



# Configuring Layer 3 Interfaces

---

This chapter contains the following sections:

- [Information About Layer 3 Interfaces, page 1](#)
- [Licensing Requirements for Layer 3 Interfaces, page 4](#)
- [Guidelines and Limitations for Layer 3 Interfaces, page 4](#)
- [Default Settings for Layer 3 Interfaces, page 4](#)
- [Configuring Layer 3 Interfaces, page 4](#)
- [Verifying the Layer 3 Interfaces Configuration, page 9](#)
- [Monitoring Layer 3 Interfaces, page 10](#)
- [Configuration Examples for Layer 3 Interfaces, page 11](#)
- [Related Documents for Layer 3 Interfaces, page 12](#)
- [MIBs for Layer 3 Interfaces, page 12](#)
- [Standards for Layer 3 Interfaces, page 12](#)
- [Feature History for Layer 3 Interfaces, page 13](#)

## Information 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 Layer 2 (switchports) by default. You can change this default behavior using the **no switchport** command from interface configuration mode. To change multiple ports at one time, you can specify a range of interfaces and then apply the **no switchport** command.

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

You can assign a static MAC address to a Layer 3 interface. For information on configuring MAC addresses, see the *Cisco Nexus 3000 Series NX-OS Layer 2 Switching Configuration Guide*.

You can also create a Layer 3 port channel from routed interfaces.

Routed interfaces and subinterfaces 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 or a port channel.

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.

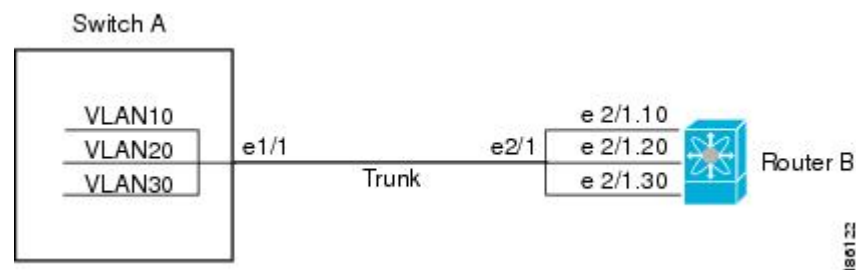
You create a subinterface with a name that consists of the parent interface name (for example, Ethernet 2/1) followed by a period and then by a number that is unique for that subinterface. For example, you could create a subinterface for Ethernet interface 2/1 named Ethernet 2/1.1 where .1 indicates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

**Figure 1: Subinterfaces for VLANs**



## VLAN Interfaces

A VLAN interface or a 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 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 3000 NX-OS System Management Configuration Guide* for information on rollbacks and checkpoints.

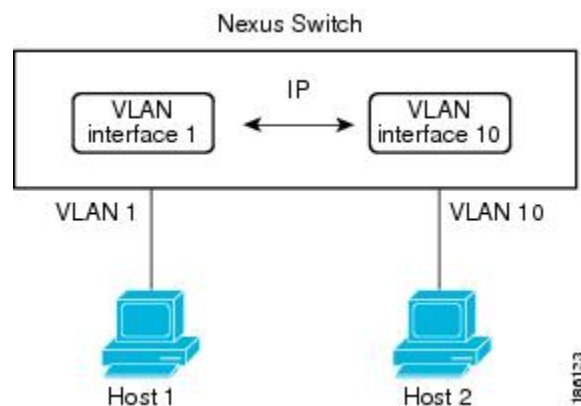


**Note** You cannot delete the VLAN interface for VLAN 1.

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 on IP addresses and IP routing, see the *Cisco Nexus 3000 Series NX-OS Unicast Routing Configuration Guide*.

The 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**



## Loopback Interfaces

A loopback interface is a virtual interface with a single endpoint that is always up. Any packet that is transmitted over a loopback interface is immediately received by this interface. Loopback interfaces emulate a physical interface.

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.

## Tunnel Interfaces

Cisco Nexus 3000 Series devices do not support tunnel interfaces.

## Licensing Requirements for Layer 3 Interfaces

This feature does not require a license. Any feature not included in a license package is bundled with the Cisco NX-OS system images and is provided at no extra charge to you. For a complete explanation of the Cisco NX-OS licensing scheme, see the *Cisco NX-OS Licensing Guide*.

## Guidelines and Limitations for Layer 3 Interfaces

Layer 3 interfaces have the following configuration guidelines and limitations:

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

## Default Settings for Layer 3 Interfaces

The default setting for the Layer 3 Admin state is Shut.

## Configuring Layer 3 Interfaces

### Configuring a Routed Interface

#### 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 slot/port</b>	Enters interface configuration mode.
<b>Step 3</b>	switch(config-if)# <b>no switchport</b>	Configures the interface as a Layer 3 interface and deletes any configuration specific to Layer 2 on this interface.

	Command or Action	Purpose
		<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>	switch(config-if)# <b>[ip   ipv6]</b> <i>]ip-address/length</i>	Configures an IPv4 or IPv6 address for this interface.
<b>Step 5</b>	switch(config-if)# <b>medium</b> { <b>broadcast   p2p</b> }	(Optional) Configures the interface medium as either point to point or broadcast.  <b>Note</b> The default setting is broadcast, and this setting does not appear in any of the <b>show</b> commands. However, if you do change the setting to <b>p2p</b> , you will see this setting when you enter the <b>show running-config</b> command.
<b>Step 6</b>	switch(config-if)# <b>show interfaces</b>	(Optional) Displays the Layer 3 interface statistics.
<b>Step 7</b>	switch(config-if)# <b>copy</b> <b>running-config startup-config</b>	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

This example shows how to configure an IPv4 routed Layer 3 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
```

## Configuring a Subinterface

### Before You Begin

- Configure the parent interface as a routed interface.
- Create the port-channel interface if you want to create a subinterface on that port channel.

### Procedure

	Command or Action	Purpose
<b>Step 1</b>	switch(config-if)# <b>copy</b> <b>running-config startup-config</b>	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

	Command or Action	Purpose
<b>Step 2</b>	switch(config)# <b>interface ethernet</b> <i>slot/port.number</i>	Enters interface configuration mode. The range for the <i>slot</i> is from 1 to 255. The range for the <i>port</i> is from 1 to 128.
<b>Step 3</b>	switch(config-if)# [ <b>ip   ipv6</b> ] <b>address</b> <i>ip-address/length</i>	Configures an IPv4 or IPv6 address for this interface.
<b>Step 4</b>	switch(config-if)# <b>encapsulation</b> <b>dot1Q</b> <i>vlan-id</i>	Configures IEEE 802.1Q VLAN encapsulation on the subinterface. The range for the <i>vlan-id</i> is from 2 to 4093.
<b>Step 5</b>	switch(config-if)# <b>show interfaces</b>	(Optional) Displays the Layer 3 interface statistics.
<b>Step 6</b>	switch(config-if)# <b>copy</b> <b>running-config startup-config</b>	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

This example shows how to configure an IPv4 routed Layer 3 interface:

```
switch# configure terminal
switch(config)# interface ethernet 2/1
switch(config-if)# ip address 192.0.2.1/8
switch(config-if)# encapsulation dot1Q 33
switch(config-if)# copy running-config startup-config
```

## Configuring the Bandwidth on an Interface

You can configure the bandwidth for a routed interface, port channel, or subinterface.

### 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</b> <b>ethernet</b> <i>slot/port</i>	Enters interface configuration mode. The range for the <i>slot</i> is from 1 to 255. The range for the <i>port</i> is from 1 to 128.
<b>Step 3</b>	switch(config-if)# <b>bandwidth</b> [ <i>value</i>   <b>inherit</b> [ <i>value</i> ]]	Configures the bandwidth parameter for a routed interface, port channel, or subinterface, as follows: <ul style="list-style-type: none"> <li>• <i>value</i>—Size of the bandwidth in kilobytes. The range is from 1 to 10000000.</li> <li>• <b>inherit</b>—Indicates that all subinterfaces of this interface inherit either the bandwidth value (if a value is specified) or the bandwidth of the parent interface (if a value is not specified).</li> </ul>

	Command or Action	Purpose
<b>Step 4</b>	switch(config-if)# <b>copy running-config startup-config</b>	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

This example shows how to configure Ethernet interface 2/1 with a bandwidth value of 80000:

```
switch# configure terminal
switch(config)# interface ethernet 2/1
switch(config-if)# bandwidth 80000
switch(config-if)# copy running-config startup-config
```

## Configuring a VLAN Interface

### 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>feature interface-vlan</b>	Enables VLAN interface mode.
<b>Step 3</b>	switch(config)# <b>interface vlan number</b>	Creates a VLAN interface. The <i>number</i> range is from 1 to 4094.
<b>Step 4</b>	switch(config-if)# [ <b>ip   ipv6</b> ] <b>address ip-address/length</b>	Configures an IPv4 or IPv6 address for this interface.
<b>Step 5</b>	switch(config-if)# <b>show interface vlan number</b>	(Optional) Displays the VLAN interface statistics. The <i>number</i> range is from 1 to 4094.
<b>Step 6</b>	switch(config-if)# <b>copy running-config startup-config</b>	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

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
```

## Configuring a Loopback Interface

### 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>	switch# <b>configure terminal</b>	Enters global configuration mode.
<b>Step 2</b>	switch(config)# <b>interface loopback</b> <i>instance</i>	Creates a loopback interface. The <i>instance</i> range is from 0 to 1023.
<b>Step 3</b>	switch(config-if)# [ <b>ip   ipv6</b> ] <b>address</b> <i>ip-address/length</i>	Configures an IPv4 or IPv6 address for this interface.
<b>Step 4</b>	switch(config-if)# <b>show interface</b> <b>loopback</b> <i>instance</i>	(Optional) Displays the loopback interface statistics. The <i>instance</i> range is from 0 to 1023.
<b>Step 5</b>	switch(config-if)# <b>copy running-config</b> <b>startup-config</b>	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

This example shows how to create a loopback interface:

```
switch# configure terminal
switch(config)# interface loopback 0
switch(config-if)# ip address 192.0.2.100/8
switch(config-if)# copy running-config startup-config
```

## Assigning an Interface to a VRF

### 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</b> <i>interface-typenumber</i>	Enters interface configuration mode.
<b>Step 3</b>	switch(config-if)# <b>vrf member</b> <i>vrf-name</i>	Adds this interface to a VRF.



	Command or Action	Purpose
<b>Step 4</b>	switch(config-if)# <b>ip   ipv6</b> <i>ip-address/length</i>	Configures an IP address for this interface. You must do this step after you assign this interface to a VRF.
<b>Step 5</b>	switch(config-if)# <b>show vrf</b> [ <i>vrf-name</i> ] <b>interface</b> <i>interface-type number</i>	(Optional) Displays VRF information.
<b>Step 6</b>	switch(config-if)# <b>show interfaces</b>	(Optional) Displays the Layer 3 interface statistics.
<b>Step 7</b>	switch(config-if)# <b>copy running-config startup-config</b>	(Optional) Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

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
```

## Verifying the Layer 3 Interfaces Configuration

Use one of the following commands to verify the configuration:

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 brief</i>	Displays the Layer 3 interface operational status.
<b>show interface ethernet</b> <i>slot/port capabilities</i>	Displays the Layer 3 interface capabilities, including port type, speed, and duplex.
<b>show interface ethernet</b> <i>slot/port description</i>	Displays the Layer 3 interface description.
<b>show interface ethernet</b> <i>slot/port status</i>	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).

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>private-vlan mapping</b>	Displays the VLAN interface private VLAN information.
<b>show interface vlan</b> <i>number</i> <b>status</b>	Displays the VLAN interface administrative status and protocol status.

## Monitoring Layer 3 Interfaces

Use one of the following commands to display statistics about the feature:

Command	Purpose
<b>load-</b> <b>interval</b> { <i>interval seconds</i> { <b>1</b>   <b>2</b>   <b>3</b> }}	Sets 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 <i>slot/port</i> counters 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 <i>slot/port</i> counters error</b>	Displays the Layer 3 interface input and output errors.
<b>show interface ethernet <i>slot/port</i> counters snmp</b>	Displays the Layer 3 interface counters reported by SNMP MIBs. You cannot clear these counters.
<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> counters 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>counters</i> snmp</b>	Displays the VLAN interface counters reported by SNMP MIBs. You cannot clear these counters.

## Configuration Examples for Layer 3 Interfaces

This example shows how to configure Ethernet subinterfaces:

```
switch# configuration terminal
switch(config)# interface ethernet 2/1.10
switch(config-if)# no switchport
switch(config-if)# description Layer 3 for VLAN 10
switch(config-if)# encapsulation dot1q 10
switch(config-if)# ip address 192.0.2.1/8
switch(config-if)# copy running-config startup-config
```

This example shows how to configure a VLAN interface:

```
switch# configuration terminal
switch(config)# interface vlan 100
switch(config-if)# no switchport
switch(config-if)# ipv6 address 33:0DB::2/8
switch(config-if)# copy running-config startup-config
```

This example shows how to configure a loopback interface:

```
switch# configuration terminal
switch(config)# interface loopback 3
switch(config-if)# no switchport
switch(config-if)# ip address 192.0.2.2/32
switch(config-if)# copy running-config startup-config
```

## Related Documents for Layer 3 Interfaces

Related Topics	Document Title
Command syntax	<i>Cisco Nexus 3000 Series Command Reference</i>
IP	“Configuring IP” chapter in the <i>Cisco Nexus 3000 Series NX-OS Unicast Routing Configuration Guide</i>
VLAN	“Configuring VLANs” chapter in the <i>Cisco Nexus 3000 Series NX-OS Layer 2 Switching Configuration Guide</i>

## MIBs for Layer 3 Interfaces

MIB	MIB Link
IF-MIB	To locate and download MIBs, go to the following URL: <a href="http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml">http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml</a>
CISCO-IF-EXTENSION-MIB	
ETHERLIKE-MIB	

## Standards for Layer 3 Interfaces

No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.

## Feature History for Layer 3 Interfaces

Feature Name	Release	Feature Information
<b>show interface vlan <i>vlan-id</i> counters</b> command	5.0(3)U3(1)	The <b>show interface vlan <i>vlan-id</i> counters</b> command has been enhanced to correctly show input and output packet counts.

