



# Configuring Layer 3 Interfaces

---

- [About Layer 3 Interfaces, on page 1](#)
- [Prerequisites for Layer 3 Interfaces, on page 6](#)
- [Guidelines and Limitations for Layer 3 Interfaces, on page 7](#)
- [Default Settings, on page 8](#)
- [Configuring Layer 3 Interfaces, on page 8](#)
- [Verifying the Layer 3 Interfaces Configuration, on page 34](#)
- [Monitoring the Layer 3 Interfaces, on page 35](#)
- [Configuration Examples for Layer 3 Interfaces, on page 36](#)
- [Related Documents, on page 38](#)

## 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.



---

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

---



---

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

---

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.

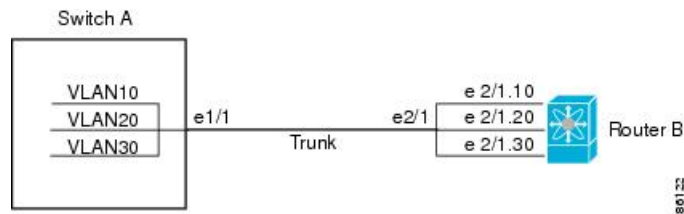
You create a subinterface with a name that consists of the parent interface name (for example, Ethernet 2/1) followed by a period and then by a number that is unique for that subinterface. For example, you could create a subinterface for Ethernet interface 2/1 named Ethernet 2/1.1 where .1 indicates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

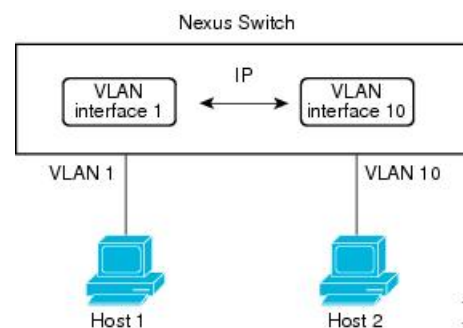


**Note** You cannot delete the VLAN interface for VLAN 1.

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 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. 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.

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, 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).



---

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

---

## 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.



---

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

---

## 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 9000 Series switch supports a maximum of 10 IPv4 and 10 IPv6 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 IPv6 DHCP client, you must configure with the **ipv6 address use-link-local-only** command before the **ipv6 address dhcp** command.

## Layer 3 Static MAC Addresses

You can configure a static MAC address for the following Layer 3 interfaces:

- Layer 3 interfaces
- Layer 3 subinterfaces
- Layer 3 port channels
- VLAN network interface



---

**Note** You cannot configure static MAC address on tunnel interfaces.

---

## 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 for Layer 3 Interfaces

Layer 3 interfaces have the following configuration guidelines and limitations:

- **show** commands with the **internal** keyword are not supported.
- Configuring a subinterface on a physical interface that is configured to be a member of a port-channel is not supported. One must configure the subinterface under the port-channel interface itself.
- 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.
- 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.
- 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.
- Static routes running over the IP unnumbered interface should use pinned static routes.



---

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

---

- An IP unnumbered interface is supported only on physical and sub-interfaces.
- Only loopback interfaces can use unnumbered interfaces as numbered interfaces.
- OSPF over an IP unnumbered interface is supported.
- ISIS over an IP unnumbered interface is supported.
- BGP over a loopback interface with an IP unnumbered interface as an overlay interface is supported.
- The default and non-default VRF is supported by IP unnumbered interfaces.
- The switch has a limit of 16 user-defined MAC addresses (MEv6/static). Configuring beyond this limit might result in issues documented in [CSCux84428](#).
- IPv6 counters for SVI and subinterfaces on Cisco Nexus 9500 Series Switches with X9700-EX and X9700-FX line cards are not supported.
- Multicast and/or broadcast counters for both SVI and subinterfaces are not supported.

- Control plane SVI/SI traffic for both SVI and subinterfaces counters are not supported.
- Beginning Cisco NX-OS Release 9.3(6), sub-interface multicast and broadcast counters are supported on Cisco Nexus N9K-C9336C-FX2 and N9K-C93240YC-FX2 switches.
- The SVI, Layer 2 VLAN, MPLS counters may not work when you enable subinterface multicast and broadcast counters.
- Up to 1000 subinterfaces are supported for this statistics.
- Beginning with Cisco NX-OS Release 10.1(2), Layer 3 Interfaces are supported on Cisco Nexus N9K-X9624D-R2 line card.



**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.

#### SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet *slot/port***
3. **no switchport**
4. **[ip address *ip-address/length* | ipv6 address *ipv6-address/length*]**
5. **show interfaces**
6. **no shutdown**
7. **copy running-config startup-config**



## DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	<b>interface ethernet slot/port</b> <b>Example:</b> <pre>switch(config)# interface ethernet 2/1 switch(config-if)#</pre>	Enters interface configuration mode.
Step 3	<b>no switchport</b> <b>Example:</b> <pre>switch(config-if)# no switchport</pre>	Configures the interface as a Layer 3 interface.
Step 4	<b>[ip address ip-address/length   ipv6 address ipv6-address/length]</b> <b>Example:</b> <pre>switch(config-if)# ip address 192.0.2.1/8</pre> <b>Example:</b> <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>
Step 5	<b>show interfaces</b> <b>Example:</b> <pre>switch(config-if)# show interfaces ethernet 2/1</pre>	(Optional) Displays the Layer 3 interface statistics.
Step 6	<b>no shutdown</b> <b>Example:</b> <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.
Step 7	<b>copy running-config startup-config</b> <b>Example:</b> <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
<b>medium</b> { <b>broadcast</b>   <b>p2p</b> } Example: <pre>switch(config-if)# medium p2p <b>medium p2p</b></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)# switchport<b>switchport</b></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.

### SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet** *slot/port.number*
3. [**ip address** *ip-address/length* | **ipv6 address** *ipv6-address/length*]
4. **encapsulation dot1Q** *vlan-id*
5. **show interfaces**

## 6. copy running-config startup-config

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	<b>interface ethernet slot/port.number</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.
Step 3	<b>[ip address ip-address/length   ipv6 address ipv6-address/length]</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>
Step 4	<b>encapsulation dot1Q vlan-id</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.
Step 5	<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.
Step 6	<b>copy running-config startup-config</b> <b>Example:</b> <pre>switch(config)# copy running-config startup-config</pre>	(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.

See the “Configuring Port Channels” chapter.

### SUMMARY STEPS

1. **configure terminal**
2. **interface port-channel** *channel-id.number*
3. [**ip address** *ip-address/length* | **ipv6 address** *ipv6-address/length*]
4. **encapsulation dot1Q** *vlan-id*
5. **show interfaces**
6. **copy running-config startup-config**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	<b>interface port-channel</b> <i>channel-id.number</i> <b>Example:</b>	Creates a subinterface and enters subinterface configuration mode.

	Command or Action	Purpose
	<code>switch(config)# interface port-channel 100.1</code> <code>switch(config-subif)#</code>	
<b>Step 3</b>	<b>[ip address <i>ip-address/length</i>   ipv6 address <i>ipv6-address/length</i>]</b> <b>Example:</b> <code>switch(config-subif)# ip address 192.0.2.1/8</code> <b>Example:</b> <code>switch(config-subif)# ipv6 address 2001:0DB8::1/8</code>	<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> <code>switch(config-subif)# encapsulation dot1Q 33</code>	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> <code>switch(config-subif)# show interfaces ethernet 2/1.1</code>	(Optional) Displays the Layer 3 interface statistics.
<b>Step 6</b>	<b>copy running-config startup-config</b> <b>Example:</b> <code>switch(config)# copy running-config startup-config</code>	(Optional) Saves the configuration change.

### 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.

### SUMMARY STEPS

1. `configure terminal`
2. `feature interface-vlan`
3. `interface vlan number`

4. [ip address ip-address/length | ipv6 address ipv6-address/length]
5. show interface vlan number
6. no shutdown
7. copy running-config startup-config

## DETAILED STEPS

	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>feature interface-vlan</b> <b>Example:</b> <pre>switch(config)# feature interface-vlan</pre>	Enables VLAN interface mode.
<b>Step 3</b>	<b>interface vlan number</b> <b>Example:</b> <pre>switch(config)# interface vlan 10 switch(config-if)#</pre>	Creates a VLAN interface. The number range is from 1 to 4094.
<b>Step 4</b>	<b>[ip address ip-address/length   ipv6 address ipv6-address/length]</b> <b>Example:</b> <pre>switch(config-if)# ip address 192.0.2.1/8</pre> <b>Example:</b> <pre>switch(config-if)# ipv6 address 2001:0DB8::1/8</pre>	<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>
<b>Step 5</b>	<b>show interface vlan number</b> <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.

### SUMMARY STEPS

1. `configure terminal`
2. `system vrf-member-change retain-l3-config`

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> <pre> switch# configure terminal switch(config)# </pre>	Enters configuration mode.
Step 2	<b>system vrf-member-change retain-l3-config</b> <b>Example:</b> <pre> switch(config)# system vrf-member-change retain-l3-config </pre> Warning: Will retain L3 configuration when vrf member change on interface.	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.

## Configuring a Static MAC Address on a Layer 3 Interface

You can configure static MAC addresses on Layer 3 interfaces. You cannot configure broadcast or multicast addresses as static MAC addresses.




---

**Note** You cannot configure static MAC addresses on tunnel interfaces.

---



**Note** This configuration is limited to 16 VLAN interfaces. Applying the configuration to additional VLAN interfaces results in a down state for the interface with a `Hardware prog failed.` status.

## SUMMARY STEPS

1. `config t`
2. `interface [ethernet slot/port | ethernet slot/port.number | port-channel number | vlan vlan-id]`
3. `mac-address mac-address`
4. `exit`
5. (Optional) `show interface [ethernet slot/port | ethernet slot/port.number | port-channel number | vlan vlan-id]`
6. (Optional) `copy running-config startup-config`

## DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<code>config t</code> <b>Example:</b> switch# config t switch(config)#	Enters configuration mode.
<b>Step 2</b>	<code>interface [ethernet slot/port   ethernet slot/port.number   port-channel number   vlan vlan-id]</code> <b>Example:</b> switch(config)# interface ethernet 7/3	Specifies the Layer 3 interface and enters the interface configuration mode. <b>Note</b> You must create the Layer 3 interface before you can assign the static MAC address.
<b>Step 3</b>	<code>mac-address mac-address</code> <b>Example:</b> switch(config-if)# mac-address 22ab.47dd.ff89 switch(config-if)#	Specifies a static MAC address to add to the Layer 3 interface.
<b>Step 4</b>	<code>exit</code> <b>Example:</b> switch(config-if)# exit switch(config)#	Exits the interface mode.
<b>Step 5</b>	(Optional) <code>show interface [ethernet slot/port   ethernet slot/port.number   port-channel number   vlan vlan-id]</code> <b>Example:</b> switch# show interface ethernet 7/3	Displays information about the Layer 3 interface.
<b>Step 6</b>	(Optional) <code>copy running-config startup-config</code> <b>Example:</b> switch# copy running-config startup-config	Copies the running configuration to the startup configuration.



**Example**

This example shows how to configure the Layer 3 interface on slot 7, port 3 with a static MAC address:

```
switch# config t
switch(config)# interface ethernet 7/3
switch(config-if)# mac-address 22ab.47dd.ff89
switch(config-if)#
```

## 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.

**SUMMARY STEPS**

1. **configure terminal**
2. **interface loopback** *instance*
3. [**ip address** *ip-address/length* | **ipv6 address** *ipv6-address/length*]
4. **show interface loopback** *instance*
5. **copy running-config startup-config**

**DETAILED STEPS**

	<b>Command or Action</b>	<b>Purpose</b>
<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</b> <i>instance</i>  <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</b> <i>ip-address/length</i>   <b>ipv6 address</b> <i>ipv6-address/length</i> ]  <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>

	Command or Action	Purpose
<b>Step 4</b>	<b>show interface loopback</b> <i>instance</i> <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.

### SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet** *slot/port*
3. **medium p2p**
4. **ip unnumbered** *type number*

### DETAILED STEPS

	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</b> <i>slot/port</i> <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.

	Command or Action	Purpose
Step 4	<b>ip unnumbered</b> <i>type number</i> <b>Example:</b> <pre>switch(config-if)# ip unnumbered loopback 100</pre>	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> .

## Configuring OSPF for an IP Unnumbered Interface

You can configure OSPF for an IP unnumbered loopback interface.

### SUMMARY STEPS

1. **configure terminal**
2. **interface ethernet** *slot/port*
3. **encapsulation dot1Q** *vlan-id*
4. **medium p2p**
5. **ip unnumbered** *type number*
6. (Optional) **ip ospf authentication**
7. (Optional) **ip ospf authentication-key** *password*
8. **ip router ospf** *instance area area-number*
9. **no shutdown**
10. **interface loopback** *instance*
11. **ip address** *ip-address/length*
12. **ip router ospf** *instance area area-number*

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	<b>interface ethernet</b> <i>slot/port</i> <b>Example:</b> <pre>switch(config)# interface ethernet 1/20.1 switch(config-if)#</pre>	Enters interface configuration mode.
Step 3	<b>encapsulation dot1Q</b> <i>vlan-id</i> <b>Example:</b> <pre>switch(config-if)# encapsulation dot1Q 100</pre>	Configures IEEE 802.1Q VLAN encapsulation on the subinterface. The range is from 2 to 4093.

	Command or Action	Purpose
<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 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> .
<b>Step 6</b>	(Optional) <b>ip ospf authentication</b> <b>Example:</b> switch(config-if) # <b>ip ospf 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 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> switch(config-if) # <b>ip router ospf 100 area 0.0.0.1</b>	Configures routing process for IP on an interface and specifies an area.  <b>Note</b> The <b>ip router ospf</b> command is required for both the unnumbered and the numbered interface.
<b>Step 9</b>	<b>no shutdown</b> <b>Example:</b> switch(config-if) # <b>no shutdown</b>	Brings up the interface (administratively).
<b>Step 10</b>	<b>interface loopback instance</b> <b>Example:</b> switch(config) # <b>interface loopback 101</b>	Creates a loopback interface. The range is from 0 to 1023.
<b>Step 11</b>	<b>ip address ip-address/length</b> <b>Example:</b> switch(config-if) # <b>192.168.101.1/32</b>	Configures an IP address for the interface.
<b>Step 12</b>	<b>ip router ospf instance area area-number</b> <b>Example:</b> switch(config-if) # <b>ip router ospf 100 area 0.0.0.1</b>	Configures routing process for IP on an interface and specifies an area.  <b>Note</b> The <b>ip router ospf</b> 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.

### SUMMARY STEPS

1. **configure terminal**
2. **feature isis**
3. **router isis** *area-tag*
4. **net** *network-entity-title*
5. **end**
6. **interface ethernet** *slot/port*
7. **encapsulation dot1Q** *vlan-id*
8. **medium p2p**
9. **ip unnumbered** *type number*
10. **ip router isis** *area-tag*
11. **no shutdown**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	<b>feature isis</b> <b>Example:</b> <pre>Switch(config)# feature isis</pre>	Enables ISIS.
Step 3	<b>router isis</b> <i>area-tag</i> <b>Example:</b> <pre>Switch(config)# router isis 100</pre>	Assigns a tag to an IS-IS process and enters router configuration mode.
Step 4	<b>net</b> <i>network-entity-title</i> <b>Example:</b> <pre>Switch(config-router)# net 49.0001.0100.0100.1001.00</pre>	Configures the network entity title (NET) on the device.
Step 5	<b>end</b> <b>Example:</b> <pre>Switch(config-router)# end</pre>	Exit router configuration mode.
Step 6	<b>interface ethernet</b> <i>slot/port</i> <b>Example:</b> <pre>switch(config)# interface ethernet 1/20.1</pre>	Enters interface configuration mode.

	Command or Action	Purpose
<b>Step 7</b>	<b>encapsulation dot1Q</b> <i>vlan-id</i> <b>Example:</b> switch(config-subif) # <b>encapsulation dot1Q 100</b>	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> switch(config-subif) # <b>medium p2p</b>	Configures the interface medium as point to point.
<b>Step 9</b>	<b>ip unnumbered</b> <i>type number</i> <b>Example:</b> switch(config-if) # <b>ip unnumbered 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> .
<b>Step 10</b>	<b>ip router isis</b> <i>area-tag</i> <b>Example:</b> switch(config-subif) # <b>ip router isis 100</b>	Enables ISIS on the unnumbered interface.
<b>Step 11</b>	<b>no shutdown</b> <b>Example:</b> switch(config-subif) # <b>no shutdown</b>	Brings up the interface (administratively).

## Configuring SVI TCAM Region

Beginning Cisco NX-OS Release 9.3(3), you can display Layer 3 statistics on SVI interfaces on Cisco Nexus 3100 Series switches. You can change the size of the SVI ternary content addressable memory (TCAM) regions in the hardware to display the Layer 3 incoming unicast counters on SVI interfaces.

### SUMMARY STEPS

1. **hardware profile tcam region** {**arpacl** | **e-racl**} | **ifacl** | **nat** | **qos**} |**qoslbl** | **racl**} | **vacl** | **svi** } *tcam\_size*
2. **copy running-config startup-config**
3. switch(config)# **show hardware profile tcam region**
4. switch(config)# **reload**

### DETAILED STEPS

	Command or Action	Purpose
<b>Step 1</b>	<b>hardware profile tcam region</b> { <b>arpacl</b>   <b>e-racl</b> }   <b>ifacl</b>   <b>nat</b>   <b>qos</b> }   <b>qoslbl</b>   <b>racl</b> }   <b>vacl</b>   <b>svi</b> } <i>tcam_size</i>	Changes the ACL TCAM region size.  • <b>arpacl</b> —Configures the size of the Address Resolution Protocol (ARP) ACL (ARPA) TCAM region.

	Command or Action	Purpose
		<ul style="list-style-type: none"> <li>• <b>e-racl</b>—Configures the size of the egress router ACL (ERACL) TCAM region.</li> <li>• <b>e-vacl</b>—Configures the size of the egress VLAN ACL (EVACL) TCAM region.</li> <li>• <b>ifacl</b>—Configures the size of the interface ACL (ifacl) TCAM region. The maximum number of entries is 1500.</li> <li>• <b>nat</b>—Configures the size of the NAT TCAM region.</li> <li>• <b>qos</b>—Configures the size of the quality of service (QoS) TCAM region.</li> <li>• <b>qoslbl</b>—Configures the size of the QoS Label (qoslbl) TCAM region.</li> <li>• <b>racl</b>—Configures the size of the router ACL (RACL) TCAM region.</li> <li>• <b>vacl</b>—Configures the size of the VLAN ACL (VACL) TCAM region.</li> <li>• <i>svi</i>—Configures the size of the SVI TCAM region. The default size of SVI TCAM size is 0.</li> <li>• <i>tcam_size</i>—TCAM size. The range is from 0 to 2,14,74, 83, 647 entries.</li> </ul> <p><b>Note</b>      <b>vacl</b> and <b>e-vacl</b> TCAM regions should be set to the same size.</p>
<b>Step 2</b>	<p><b>copy running-config startup-config</b></p> <p><b>Example:</b></p> <pre>switch(config)# copy running-config startup-config</pre>	<p>Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.</p>
<b>Step 3</b>	<p>switch(config)# <b>show hardware profile tcam region</b></p> <p><b>Example:</b></p> <pre>switch(config)# show hardware profile tcam region</pre>	<p>Displays the TCAM sizes that will be applicable on the next reload of the switch.</p>
<b>Step 4</b>	<p>switch(config)# <b>reload</b></p> <p><b>Example:</b></p> <pre>switch(config)# reload</pre>	<p>Copies the running configuration to the startup configuration.</p> <p><b>Note</b>      The new size values are effective only upon the next reload after saving the <b>copy running-config to startup-config</b>.</p>

### Example

The following example shows how to change the size of the SVI TCAM region:

```
switch(config)# hardware profile tcam region svi 256
[SUCCESS] New tcam size will be applicable only at boot time.
You need to 'copy run start' and 'reload'
```

```
switch(config)# copy running-config startup-config
switch(config)# reload
WARNING: This command will reboot the system
Do you want to continue? (y/n) [n] y
```

## Assigning an Interface to a VRF

You can add a Layer 3 interface to a VRF.

### SUMMARY STEPS

1. **configure terminal**
2. **interface** *interface-type number*
3. **vrf member** *vrf-name*
4. **ip address** *ip-prefix/length*
5. **show vrf** [*vrf-name*] **interface** *interface-type number*
6. **copy running-config startup-config**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b>  <b>Example:</b> switch# <b>configure terminal</b> switch(config)#	Enters configuration mode.
Step 2	<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.
Step 3	<b>vrf member</b> <i>vrf-name</i>  <b>Example:</b> switch(config-if)# <b>vrf member RemoteOfficeVRF</b>	Adds this interface to a VRF.
Step 4	<b>ip address</b> <i>ip-prefix/length</i>  <b>Example:</b> switch(config-if)# <b>ip address 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.



	Command or Action	Purpose
Step 5	<b>show vrf</b> [ <i>vrf-name</i> ] <b>interface</b> <i>interface-type number</i> <b>Example:</b> <pre>switch(config-vrf)# show vrf Enterprise interface loopback 0</pre>	(Optional) Displays VRF information.
Step 6	<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 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

You can configure a MAC-embedded IPv6 (MEv6) address.

### SUMMARY STEPS

1. **configure terminal**
2. **interface** *type slot/port*
3. **no switchport**
4. **mac-address ipv6-extract**
5. **ipv6 address** *ip-address/length*
6. **ipv6 nd mac-extract** [**exclude nud-phase**]
7. (Optional) **show ipv6 icmp interface** *type slot/port*
8. (Optional) **copy running-config startup-config**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	<b>interface</b> <i>type slot/port</i> <b>Example:</b>	Enters the interface configuration mode for the specified interface.

	Command or Action	Purpose
	<pre>switch(config)# interface ethernet 1/3 switch(config-if)#</pre>	
<b>Step 3</b>	<p><b>no switchport</b></p> <p><b>Example:</b></p> <pre>switch(config-if)# no switchport</pre>	<p>Configures the interface as a Layer 3 interface and deletes any configuration specific to Layer 2 on this interface.</p> <p><b>Note</b> To convert a Layer 3 interface back into a Layer 2 interface, use the <b>switchport</b> command.</p>
<b>Step 4</b>	<p><b>mac-address ipv6-extract</b></p> <p><b>Example:</b></p> <pre>switch(config-if)# mac-address ipv6-extract</pre>	<p>Extracts the MAC address embedded in the IPv6 address configured on the interface.</p> <p><b>Note</b> The MEv6 configuration is currently not supported with the EUI-64 format of IPv6 address.</p>
<b>Step 5</b>	<p><b>ipv6 address ip-address/length</b></p> <p><b>Example:</b></p> <pre>switch(config-if)# ipv6 address 2002:1::10/64</pre>	<p>Configures an IPv6 address for this interface.</p>
<b>Step 6</b>	<p><b>ipv6 nd mac-extract [exclude nud-phase]</b></p> <p><b>Example:</b></p> <pre>switch(config-if)# ipv6 nd mac-extract</pre>	<p>Extracts the next-hop MAC address embedded in a next-hop IPv6 address.</p> <p>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.</p>
<b>Step 7</b>	<p>(Optional) <b>show ipv6 icmp interface type slot/port</b></p> <p><b>Example:</b></p> <pre>switch(config-if)# show ipv6 icmp interface ethernet 1/3</pre>	<p>Displays IPv6 Internet Control Message Protocol version 6 (ICMPv6) interface information.</p>
<b>Step 8</b>	<p>(Optional) <b>copy running-config startup-config</b></p> <p><b>Example:</b></p> <pre>switch(config-if)# copy running-config startup-config</pre>	<p>Copies the running configuration to the startup configuration.</p>

### 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

### SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **interface ethernet** *type slot/port* | **mgmt** *mgmt-interface-number* | **vlan** *vlan id*
3. switch(config-if)# [**no**] **ipv6 address use-link-local-only**
4. switch(config-if)# [**no**] [**ip** | **ipv6**] **address dhcp**
5. (Optional) switch(config)# **copy running-config startup-config**

### DETAILED STEPS

	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.  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
```

## Configuring SVI and Subinterface Ingress/Egress Unicast Counters

Beginning Cisco NX-OS Release 9.3(3), SVI and subinterface unicast counters are supported on Cisco Nexus 9300-EX, 9300-FX/FX2 switches; and Cisco Nexus 9500 series switches with X9700-EX and X9700-FX line cards. Beginning Cisco NX-OS Release 9.3(5), SVI and subinterface unicast counters are supported on Cisco Nexus N9K-C9316D-GX, N9K-C93600CD-GX, N9K-C9364C-GX switches.



**Note** Enabling this feature disables VxLAN, MPLS, Tunnel, Multicast, and ERSPAN counters. Reload the switch for the changes to take effect.



**Note** For a vPC setup, the **peer-gateway** feature must be enabled under the **vpc domain** on both vPC peers. Otherwise, SVI counters may be inconsistent.

To configure SVI and subinterface ingress and/or egress unicast counters on a device, follow these steps:

### SUMMARY STEPS

1. **configure terminal**
2. **[no] hardware profile svi-and-si flex-stats-enable**
3. **copy running-config startup-config**
4. **reload**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	<b>[no] hardware profile svi-and-si flex-stats-enable</b> <b>Example:</b> <pre>switch(config)# hardware profile svi-and-si flex-stats-enable switch(config-if)#</pre>	Configures the ingress/egress unicast counters on SVI and subinterface. <b>Note</b> You must save the configuration and reload the switch for this command to work.

	Command or Action	Purpose
<b>Step 3</b>	<b>copy running-config startup-config</b> <b>Example:</b> <pre>switch(config-if)# copy running-config startup-config</pre>	Saves this configuration.
<b>Step 4</b>	<b>reload</b> <b>Example:</b> <pre>switch(config-if)# reload</pre>	Reload the switch.

## Configuring Subinterface Multicast and Broadcast Counters

Beginning Cisco NX-OS Release 9.3(6), subinterface multicast and broadcast counters are supported on Cisco Nexus N9K-C9336C-FX2 and N9K-C93240YC-FX2 switches.

To configure multicast and broadcast counters on a device, follow these steps:

### SUMMARY STEPS

1. **configure terminal**
2. **[no] hardware profile sub-interface flex-stats**
3. **copy running-config startup-config**
4. **reload**

### DETAILED STEPS

	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>[no] hardware profile sub-interface flex-stats</b> <b>Example:</b> <pre>switch(config)# hardware profile sub-interface flex-stats switch(config-if)#</pre>	Enables subinterface flex stats for multicast and broadcast counters.
<b>Step 3</b>	<b>copy running-config startup-config</b> <b>Example:</b> <pre>switch(config-if)# copy running-config startup-config</pre>	Saves this configuration.
<b>Step 4</b>	<b>reload</b> <b>Example:</b> <pre>switch(config-if)# reload</pre>	Reload the switch.

**Example**

The following example displays the subinterface multicast and broadcast counters as a result of show interface counters command:

```
switch(config)# show int ethernet 1/31/4.1 counters
```

Port	InOctets	InUcastPkts
Eth1/31/4.1	0	0

Port	InMcastPkts	InBcastPkts
Eth1/31/4.1	0	0

Port	InIPv4Octets	InIPv4UcastPkts
Eth1/31/4.1	0	0

Port	InIPv4McastPkts	InIPv4BcastPkts
Eth1/31/4.1	0	0

Port	InIPv6Octets	InIPv6UcastPkts
Eth1/31/4.1	0	0

Port	InIPv6McastPkts	InIPv6BcastPkts
Eth1/31/4.1	0	0

Port	OutOctets	OutUcastPkts
Eth1/31/4.1	0	0

Port	OutMcastPkts	OutBcastPkts
Eth1/31/4.1	0	0

Port	OutIPv4Octets	OutIPv4UcastPkts
Eth1/31/4.1	0	0

Port	OutIPv4McastPkts	OutIPv4BcastPkts
Eth1/31/4.1	0	0

Port	OutIPv6Octets	OutIPv6UcastPkts
Eth1/31/4.1	0	0

Port	OutIPv6McastPkts	OutIPv6BcastPkts
Eth1/31/4.1	0	0

-----  
Eth1/31/4.1

0

0

## Configuring Hardware Forwarded IPv4/IPv6 Interface Statistics

Beginning Cisco NX-OS Release 10.1(1) the **hardware forwarding ip statistics** command can be used to enable the device to export hardware forwarded IPv4/IPv6 interface statistics (interface IPv4 and IPv6 Rx and Tx packets and byte counter ) when **ipIfStatsTable** is polled through SNMP. By default Cisco NX-OS exports only IPv4/IPv6 interface counters for the packets forwarded by IPv4/IPv6 Netstack software running on the SUP CPU.

Beginning Cisco NX-OS Release 10.1(1), IPv4/IPv6 MIB Support is available on the following platforms/line cards: N9K-X9736C-FX, N9K-X9736Q-FX, N9K-X9788TC-FX, N9K-X9788TC2-FX, N9K-X97284YC-FX, N9K-C93180YC-FX, N9K-C93180YC2-FX, N9K-C93108TC-FX, N9K-C93108TC2-FX, N9K-X9732C-FX, N9K-C92348GC.

The following are the supported object identifiers (OIDs) :

- ipIfStatsInReceives
- ipIfStatsOutTransmits
- ipIfStatsOutOctets
- ipIfStatsInOctets
- ipIfStatsHCInReceives
- ipIfStatsHCOutTransmits
- ipIfStatsHCOutOctets
- ipIfStatsHCInOctets

Hardware forwarded IP interface statistics feature has the following restrictions:

- This feature does not work on a physical interface which has more than 7 sub-interfaces.
- Specified **ipIfStatsTable** counters are only supported with front panel ethernet interfaces.
- All object identifiers (OIDs) other than supported OIDs is set to zero in the **ipIfStatsTable**.
- There is no option to clear or reset the counters.
- Maximum number of supported L3-physical-interfaces per slice is 62.

To configure **hardware forwarding ip statistics** on a device, follow these steps:

### SUMMARY STEPS

1. **configure terminal**
2. **[no] hardware forwarding ip statistics**
3. **hardware access-list tcam region ing-ctacl 512**
4. **hardware access-list tcam region egr-ctacl 512**
5. **hardware access-list tcam region ing-racl 512**
6. **hardware access-list tcam region egr-racl 512**



7. copy running-config startup-config
8. reload

#### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>configure terminal</b> <b>Example:</b> <pre>switch# configure terminal switch(config)#</pre>	Enters global configuration mode.
Step 2	<b>[no] hardware forwarding ip statistics</b> <b>Example:</b> <pre>switch(config)# hardware forwarding ip statistics</pre>	Configures hardware forwarded IPv4/IPv6 interface statistics.
Step 3	<b>hardware access-list tcam region ing-cntacl 512</b> <b>Example:</b> <pre>switch(config)# hardware access-list tcam region ing-cntacl 512</pre>	Configures ACL TCAM carving and the size of the ingress IP or MAC port TCAM region.
Step 4	<b>hardware access-list tcam region egr-cntacl 512</b> <b>Example:</b> <pre>switch(config)# hardware access-list tcam region egr-cntacl 512</pre>	Configures ACL TCAM carving and the size of the egress IP or MAC port TCAM region.
Step 5	<b>hardware access-list tcam region ing-racl 512</b> <b>Example:</b> <pre>switch(config)# hardware access-list tcam region ing-racl 512</pre>	Configures the size of the ingress IP router ACL (RACL) TCAM region.
Step 6	<b>hardware access-list tcam region egr-racl 512</b> <b>Example:</b> <pre>switch(config)# hardware access-list tcam region egr-racl 512</pre>	Configures the size of the egress IP router ACL (RACL) TCAM region.
Step 7	<b>copy running-config startup-config</b> <b>Example:</b> <pre>switch(config)# copy running-config startup-config</pre>	Saves this configuration.
Step 8	<b>reload</b> <b>Example:</b> <pre>switch(config)# reload</pre>	Reload the switch.

## Verifying the Layer 3 Interfaces Configuration

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

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

Command	Purpose
<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.
<b>show interface ethernet errors</b> <i>slot/port</i> <b>detailed</b> [ <b>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</b> <i>slot/port</i> <b>counters errors</b>	Displays the Layer 3 interface input and output errors.
<b>show interface ethernet errors</b> <i>slot/port</i> <b>counters snmp</b>	Displays the Layer 3 interface counters reported by SNMP MIBs.
<b>show interface ethernet</b> <i>slot/port.number</i> <b>counters</b>	Displays the subinterface statistics (unicast, multicast, and broadcast).
<b>show interface port-channel</b> <i>channel-id.number</i> <b>counters</b>	Displays the port-channel subinterface statistics (unicast, multicast, and broadcast).
<b>show interface loopback</b> <i>number</i> <b>counters</b>	Displays the loopback interface input and output counters (unicast, multicast, and broadcast).
<b>show interface loopback</b> <i>number</i> <b>detailed</b> [ <b>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</b> <i>number</i> <b>counters errors</b>	Displays the loopback interface input and output errors.
<b>show interface vlan</b> <i>number</i> <b>counters</b>	Displays the VLAN interface input and output counters (unicast, multicast, and broadcast).

Command	Purpose
<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>