



Configuring Layer 3 Interfaces

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Information About Layer 3 Interfaces

Layer 3 interfaces forward 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. The default MAC address for a Layer 3 interface is the address of the virtual device context (VDC) that is associated with it. You can change the default MAC address by using the **mac-address** command from the interface configuration mode. A static MAC address can be configured on SVI, Layer 3 interfaces, port channels, Layer 3 subinterfaces, and tunnel interfaces. You can also configure static MAC addresses on a range of ports and port channels. However, all ports must be in the Layer 3 interface. Even if one of the ports is in the range of ports is in Layer 2, the command will be

rejected, and an error message appears. For information on configuring MAC addresses, see Layer 2 Switching Configuration Guide for your device.

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.

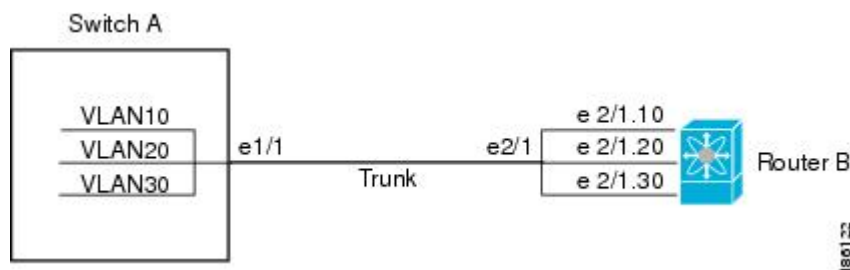
You create a subinterface with a name that consists of the parent interface name (for example, Ethernet 2/1) followed by a period and then by a number that is unique for that subinterface. For example, you could create a subinterface for Ethernet interface 2/1 named Ethernet 2/1.1 where .1 indicates 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 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 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. For information about rollbacks and checkpoints, see the System Management Configuration Guide for your device.

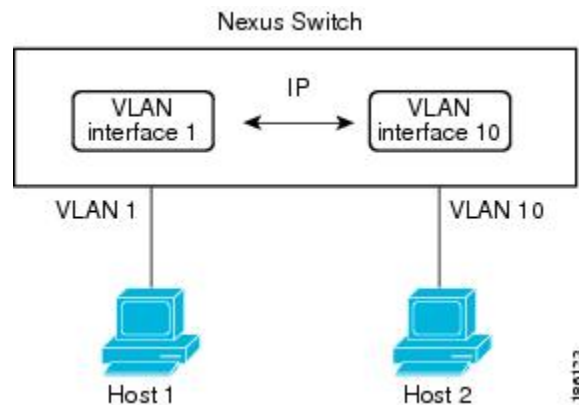


Note You cannot delete the VLAN interface for VLAN 1.

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 Unicast Routing Configuration Guide for your device.

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



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.

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.
- When you set a user-defined MAC limit using the **mac address-table limit** <16-256> user-defined command, the FHRP group limit is automatically adjusted to make the total user defined MAC limits and the FHRP limits to 490. For example, if you set the user defined MAC limit as 100, the FHRP limit gets reduced to 390.
- Beginning Cisco NX-OS Release 9.3(7), you can configure a user-defined MAC address limit between the range of 16–256.

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

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **interface ethernet slot/port**
3. switch(config-if)# **no switchport**
4. switch(config-if)# **ipip-address/length**
5. (Optional) switch(config-if)# **medium {broadcast | p2p}**
6. (Optional) switch(config-if)# **show interfaces**
7. (Optional) switch(config-if)# **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface ethernet slot/port	Enters interface configuration mode.
Step 3	switch(config-if)# no switchport	Configures the interface as a Layer 3 interface and deletes any configuration specific to Layer 2 on this interface.

	Command or Action	Purpose
		Note To convert a Layer 3 interface back into a Layer 2 interface, use the switchport command.
Step 4	switch(config-if)# ip <i>address/length</i>	Configures an IP address for this interface.
Step 5	(Optional) switch(config-if)# medium { broadcast p2p }	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.
Step 6	(Optional) switch(config-if)# show interfaces	Displays the Layer 3 interface statistics.
Step 7	(Optional) switch(config-if)# copy running-config startup-config	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

Example

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.

SUMMARY STEPS

1. (Optional) switch(config-if)# **copy running-config startup-config**
2. switch(config)# **interface ethernet** *slot/port.number*
3. switch(config-if)# **ip address** *ip-address/length*
4. switch(config-if)# **encapsulation dot1Q** *vlan-id*
5. (Optional) switch(config-if)# **show interfaces**
6. (Optional) switch(config-if)# **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	(Optional) switch(config-if)# copy running-config startup-config	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.
Step 2	switch(config)# interface ethernet <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.
Step 3	switch(config-if)# ip address <i>ip-address/length</i>	Configures an IP address for this interface.
Step 4	switch(config-if)# encapsulation dot1Q <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.
Step 5	(Optional) switch(config-if)# show interfaces	Displays the Layer 3 interface statistics.
Step 6	(Optional) switch(config-if)# copy running-config startup-config	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

Example

This example shows how to create a subinterface:

```
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.

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **interface ethernet** *slot/port*
3. switch(config-if)# **bandwidth** [*value* | **inherit** [*value*]]
4. (Optional) switch(config-if)# **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface ethernet <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.

	Command or Action	Purpose
Step 3	switch(config-if)# bandwidth [<i>value</i> inherit [<i>value</i>]]	Configures the bandwidth parameter for a routed interface, port channel, or subinterface, as follows: <ul style="list-style-type: none"> • value—Size of the bandwidth in kilobytes. The range is from 1 to 10000000. • inherit—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).
Step 4	(Optional) switch(config-if)# copy running-config startup-config	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

Example

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

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **feature interface-vlan**
3. switch(config)# **interface vlan** *number*
4. switch(config-if)# **ip address** *ip-address/length*
5. switch(config-if)# **no shutdown**
6. (Optional) switch(config-if)# **show interface vlan** *number*
7. (Optional) switch(config-if)# **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# feature interface-vlan	Enables VLAN interface mode.
Step 3	switch(config)# interface vlan <i>number</i>	Creates a VLAN interface. The <i>number</i> range is from 1 to 4094.
Step 4	switch(config-if)# ip address <i>ip-address/length</i>	Configures an IP address for this interface.

	Command or Action	Purpose
Step 5	switch(config-if)# no shutdown	Brings the interface up administratively.
Step 6	(Optional) switch(config-if)# show interface vlan <i>number</i>	Displays the VLAN interface statistics. The <i>number</i> range is from 1 to 4094.
Step 7	(Optional) switch(config-if)# copy running-config startup-config	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

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
```

Configuring a Loopback Interface

Before you begin

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

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **interface loopback** *instance*
3. switch(config-if)# **ip address** *ip-address/length*
4. (Optional) switch(config-if)# **show interface loopback** *instance*
5. (Optional) switch(config-if)# **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface loopback <i>instance</i>	Creates a loopback interface. The <i>instance</i> range is from 0 to 1023.
Step 3	switch(config-if)# ip address <i>ip-address/length</i>	Configures an IP address for this interface.
Step 4	(Optional) switch(config-if)# show interface loopback <i>instance</i>	Displays the loopback interface statistics. The <i>instance</i> range is from 0 to 1023.

	Command or Action	Purpose
Step 5	(Optional) switch(config-if)# copy running-config startup-config	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

Example

This example shows how to create a loopback interface:

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

Assigning an Interface to a VRF

Before you begin

Assign the IP address for a tunnel interface after you have configured the interface for a VRF.

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **interface** *interface-typenumber*
3. switch(config-if)# **vrf member** *vrf-name*
4. switch(config-if)# **ip** *ip-address/length*
5. (Optional) switch(config-if)# **show vrf** [*vrf-name*] **interface** *interface-type number*
6. (Optional) switch(config-if)# **show interfaces**
7. (Optional) switch(config-if)# **copy running-config startup-config**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface <i>interface-typenumber</i>	Enters interface configuration mode.
Step 3	switch(config-if)# vrf member <i>vrf-name</i>	Adds this interface to a VRF.
Step 4	switch(config-if)# ip <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.
Step 5	(Optional) switch(config-if)# show vrf [<i>vrf-name</i>] interface <i>interface-type number</i>	Displays VRF information.
Step 6	(Optional) switch(config-if)# show interfaces	Displays the Layer 3 interface statistics.

	Command or Action	Purpose
Step 7	(Optional) switch(config-if)# copy running-config startup-config	Saves the change persistently through reboots and restarts by copying the running configuration to the startup configuration.

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 an Interface MAC Address and Limit

Before you begin

You can configure a static MAC address on SVI, Layer 3 interfaces, port channels, Layer 3 subinterfaces, and tunnel interfaces. You can also configure static MAC addresses on a range of ports and port channels.

By default, the maximum MAC addresses that can be configured on a switch is 16. However, you can change this limit and set it to a range of MAC addresses between 16–256.



Note When vPC peer-gateway is enabled, the configured limit includes user-defined mac-addresses configured locally and which are configured on the VLAN interfaces (SVI) of the vPC peer device, which is synced. While configuring user-defined mac-address on a VLAN interface (SVI), ensure that the vPC peer device has not exhausted the configured user-defined mac-address limit.

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **interface ethernet** *slot/port*
3. switch(config-if)# **[no] mac-address** *static router MAC address*
4. switch(config-if)# **show interface ethernet** *slot/port*
5. switch(config)# **mac address-table limit** *16-256 user-defined*
6. switch(config)# **show mac address-table limit user-defined**

SUMMARY STEPS

1. switch# **configure terminal**
2. switch(config)# **interface ethernet** *slot/port*
3. switch(config-if)# **[no]mac-address** *static router MAC address*
4. switch(config-if)# **show interface ethernet** *slot/port*

5. switch(config-if)# **mac address-table limit 16-256 user-defined**
6. (Optional) switch(config-if)# **show mac address-table limit user-defined**

DETAILED STEPS

	Command or Action	Purpose
Step 1	switch# configure terminal	Enters global configuration mode.
Step 2	switch(config)# interface ethernet slot/port	Enters interface configuration mode.
Step 3	switch(config-if)# [no]mac-address static router MAC address	<p>Configures the interface MAC address. The no form removes the configuration. You can enter the MAC address in any one of the four supported formats:</p> <ul style="list-style-type: none"> • E.E.E • EE-EE-EE-EE-EE-EE • EE:EE:EE:EE:EE:EE • EEEE.EEEE.EEEE <p>Do not enter any of the following invalid MAC addresses:</p> <ul style="list-style-type: none"> • Null MAC address—0000.0000.0000 • Broadcast MAC address—FFFF.FFFF.FFFF • Multicast MAC address—0100.DAAA.ADDD
Step 4	switch(config-if)# show interface ethernet slot/port	Displays all information for the interface.
Step 5	switch(config-if)# mac address-table limit 16-256 user-defined	<p>Example:</p> <pre>switch(config)# mac address-table limit 200 user-defined switch(config)#</pre> <p>Configures the maximum number of MAC addresses that can be configured on a switch.</p>
Step 6	(Optional) switch(config-if)# show mac address-table limit user-defined	<p>Example:</p> <pre>switch(config)# show mac address-table limit user-defined</pre> <p>Displays the maximum number of MAC-addresses that can be configured on a switch.</p>

Example

This example shows how to configure an interface MAC address:

```
switch# configure terminal
switch(config)# interface ethernet 3/3
switch(config-if)# mac-address aaaa.bbbb.dddd
switch(config-if)# show interface ethernet 3/3
switch(config-if)#
switch(config)# mac address-table limit 100 user-defined
```

```
Warning: Configure the same User-Defined Mac Limit on the peer.
Warning: New Fhrp max group limit is 390
switch# show mac address-table limit user-defined
User Defined Mac Limit: 100
FHRP Mac Limit: 390
```

Verifying the Layer 3 Interfaces Configuration

Use one of the following commands to verify the configuration:

Command	Purpose
show interface ethernet <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).
show interface ethernet <i>slot/port</i> brief	Displays the Layer 3 interface operational status.
show interface ethernet <i>slot/port</i> capabilities	Displays the Layer 3 interface capabilities, including port type, speed, and duplex.
show interface ethernet <i>slot/port</i> description	Displays the Layer 3 interface description.
show interface ethernet <i>slot/port</i> status	Displays the Layer 3 interface administrative status, port mode, speed, and duplex.
show interface ethernet <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).
show interface port-channel <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).
show interface loopback <i>number</i>	Displays the loopback interface configuration, status, and counters.
show interface loopback <i>number</i> brief	Displays the loopback interface operational status.
show interface loopback <i>number</i> description	Displays the loopback interface description.
show interface loopback <i>number</i> status	Displays the loopback interface administrative status and protocol status.
show interface vlan <i>number</i>	Displays the VLAN interface configuration, status, and counters.
show interface vlan <i>number</i> brief	Displays the VLAN interface operational status.
show interface vlan <i>number</i> description	Displays the VLAN interface description.

Command	Purpose
show interface vlan <i>number</i> status	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
show interface ethernet <i>slot/port</i> counters	Displays the Layer 3 interface statistics (unicast, multicast, and broadcast).
show interface ethernet <i>slot/port</i> counters brief	Displays the Layer 3 interface input and output counters.
show interface ethernet <i>slot/port</i> counters detailed [all]	Displays the Layer 3 interface statistics. You can optionally include all 32-bit and 64-bit packet and byte counters (including errors).
show interface ethernet <i>slot/port</i> counters error	Displays the Layer 3 interface input and output errors.
show interface ethernet <i>slot/port</i> counters snmp	Displays the Layer 3 interface counters reported by SNMP MIBs. You cannot clear these counters.
show interface ethernet <i>slot/port.number</i> counters	Displays the subinterface statistics (unicast, multicast, and broadcast).
show interface port-channel <i>channel-id.number</i> counters	Displays the port-channel subinterface statistics (unicast, multicast, and broadcast).
show interface loopback <i>number</i> counters	Displays the loopback interface input and output counters (unicast, multicast, and broadcast).
show interface loopback <i>number</i> counters detailed [all]	Displays the loopback interface statistics. You can optionally include all 32-bit and 64-bit packet and byte counters (including errors).
show interface loopback <i>number</i> counters errors	Displays the loopback interface input and output errors.
show interface vlan <i>number</i> counters	Displays the VLAN interface input and output counters (unicast, multicast, and broadcast).
show interface vlan <i>number</i> counters detailed [all]	Displays the VLAN interface statistics. You can optionally include all Layer 3 packet and byte counters (unicast and multicast).
show interface vlan <i>counters</i> snmp	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)# 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)# ip address 192.0.2.1/8
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	Cisco Nexus 3548 Switch NX-OS Interfaces Command Reference
IP	“Configuring IP” chapter in the <i>Cisco Nexus 3548 Switch NX-OS Unicast Routing Configuration Guide</i>
VLAN	“Configuring VLANs” chapter in the <i>Cisco Nexus 3548 Switch 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: http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml
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.

