



## Configuring Routing Between VLANs with IEEE 802.1Q Encapsulation

---

This chapter describes the required and optional tasks for configuring routing between VLANs with IEEE 802.1Q encapsulation. For a complete description of VLAN commands used in this chapter, refer to the “Cisco IOS Switching Commands” chapter in the *Cisco IOS Switching Services Command Reference*. For documentation of other commands that appear in this chapter, you can use the command reference master index or search online.

The IEEE 802.1Q protocol is used to interconnect multiple switches and routers, and for defining VLAN topologies. IEEE 802.1Q support is currently available for Fast Ethernet interfaces.

### IEEE 802.1Q Encapsulation Configuration Task List

You can configure routing between any number of VLANs in your network. This section documents the configuration tasks for each protocol supported with IEEE 802.1Q encapsulation. The basic process is the same, regardless of the protocol being routed. It involves:

- Enabling the protocol on the router.
- Enabling the protocol on the interface.
- Defining the encapsulation format as IEEE 802.1Q.
- Customizing the protocol according to the requirements for your environment.

The configuration processes documented in this chapter include the following:

- Configuring AppleTalk Routing over IEEE 802.1Q
- Configuring IP Routing over IEEE 802.1Q
- Configuring IPX Routing over IEEE 802.1Q

### Configuring AppleTalk Routing over IEEE 802.1Q

AppleTalk can be routed over virtual LAN (VLAN) subinterfaces using the IEEE 802.1Q VLAN encapsulation protocol. AppleTalk Routing provides full-feature Cisco IOS software AppleTalk support on a per-VLAN basis, allowing standard AppleTalk capabilities to be configured on VLANs.

To route AppleTalk over IEEE 802.1Q between VLANs, you need to customize the subinterface to create the environment in which it will be used. Perform these tasks in the order in which they appear:

- Enabling AppleTalk Routing
- Defining the VLAN Encapsulation Format
- Configuring AppleTalk on the Subinterface

## Enabling AppleTalk Routing

To enable AppleTalk routing on IEEE 802.1Q interfaces, use the following command in global configuration mode:

Command	Purpose
<code>appletalk routing [eigrp router-number]</code>	Enables AppleTalk routing globally.



### Note

For more information on configuring AppleTalk, see the “Configuring AppleTalk” chapter in the *Cisco IOS AppleTalk and Novell IPX Configuration Guide*.

## Configuring AppleTalk on the Subinterface

After you enable AppleTalk globally and define the encapsulation format, you need to enable it on the subinterface by specifying the cable range and naming the AppleTalk zone for each interface. To enable the AppleTalk protocol on the subinterface, use the following commands in interface configuration mode:

	Command	Purpose
Step 1	<code>appletalk cable-range cable-range [network.node]</code>	Assigns the AppleTalk cable range and zone for the subinterface.
Step 2	<code>appletalk zone zone-name</code>	Assigns the AppleTalk zone for the subinterface.

## Defining the VLAN Encapsulation Format

To define the VLAN encapsulation format as IEEE 802.1Q, use the following commands in interface configuration mode:

	Command	Purpose
Step 1	<code>interface fastethernet slot/port.subinterface-number</code>	Specifies the subinterface the VLAN will use.
Step 2	<code>encapsulation dot1q vlan-identifier</code>	Defines the encapsulation format as IEEE 802.1Q ( <b>dot1q</b> ), and specify the VLAN identifier.

## Configuring IP Routing over IEEE 802.1Q

IP routing over IEEE 802.1Q extends IP routing capabilities to include support for routing IP frame types in VLAN configurations using the IEEE 802.1Q encapsulation.

To route IP over IEEE 802.1Q between VLANs, you need to customize the subinterface to create the environment in which it will be used. Perform these tasks in the order in which they appear:

- Enabling IP Routing
- Defining the VLAN Encapsulation Format
- Assigning IP Address to Network Interface

### Enabling IP Routing

IP routing is automatically enabled in the Cisco IOS software for routers. To reenable IP routing if it has been disabled, use the following command in global configuration mode:

Command	Purpose
<code>ip routing</code>	Enables IP routing on the router.

Once you have IP routing enabled on the router, you can customize the characteristics to suit your environment. If necessary, refer to the IP configuration chapters in the *Cisco IOS IP and IP Routing Configuration Guide* for guidelines on configuring IP.

### Defining the VLAN Encapsulation Format

To define the encapsulation format as IEEE 802.1Q, use the following commands in interface configuration mode:

	Command	Purpose
Step 1	<code>interface fastethernet slot/port.subinterface-number</code>	Specifies the subinterface on which IEEE 802.1Q will be used.
Step 2	<code>encapsulation dot1q vlanid</code>	Defines the encapsulation format as IEEE 802.1Q ( <b>dot1q</b> ), and specify the VLAN identifier

### Assigning IP Address to Network Interface

An interface can have one primary IP address. To assign a primary IP address and a network mask to a network interface, use the following command in interface configuration mode:

Command	Purpose
<code>ip address ip-address mask</code>	Sets a primary IP address for an interface.

A mask identifies the bits that denote the network number in an IP address. When you use the mask to subnet a network, the mask is then referred to as a *subnet mask*.

## Configuring IPX Routing over IEEE 802.1Q

IPX Routing over IEEE 802.1Q VLANs extends Novell NetWare routing capabilities to include support for routing Novell Ethernet\_802.3 encapsulation frame types in VLAN configurations. Users with Novell NetWare environments can configure Novell Ethernet\_802.3 encapsulation frames to be routed using IEEE 802.1Q encapsulation across VLAN boundaries.

To configure Cisco IOS software on a router with connected VLANs to exchange IPX Novell Ethernet\_802.3 encapsulated frames, perform these tasks in the order in which they appear:

- Enabling NetWare Routing
- Defining the VLAN Encapsulation Format
- Configuring NetWare on the Subinterface

### Enabling NetWare Routing

To enable IPX routing on IEEE 802.1Q interfaces, use the following command in global configuration mode:

Command	Purpose
<code>ipx routing [node]</code>	Enables IPX routing globally.

### Defining the VLAN Encapsulation Format

To define the encapsulation format as IEEE 802.1Q, use the following commands in interface configuration mode:

	Command	Purpose
Step 1	<code>interface fastethernet slot/port.subinterface-number</code>	Specifies the subinterface on which IEEE 802.1Q will be used.
Step 2	<code>encapsulation dot1q vlan-identifier</code>	Defines the encapsulation format as IEEE 802.1Q and specify the VLAN identifier.

### Configuring NetWare on the Subinterface

After you enable NetWare globally and define the VLAN encapsulation format, you may need to enable the subinterface by specifying the NetWare network number. Use this command in interface configuration mode:

Command	Purpose
<code>ipx network network</code>	Specifies the IPX network number.

# IEEE 802.1Q Encapsulation Configuration Examples

This section provides configuration examples for each of the protocols described in this feature guide. It includes these examples:

- Configuring AppleTalk over IEEE 802.1Q Example
- Configuring IP Routing over IEEE 802.1Q Example
- Configuring IPX Routing over IEEE 802.1Q Example

## Configuring AppleTalk over IEEE 802.1Q Example

This configuration example shows AppleTalk being routed on VLAN 100.

```
!  
appletalk routing  
!  
interface fastethernet 4/1.100  
  encapsulation dot1q 100  
  appletalk cable-range 100-100 100.1  
  appletalk zone eng  
!
```

## Configuring IP Routing over IEEE 802.1Q Example

This configuration example shows IP being routed on VLAN 101.

```
!  
ip routing  
!  
interface fastethernet 4/1.101  
  encapsulation dot1q 101  
  ip addr 10.0.0.11 255.0.0.0  
!
```

## Configuring IPX Routing over IEEE 802.1Q Example

This configuration example shows IPX being routed on VLAN 102.

```
!  
ipx routing  
!  
interface fastethernet 4/1.102  
  encapsulation dot1q 102  
  ipx network 100  
!
```

