b>	Negates shutdown.

## Configuring IP Unnumbered on SVI Secondary VLAN on the Gateway

This procedure configures IP unnumbered on the secondary SVI in the gateway.

## Procedure

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> switch# <b>configure terminal</b>	Enter configuration mode.
Step 2	<b>interface vlan <i>vlan-list</i></b> <b>Example:</b> switch(config)# <b>interface vlan 2001</b>	Creates a VLAN interface and enters interface configuration mode. The range is from 1 to 4094. This is the secondary VLAN.
Step 3	<b>ip unnumbered vlan <i>primary-vlan-id</i></b> <b>Example:</b> switch(config-if)# <b>ip unnumbered vlan 2003</b>	Enables IP processing on an interface without assigning an explicit IP address to an interface.
Step 4	(Optional) <b>ip policy route-map <i>pbr-sample</i></b> <b>Example:</b> switch(config-if)# <b>ip policy route-map pbr-sample</b>	Enter this command if you want to apply a PBR policy on the unnumbered Primary/Secondary VLAN interface.
Step 5	<b>no ip redirects</b> <b>Example:</b> switch(config-if)# <b>no ip redirects</b>	Needs to be configured on all unnumbered primary and secondary VLAN interfaces.
Step 6	<b>hsrp version 2</b> <b>Example:</b> switch(config-if)# <b>hsrp version 2</b>	Set the HSRP version.
Step 7	<b>hsrp <i>group-num</i></b> <b>Example:</b> switch(config-if)# <b>hsrp 200</b>	Set the HSRP group number.
Step 8	<b>follow <i>name</i></b> <b>Example:</b> switch(config-if-hsrp)# <b>follow master</b>	Configure the group to be followed.
Step 9	<b>ip <i>ip-addr</i></b> <b>Example:</b> switch(config-if-hsrp)# <b>ip 10.0.0.100</b>	Enters HSRP IPv4 and sets the virtual IP address.
Step 10	<b>no shutdown</b> <b>Example:</b> switch(config-if-hsrp)# <b>no shutdown</b>	Negate shutdown.

## Assigning an Interface to a VRF

You can add a Layer 3 interface to a VRF.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> switch# <b>configure terminal</b> switch(config)#	Enters configuration mode.
<b>Step 2</b>	<b>interface</b> <i>interface-type number</i>  <b>Example:</b> switch(config)# <b>interface loopback 0</b> switch(config-if)#	Enters interface configuration mode.
<b>Step 3</b>	<b>vrf member</b> <i>vrf-name</i>  <b>Example:</b> switch(config-if)# <b>vrf member</b> <b>RemoteOfficeVRF</b>	Adds this interface to a VRF.
<b>Step 4</b>	<b>ip address</b> <i>ip-prefix/length</i>  <b>Example:</b> switch(config-if)# <b>ip address</b> <b>192.0.2.1/16</b>	Configures an IP address for this interface. You must do this step after you assign this interface to a VRF.
<b>Step 5</b>	<b>show vrf</b> [ <i>vrf-name</i> ] <b>interface</b> <i>interface-type number</i>  <b>Example:</b> switch(config-vrf)# <b>show vrf Enterprise</b> <b>interface loopback 0</b>	(Optional) Displays VRF information.
<b>Step 6</b>	<b>copy running-config startup-config</b>  <b>Example:</b> switch(config-if)# <b>copy running-config</b> <b>startup-config</b>	(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 MAC-Embedded IPv6 Address

Beginning with 7.0(3)I2(1), you can configure a MAC-embedded IPv6 (MEv6) address.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	<b>configure terminal</b>  <b>Example:</b> switch# configure terminal switch(config)#	Enters global configuration mode.
<b>Step 2</b>	<b>interface type slot/port</b>  <b>Example:</b> switch(config)# interface ethernet 1/3 switch(config-if)#	Enters the interface configuration mode for the specified interface.
<b>Step 3</b>	<b>no switchport</b>  <b>Example:</b> switch(config-if)# no switchport	Configures the interface as a Layer 3 interface and deletes any configuration specific to Layer 2 on this interface.  <b>Note</b> To convert a Layer 3 interface back into a Layer 2 interface, use the <b>switchport</b> command.
<b>Step 4</b>	<b>mac-address ipv6-extract</b>  <b>Example:</b> switch(config-if)# mac-address ipv6-extract	Extracts the MAC address embedded in the IPv6 address configured on the interface.  <b>Note</b> The MEv6 configuration is currently not supported with the EUI-64 format of IPv6 address.
<b>Step 5</b>	<b>ipv6 address ip-address/length</b>  <b>Example:</b> switch(config-if)# ipv6 address 2002:1::10/64	Configures an IPv6 address for this interface.
<b>Step 6</b>	<b>ipv6 nd mac-extract [exclude nud-phase]</b>  <b>Example:</b> switch(config-if)# ipv6 nd mac-extract	Extracts the next-hop MAC address embedded in a next-hop IPv6 address.  The <b>exclude nud-phase</b> option blocks packets during the ND phase only. When the <b>exclude nud-phase</b> option is not specified, packets are blocked during both ND and neighbor unreachability detection (NUD) phases.
<b>Step 7</b>	(Optional) <b>show ipv6 icmp interface type slot/port</b>  <b>Example:</b>	Displays IPv6 Internet Control Message Protocol version 6 (ICMPv6) interface information.

	Command or Action	Purpose
	switch(config-if)# show ipv6 icmp interface ethernet 1/3	
<b>Step 8</b>	(Optional) <b>copy running-config startup-config</b>  <b>Example:</b> switch(config-if)# copy running-config startup-config	Copies the running configuration to the startup configuration.

**Example**

This example shows how to configure a MAC-embedded IPv6 address with ND mac-extract enabled:

```
switch# configure terminal
switch(config)# interface ethernet 1/3
switch(config-if)# no switchport
switch(config-if)# mac-address ipv6-extract
switch(config-if)# ipv6 address 2002:1::10/64
switch(config-if)# ipv6 nd mac-extract
switch(config-if)# show ipv6 icmp interface ethernet 1/3
ICMPv6 Interfaces for VRF "default"
Ethernet1/3, Interface status: protocol-up/link-up/admin-up
IPv6 address: 2002:1::10
IPv6 subnet: 2002:1::/64
IPv6 interface DAD state: VALID
ND mac-extract : Enabled
ICMPv6 active timers:
  Last Neighbor-Solicitation sent: 00:01:39
  Last Neighbor-Advertisement sent: 00:01:40
  Last Router-Advertisement sent: 00:01:41
  Next Router-Advertisement sent in: 00:03:34
Router-Advertisement parameters:
  Periodic interval: 200 to 600 seconds
  Send "Managed Address Configuration" flag: false
  Send "Other Stateful Configuration" flag: false
  Send "Current Hop Limit" field: 64
  Send "MTU" option value: 1500
  Send "Router Lifetime" field: 1800 secs
  Send "Reachable Time" field: 0 ms
  Send "Retrans Timer" field: 0 ms
  Suppress RA: Disabled
  Suppress MTU in RA: Disabled
Neighbor-Solicitation parameters:
  NS retransmit interval: 1000 ms
ICMPv6 error message parameters:
  Send redirects: true
  Send unreachable: false
ICMPv6-nd Statistics (sent/received):
  RAs: 3/0, RSs: 0/0, NAs: 2/0, NSs: 7/0, RDs: 0/0
  Interface statistics last reset: never
```

This example shows how to configure a MAC-embedded IPv6 address with ND mac-extract (excluding NUD phase) enabled:

```
switch# configure terminal
switch(config)# interface ethernet 1/5
switch(config-if)# no switchport
switch(config-if)# mac-address ipv6-extract
```

```

switch(config-if)# ipv6 address 2002:2::10/64
switch(config-if)# ipv6 nd mac-extract exclude nud-phase
switch(config-if)# show ipv6 icmp interface ethernet 1/5
ICMPv6 Interfaces for VRF "default"
Ethernet1/5, Interface status: protocol-up/link-up/admin-up
  IPv6 address: 2002:2::10
  IPv6 subnet: 2002:2::/64
  IPv6 interface DAD state: VALID
  ND mac-extract : Enabled (Excluding NUD Phase)
  ICMPv6 active timers:
    Last Neighbor-Solicitation sent: 00:06:45
    Last Neighbor-Advertisement sent: 00:06:46
    Last Router-Advertisement sent: 00:02:18
    Next Router-Advertisement sent in: 00:02:24
  Router-Advertisement parameters:
    Periodic interval: 200 to 600 seconds
    Send "Managed Address Configuration" flag: false
    Send "Other Stateful Configuration" flag: false
    Send "Current Hop Limit" field: 64
    Send "MTU" option value: 1500
    Send "Router Lifetime" field: 1800 secs
    Send "Reachable Time" field: 0 ms
    Send "Retrans Timer" field: 0 ms
    Suppress RA: Disabled
    Suppress MTU in RA: Disabled
  Neighbor-Solicitation parameters:
    NS retransmit interval: 1000 ms
  ICMPv6 error message parameters:
    Send redirects: true
    Send unreachable: false
  ICMPv6-nd Statistics (sent/received):
    RAs: 6/0, RSs: 0/0, NAs: 2/0, NSs: 7/0, RDs: 0/0
  Interface statistics last reset: never

```

## Configuring a DHCP Client on an Interface

You can configure the DHCP client on an SVI, a management interface, or a physical Ethernet interface for IPv4 or IPv6 address

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	switch(config)# <b>interface ethernet</b> <i>type slot/port</i>   <b>mgmt</b> <i>mgmt-interface-number</i>   <b>vlan</b> <i>vlan id</i>	Creates a physical Ethernet interface, a management interface, or a VLAN interface. The range of <i>vlan id</i> is from 1 to 4094.
<b>Step 3</b>	switch(config-if)# [ <b>no</b> ] <b>ipv6 address use-link-local-only</b>	Prepares for request to the DHCP server. <b>Note</b> This command is only required for an IPv6 address.
<b>Step 4</b>	switch(config-if)# [ <b>no</b> ] [ <b>ip</b>   <b>ipv6</b> ] <b>address dhcp</b>	Requests the DHCP server for an IPv4 or IPv6 address.

	Command or Action	Purpose
		The <b>no</b> form of this command removes any address that was acquired.
<b>Step 5</b>	(Optional) switch(config)# <b>copy running-config startup-config</b>	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

### Example

This example shows how to configure the IP address of a DHCP client on an SVI:

```
switch# configure terminal
switch(config)# interface vlan 15
switch(config-if)# ip address dhcp
```

This example shows how to configure an IPv6 address of a DHCP client on a management interface:

```
switch# configure terminal
switch(config)# interface mgmt 0
switch(config-if)# ipv6 address use-link-local-only
switch(config-if)# ipv6 address dhcp
```

## Verifying the Layer 3 Interfaces Configuration

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

Command	Purpose
<b>show interface ethernet <i>slot/port</i></b>	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).
<b>show interface ethernet <i>slot/port</i> brief</b>	Displays the Layer 3 interface operational status.
<b>show interface ethernet <i>slot/port</i> capabilities</b>	Displays the Layer 3 interface capabilities, including port type, speed, and duplex.
<b>show interface ethernet <i>slot/port</i> description</b>	Displays the Layer 3 interface description.
<b>show interface ethernet <i>slot/port</i> status</b>	Displays the Layer 3 interface administrative status, port mode, speed, and duplex.
<b>show interface ethernet <i>slot/port.number</i></b>	Displays the subinterface configuration, status, and counters (including the f-minute exponentially decayed moving average of inbound and outbound packet and byte rates).

Command	Purpose
<b>show interface port-channel</b> <i>channel-id.number</i>	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).
<b>show interface loopback</b> <i>number</i>	Displays the loopback interface configuration, status, and counters.
<b>show interface loopback</b> <i>number</i> <b>brief</b>	Displays the loopback interface operational status.
<b>show interface loopback</b> <i>number</i> <b>description</b>	Displays the loopback interface description.
<b>show interface loopback</b> <i>number</i> <b>status</b>	Displays the loopback interface administrative status and protocol status.
<b>show interface vlan</b> <i>number</i>	Displays the VLAN interface configuration, status, and counters.
<b>show interface vlan</b> <i>number</i> <b>brief</b>	Displays the VLAN interface operational status.
<b>show interface vlan</b> <i>number</i> <b>description</b>	Displays the VLAN interface description.
<b>show interface vlan</b> <i>number</i> <b>status</b>	Displays the VLAN interface administrative status and protocol status.
<b>show ip interface brief</b>	Displays interface address and interface status (numbered/unnumbered).
<b>show ip route</b>	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
<b>load- interval</b> { <i>interval seconds</i> { <b>1</b>   <b>2</b>   <b>3</b> }}	Cisco Nexus 9000 Series devices set three different sampling intervals to bit-rate and packet-rate statistics.  The range for VLAN network interface is 60 to 300 seconds, and the range for Layer interfaces is 30 to 300 seconds.
<b>show interface ethernet</b> <i>slot/port</i> <b>counters</b>	Displays the Layer 3 interface statistics (unicast, multicast, and broadcast).
<b>show interface ethernet</b> <i>slot/port</i> <b>counters brief</b>	Displays the Layer 3 interface input and output counters.

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

## Configuration Examples for Layer 3 Interfaces

This example shows how to configure Ethernet subinterfaces:

```
interface ethernet 2/1.10
description Layer 3
ip address 192.0.2.1/8
```

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
mtu 9192
vrf member blue
no ip redirects
ip address 192.168.211.2/27
ipv6 address 2620:10d:c041:12::2/64
ipv6 link-local fe80::1
ip router ospf 1 area 0.0.0.0
ipv6 router ospfv3 1 area 0.0.0.0
hsrp version 2
hsrp 2002
preempt delay minimum 300 reload 600
priority 110 forwarding-threshold lower 1 upper 110
ip 192.168.211.1
hsrp 2002 ipv6
preempt delay minimum 300 reload 600
priority 110 forwarding-threshold lower 1 upper 110
ip 2620:10d:c041:12::1
```

- Change the SVI interface VRF to "red".

```
switch# configure terminal

Enter configuration commands, one per line. End with CNTL/Z.
switch(config)# interface vlan 2002
switch(config-if)# vrf member red

Warning: Retain-L3-config is on, deleted and re-added L3 config on interface Vlan2002
```

- Verify SVI interface after VRF change.

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

interface Vlan2002
description TESTSVI
no shutdown
mtu 9192
```

```

vrf member red
no ip redirects
ip address 192.168.211.2/27
ipv6 address 2620:10d:c041:12::2/64
ipv6 link-local fe80::1
ip router ospf 1 area 0.0.0.0
ipv6 router ospfv3 1 area 0.0.0.0
hsrp version 2
hsrp 2002
preempt delay minimum 300 reload 600
priority 110 forwarding-threshold lower 1 upper 110
ip 192.168.211.1
hsrp 2002 ipv6
preempt delay minimum 300 reload 600
priority 110 forwarding-threshold lower 1 upper 110
ip 2620:10d:c041:12::1

```

**Note**

- When changing the VRF, the Layer 3 configuration retention affects:
  - Physical Interface
  - Loopback Interface
  - SVI Interface
  - Sub-interface
  - Tunnel Interface
  - Port-Channel
- When changing the VRF, the existing Layer 3 configuration is deleted and reapplied. All routing protocols, such as OSPF/ISIS/EIGRP/HSRP, go down in the old VRF and come up in the new VRF.
- Direct/Local IPv4/IPv6 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	<i>Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</i>
VLANs	<i>Cisco Nexus 9000 Series NX-OS Layer 2 Switching Configuration Guide</i>

