



Configuring the Cisco Gigabit EtherSwitch EHWIC

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This document provides configuration tasks for the Cisco Gigabit EtherSwitch enhanced high-speed WAN interface cards (EHWICs) supported on Cisco Integrated Services Routers Generation 2 (ISR G2).

Feature History for Cisco Gigabit EtherSwitch Enhanced High-Speed Interface Cards

Release	Modification
15.1(2)T	This feature was introduced.

Finding Support Information for Platforms and Cisco IOS Software Images

Use Cisco Feature Navigator to find information about platform support and Cisco IOS software image support. Access Cisco Feature Navigator at <http://www.cisco.com/go/fn>. You must have an account on Cisco.com. If you do not have an account or have forgotten your username or password, click **Cancel** at the login dialog box and follow the instructions that appear.

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Prerequisites for Gigabit EtherSwitch EHWICs

The following are prerequisites to configuring Cisco Gigabit EtherSwitch EHWICs:

- Configure IP routing on the host router. (See *Cisco IOS IP Configuration Guide* at http://www.cisco.com/en/US/products/ps10592/products_installation_and_configuration_guides_list.html.)
- Install the Cisco Gigabit EtherSwitch EHWIC on a Cisco ISR G2 platform running Cisco IOS 15.1(2)T or later.

Restrictions for Gigabit EtherSwitch EHWICs

The following restrictions apply to the Cisco Gigabit EtherSwitch EHWICs:

- The Cisco Gigabit EtherSwitch EHWIC cannot function with the following modules in the chassis at the same time:
 - HWIC-4ESW
 - HWIC-4ESW-POE
 - HWIC-D-9ESW
 - HWIC-D-9ESW-POE
 - NM-16ESW
 - NM-36ESW
- On the Cisco 1905, 1906, and 1921 ISR platforms, only a single gigabit EtherSwitch EHWIC is supported.
- Online insertion and removal (OIR) is not supported.
- When Ethernet switches have been installed and configured in a host router, do not perform OIR of the CompactFlash memory card in the router. OIR of the CompactFlash memory card compromises the configuration of the Ethernet switches.
- VLAN trunking protocol (VTP) pruning is not supported.
- No more than 200 secure MAC addresses per platform are supported by an EtherSwitch EHWIC.

Information About Gigabit EtherSwitch EHWICs

Cisco Gigabit EHWICs are 10/100/1000 BaseT Layer 2 gigabit Ethernet switches with Layer 3 routing capability. Layer 3 routing is done on the host router.



Note

To link a port on a Cisco Gigabit EtherSwitch EHWIC to an enhanced EtherSwitch service module or EtherSwitch service module in the same VTP domain, the port and the Cisco Gigabit EtherSwitch EHWIC should be stacked.

The gigabit EHWICs are also available with a power over Ethernet (PoE) module to provide inline power for IP telephones.

To configure the Cisco Gigabit EHWICs, you should understand the following concepts:

Concepts	Link
VLANs	http://www.cisco.com/en/US/docs/ios/lanswitch/configuration/guide/lsw_enet_switch_net_external_docbase_0900e4b18090920b_4container_external_docbase_0900e4b18096f791.html
Inline Power for Cisco IP Phones	
Layer 2 Ethernet Switching	
802.1x Authentication	
Spanning Tree Protocol	
Cisco Discovery Protocol	
Switched Port Analyzer	
IGMP Snooping	
Storm Control	
Fallback Bridging	

How to Configure Gigabit EtherSwitch EHWICs

The following sections provide the configuration tasks for the EtherSwitch EHWICs:

- [Configuring VLANs, page 4](#)
- [Configuring VLAN Trunking Protocol, page 8](#)
- [Configuring Layer 2 Interfaces, page 10](#)
- [Configuring 802.1x Authentication, page 19](#)
- [Configuring Spanning Tree, page 29](#)
- [Configuring MAC Table Manipulation, page 35](#)
- [Configuring Cisco Discovery Protocol, page 38](#)
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- [Configuring Power Management on the Interface, page 40](#)
- [Configuring IP Multicast Layer 3 Switching, page 42](#)
- [Configuring IGMP Snooping, page 45](#)
- [Configuring Per-Port Storm-Control, page 50](#)
- [Configuring Fallback Bridging, page 52](#)
- [Configuring Separate Voice and Data Subnets, page 65](#)
- [Managing the EtherSwitch EHWIC, page 67](#)
- [Configuring Port Security, page 78](#)

Configuring VLANs

This section describes how to configure VLANs on the switch, and contains the following sections:

- [Adding VLAN Instances, page 4](#)
- [Verifying the VLAN Configuration, page 5](#)
- [Deleting a VLAN Instance from the Database, page 6](#)

Table 1 shows the number of VLANs supported by a Cisco Gigabit EtherSwitch EHWIC.

Table 1 **Number of VLANs Supported**

Platform	Number of VLANs Supported
1900 Series	16
2901	16
2911	32
2921 and 2951	48
3925	48
3925E, 3945, and 3945E	64

Adding VLAN Instances

Beginning in global configuration mode, follow these steps to configure a Gigabit Ethernet (GE) interface as Layer 2 access.

SUMMARY STEPS

1. `vlan vlan_id`
2. `exit`

DETAILED STEPS

	Command	Purpose
Step 1	<code>vlan vlan_id</code> Example: Router(config)#vlan 1	Adds an Ethernet VLAN.
Step 2	<code>exit</code> Example: Router(config)#exit	Updates the VLAN database, propagates it throughout the administrative domain, and returns to privileged EXEC mode.

Verifying the VLAN Configuration

You can verify the VLAN configuration in VLAN database mode or in privileged EXEC mode.

- [Verifying VLAN Configuration in VLAN Database Mode, page 5](#)
- [Verifying VLAN Configuration in EXEC Mode, page 6.](#)

Verifying VLAN Configuration in VLAN Database Mode

Enter the **show** command in VLAN database mode to verify the VLAN configuration.

```
Router#vlan database
Router(vlan)#show
  VLAN ISL Id: 1
  Name: default
  Media Type: Ethernet
  VLAN 802.10 Id: 100001
  State: Operational
  MTU: 1500
  Translational Bridged VLAN: 1002
  Translational Bridged VLAN: 1003

  VLAN ISL Id: 2
  Name: VLAN0002
  Media Type: Ethernet
  VLAN 802.10 Id: 100002
  State: Operational
  MTU: 1500

  VLAN ISL Id: 1002
  Name: fddi-default
  Media Type: FDDI
  VLAN 802.10 Id: 101002
  State: Operational
  MTU: 1500
  Bridge Type: SRB
  Translational Bridged VLAN: 1
  Translational Bridged VLAN: 1003

  VLAN ISL Id: 1003
  Name: token-ring-default
  Media Type: Token Ring
  VLAN 802.10 Id: 101003
  State: Operational
  MTU: 1500
  Bridge Type: SRB
  Ring Number: 0
  Bridge Number: 1
  Parent VLAN: 1005
  Maximum ARE Hop Count: 7
  Maximum STE Hop Count: 7
  Backup CRF Mode: Disabled
  Translational Bridged VLAN: 1
  Translational Bridged VLAN: 1002

  VLAN ISL Id: 1004
  Name: fddinet-default
  Media Type: FDDI Net
  VLAN 802.10 Id: 101004
  State: Operational
  MTU: 1500
  Bridge Type: SRB
  Bridge Number: 1
```

```

STP Type: IBM

VLAN ISL Id: 1005
Name: trnet-default
Media Type: Token Ring Net
VLAN 802.10 Id: 101005
State: Operational
MTU: 1500
Bridge Type: SRB
Bridge Number: 1
STP Type: IBM

router(vlan)#exit
APPLY completed.
Exiting...
router#

```

Verifying VLAN Configuration in EXEC Mode

Enter the **show vlan-switch** command in privileged EXEC mode to verify the VLAN configuration.

```

Router#show vlan-switch
VLAN Name                               Status      Ports
-----
1    default                               active     Gi0/1/0, Gi0/1/1, Gi0/1/2
                                           Gi0/1/3
2    VLAN0002                               active
1002 fddi-default                          act/unsup
1003 token-ring-default                  act/unsup
1004 fddinet-default                     act/unsup
1005 trnet-default                       act/unsup

VLAN Type  SAID          MTU   Parent  RingNo  BridgeNo  Stp    BrdgMode  Trans1
-----
Trans2
-----
1    enet    100001       1500   -       -       -       -       -       1002   1003
2    enet    100002       1500   -       -       -       -       -       0       0
1002 fddi    101002       1500   -       -       -       -       -       1       1003
1003 tr     101003       1500   1005   0       -       -       srb    1       1002
1004 fdnet 101004       1500   -       -       1       -       ibm    -       0       0
1005 trnet 101005       1500   -       -       1       -       ibm    -       0       0
router#

```

Deleting a VLAN Instance from the Database

You cannot delete the default VLANs for the different media types: Ethernet VLAN 1 and FDDI or Token Ring VLANs 1002 to 1005.

Beginning in global configuration mode, follow these steps to delete a VLAN from the database:

SUMMARY STEPS

1. **no vlan** *vlan_id*
2. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	no vlan <i>vlan_id</i>	Deletes the VLAN.
	Example: Router(config)#no vlan 2	
Step 2	exit	Updates the VLAN database, propagates it throughout the administrative domain, and returns to privileged EXEC mode.
	Example: Router(config)#exit	

Verifying VLAN Deletion

You can verify that a VLAN has been deleted from the switch in VLAN database mode.

Use the **show** command in VLAN database mode to verify that a VLAN has been deleted from the switch, as shown in the following output example:

```
Router#vlan database
Router(vlan)#show
  VLAN ISL Id: 1
    Name: default
    Media Type: Ethernet
  VLAN 802.10 Id: 100001
    State: Operational
    MTU: 1500
  Translational Bridged VLAN: 1002
  Translational Bridged VLAN: 1003

  VLAN ISL Id: 1002
    Name: fddi-default
    Media Type: FDDI
  VLAN 802.10 Id: 101002
    State: Operational
    MTU: 1500
    Bridge Type: SRB
  Translational Bridged VLAN: 1
  Translational Bridged VLAN: 1003
<output truncated>

Router(vlan)#
```

Enter the **show vlan-switch brief** command in EXEC mode to verify that a VLAN has been deleted from the switch, as shown in the following output example:

```
Router#show vlan-switch brief

VLAN Name                Status      Ports
-----
1    default                active     Gi0/1/0, Gi0/1/1, Gi0/1/2
                                     Gi0/1/3, Gi0/1/4, Gi0/1/5
                                     Gi0/1/6, Gi0/1/7

1002 fddi-default          act/unsup
1003 token-ring-default  active/unsup
1004 fddinet-default     active/unsup
1005 trnet-default       active/unsup
Router#
```

Configuring VLAN Trunking Protocol

This section describes how to configure the VLAN Trunking Protocol (VTP) on an EtherSwitch EHWIC, and contains the following sections:

- [Configuring a VTP Server, page 8](#)
- [Configuring a VTP Client, page 9](#)
- [Disabling VTP \(VTP Transparent Mode\), page 9](#)
- [Verifying VTP, page 10](#)



Note

VTP pruning is not supported by EtherSwitch EHWICs.

Configuring a VTP Server

When a switch is in VTP server mode, you can change the VLAN configuration and have it propagate throughout the network.

Beginning in global configuration mode, follow these steps to configure the switch as a VTP server.

SUMMARY STEPS

1. **vtp mode server**
2. **vtp domain** *domain_name*
3. **vtp password** *password_value*
4. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	vtp mode server Example: Router(config)#vtp mode server	Configures the switch as a VTP server.
Step 2	vtp domain <i>domain_name</i> Example: Router(config)#vtp domain domain1	Defines the VTP domain name, which can be up to 32 characters long.
Step 3	vtp password <i>password_value</i> Example: Router(config)#vtp password password1	(Optional) Sets a password, which can be from 8 to 64 characters long, for the VTP domain.
Step 4	exit Example: Router(config)#exit	Exits global configuration mode.

Configuring a VTP Client

When a switch is in VTP client mode, you cannot change the VLAN configuration on the switch. The client switch receives VTP updates from a VTP server in the management domain and modifies its configuration accordingly.

Beginning in global configuration mode, follow these steps to configure the switch as a VTP client.

SUMMARY STEPS

1. **vtp mode client**
2. **vtp domain** *domain_name*
3. **vtp password** *password_value*
4. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	vtp mode client Example: Router(config)#vtp mode client	Configures the switch as a VTP client.
Step 2	vtp domain <i>domain_name</i> Example: Router(config)#vtp domain domain1	Defines the VTP domain name, which can be up to 32 characters long.
Step 3	vtp password <i>password_value</i> Example: Router(config)#vtp password password2	(Optional) Sets a password, which can be from 8 to 64 characters long, for the VTP domain.
Step 4	exit Example: Router(config)#exit	Exits global configuration mode.

Disabling VTP (VTP Transparent Mode)

When you configure the switch as VTP transparent, you disable VTP on the switch. A VTP transparent switch does not send VTP updates and does not act on VTP updates received from other switches.

Beginning in global configuration mode, follow these steps to disable VTP on the switch.

SUMMARY STEPS

1. **vtp mode transparent**
2. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	vtp mode transparent Example: Router(config)#vtp mode transparent	Configures VTP transparent mode.
Step 2	exit Example: Router(config)#exit	Exits global configuration mode.

Verifying VTP

Use the **show vtp status** command in privileged EXEC mode to verify VTP status:

```
Router#show vtp status
```

```
VTP Version                : 2
Configuration Revision     : 0
Maximum VLANs supported locally : 256
Number of existing VLANs   : 5
VTP Operating Mode         : Server
VTP Domain Name           : domain1
VTP Pruning Mode           : Disabled
VTP V2 Mode                : Disabled
VTP Traps Generation       : Disabled
MD5 digest                 : 0xBF 0x86 0x94 0x45 0xFC 0xDF 0xB5 0x70
Configuration last modified by 0.0.0.0 at 0-0-00 00:00:00
Local updater ID is 1.3.214.25 on interface Gi0/0 (first interface found)
Router#
```

Configuring Layer 2 Interfaces

This section provides the following configuration information:

- [Configuring a Range of Interfaces, page 10](#) (required)
- [Defining a Range Macro, page 11](#) (optional)
- [Configuring Layer 2 Optional Interface Features, page 12](#) (optional)

Configuring a Range of Interfaces

Use the **interface range** command in global configuration mode to configure a range of interfaces.

SUMMARY STEPS

1. **configure terminal**
2. **interface range** {*gigabitethernet interfacenumber - interfacenumber* | *vlan number* | *macro word*}
3. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface range {gigabitethernet <i>interfacenumber</i> - <i>interfacenumber</i> vlan <i>number</i> macro <i>word</i>} Example: Router(config)#interface range gigabitethernet 0/2/0 - 3	Selects the range of interfaces to be configured. <ul style="list-style-type: none"> • The space around the dash is required. For example, the command interface range gigabitethernet 0/2/0 - 3 is valid; the command interface range gigabitethernet 0/2/0-3 is not valid. • You can enter one macro or up to five comma-separated ranges. • Comma-separated ranges can include both VLANs and physical interfaces. • You are not required to enter spaces before or after the comma. • The interface range command only supports VLAN interfaces that are configured with the interface vlan command.
Step 3	exit Example: Router(config)#exit	Exits global configuration mode.

Defining a Range Macro

Use the **define interface-range** command in global configuration mode to define an interface range macro:

SUMMARY STEPS

1. **configure terminal**
2. **define interface-range *macro-name* {gigabitethernet *slot/first-interface* - *last-interface*} | vlan *vlan-ID* - *vlan-ID*}**
3. **exit**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	define interface-range <i>macro-name</i> { gigabitethernet <i>slot/first-interface - last-interface</i>] vlan <i>vlan-ID - vlan-ID</i> } Example: Router(config)#define interface-range first_three gigabitethernet 0/1/0 - 2	Defines the interface-range macro and saves it in NVRAM.
Step 3	exit Example: Router(config)#exit	Exits global configuration mode.

Verifying Configuration of an Interface Range Macro

Use the **show running-configuration** command to show the defined interface-range macro configuration, as shown below:

```
Router#show running-configuration | include define
define interface-range first_three GigabitEthernet0/1/0 - 2
```

Configuring Layer 2 Optional Interface Features

- [Interface Speed and Duplex Configuration Guidelines, page 12](#)
- [Configuring the Interface Speed, page 13](#)
- [Configuring the Interface Duplex Mode, page 13](#)
- [Verifying Interface Speed and Duplex Mode Configuration, page 14](#)
- [Configuring a Description for an Interface, page 15](#)
- [Configuring a Gigabit Ethernet Interface as a Layer 2 Trunk, page 15](#)
- [Configuring a GE Interface as Layer 2 Access, page 17](#)

Interface Speed and Duplex Configuration Guidelines

When configuring an interface speed and duplex mode, follow these guidelines:

- If both ends of the line support autonegotiation, we recommend the default auto negotiation settings.
- If one interface supports auto negotiation and the other end does not, configure duplex and speed on both interfaces; do not use the **auto** setting on the supported side.
- Both ends of the line need to be configured to the same setting, for example, both hard-set or both auto-negotiate. Mismatched settings are not supported.

**Caution**

Changing the interface speed and duplex mode configuration might shut down and enable the interface during the reconfiguration.

Configuring the Interface Speed

Beginning in global configuration mode, follow these steps to set the interface speed.

SUMMARY STEPS

1. **interface gigabitethernet *0/slot/port***
2. **speed [10 | 100 | 1000 | auto]**

DETAILED STEPS

	Command	Purpose
Step 1	interface gigabitethernet <i>0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/1/2	Selects the interface to be configured. The EHWIC <i>slot</i> number can be 0 to 3, and the EHWIC <i>port</i> number can be 0 to 7.
Step 2	speed [10 100 1000 auto] Example: Router(config-if)#speed 1000	Sets the interface speed of the interface.

**Note**

If you set the interface speed to auto on a 10/100/1000-Mbps Gigabitethernet interface, both speed and duplex are auto negotiated.

Configuring the Interface Duplex Mode

Beginning in interface configuration mode, follow these steps to set the duplex mode of a Gigabit Ethernet interface.

SUMMARY STEPS

1. **duplex [auto | full | half]**
2. **end**

DETAILED STEPS

	Command	Purpose
Step 1	duplex [auto full half] Example: Router(config-if)#duplex auto	Sets the duplex mode of the interface.
Step 2	end Example: Router(config-if)#end	Returns to privileged EXEC mode.

**Note**

If you set the port speed to auto on a 10/100/1000-Mbps Gigabit Ethernet interface, both speed and duplex are auto negotiated, and the duplex mode cannot be modified.

The following example shows how to set the interface duplex mode to auto on gigabit Ethernet interface 3:

```
Router(config)#interface gigabitethernet 0/1/2
router(config-if)#speed 1000
Router(config-if)#duplex auto
Router(config-if)#end
```

Verifying Interface Speed and Duplex Mode Configuration

Use the **show interfaces** command to verify the interface speed and duplex mode configuration for an interface, as shown in the following output example:

```
Router#show interfaces gigabitethernet 0/1/2

GigabitEthernet0/1/2 is up, line protocol is down
  Hardware is EHWIC-4 Gigabit Ethernet, address is 0022.bdd2.7915 (bia 0022.bdd2
.7915)
  MTU 1500 bytes, BW 1000000 Kbit/sec, DLY 10 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Auto-duplex, 1000
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
    Received 0 broadcasts (0 multicasts)
    0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    0 watchdog, 0 multicast, 0 pause input
    0 input packets with dribble condition detected
    0 packets output, 0 bytes, 0 underruns
    0 output errors, 0 collisions, 2 interface resets
```

```

0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier, 0 pause output
0 output buffer failures, 0 output buffers swapped out
Router#

```

Configuring a Description for an Interface

You can add a description of an interface to help you remember its function. The description appears in the output of the following commands: **show configuration**, **show running-config**, and **show interfaces**.

Use the **description** command, in interface configuration mode, to add a description for an interface. Beginning in global configuration mode, follow these steps to add a description to the interface:

SUMMARY STEPS

1. **interface gigabitethernet** *0/slot/port*
2. **description** *string*

DETAILED STEPS

	Command	Purpose
Step 1	interface gigabitethernet <i>0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/1/2	Selects the interface to configure.
Step 2	description <i>string</i> Example: Router(config-if)#description gigabitethernet1	Adds a description for an interface.

Configuring a Gigabit Ethernet Interface as a Layer 2 Trunk

Beginning in global configuration mode, follow these steps to configure a GigabitEthernet interface as a Layer 2 trunk.

SUMMARY STEPS

1. **interface gigabitethernet** *0/slot/port*
2. **shutdown**
3. **switchport mode trunk**
4. **switchport trunk native vlan** *vlan-num*
5. **switchport trunk allowed vlan** {**add** | **except** | **none** | **remove**} *vlan1[,vlan[,vlan[,...]]*
6. **no shutdown**
7. **end**

DETAILED STEPS

	Command	Purpose
Step 1	interface gigabitethernet <i>0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/1/2	Selects the interface to configure.
Step 2	shutdown Example: Router(config-if)#shutdown	(Optional) Shuts down the interface to prevent traffic flow until configuration is complete.
Step 3	switchport mode trunk Example: Router(config-if)#switchport mode trunk	Configures the interface as a Layer 2 trunk. Note Encapsulation is always dot1q.
Step 4	switchport trunk native vlan <i>vlan-num</i> Example: Router(config-if)#switchport trunk native vlan 1	(Optional) For 802.1Q trunks, specifies the native VLAN.
Step 5	switchport trunk allowed vlan { add except none remove } <i>vlan1[,vlan[,vlan[,...]]</i> Example: Router(config-if)#switchport trunk allowed vlan {add except none remove} vlan1[,vlan[,vlan[,...]]	(Optional) Configures the list of VLANs allowed on the trunk. All VLANs are allowed by default. You cannot remove any of the default VLANs from a trunk.
Step 6	no shutdown Example: Router(config-if)#no shutdown	Activates the interface. (Required only if you shut down the interface.)
Step 7	end Example: Router(config-if)#end	Exits interface configuration mode.

**Note**

Ports do not support Dynamic Trunk Protocol (DTP). Ensure that the neighboring switch is set to a mode that does not send DTP.

Verifying a GigabitEthernet Interface as a Layer 2 Trunk

Use the following **show** commands to verify the configuration of a GigabitEthernet interface as a Layer 2 trunk:

```
router#show running-config interface gigabitethernet 0/1/2
Building configuration...
Current configuration: 71 bytes
```

```

!
interface GigabitEthernet0/1/2
  switchport mode trunk
end
router#

router#show interfaces trunk
Port      Mode      Encapsulation  Status      Native vlan
Gi0/1/2   on        802.1q         trunking    1

Port      Vlans allowed on trunk
Gi0/1/2   1-4094

Port      Vlans allowed and active in management domain
Gi0/1/2   1,10,30

Port      Vlans in spanning tree forwarding state and not pruned
Gi0/1/2   1,10,30

router#

```

Configuring a GE Interface as Layer 2 Access

Beginning in global configuration mode, follow these steps to configure a GE interface as Layer 2 access.

SUMMARY STEPS

1. **interface gigabitethernet** *0/slot/port*
2. **shutdown**
3. **switchport mode access**
4. **switchport access vlan** *vlan_num*
5. **no shutdown**
6. **end**

DETAILED STEPS

	Command	Purpose
Step 1	interface gigabitethernet <i>0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/1/2	Selects the interface to configure.
Step 2	shutdown Example: Router(config-if)#shutdown	(Optional) Shuts down the interface to prevent traffic flow until configuration is complete.

	Command	Purpose
Step 3	switchport mode access Example: Router(config-if)#switchport mode access	Configures the interface as a Layer 2 access.
Step 4	switchport access vlan <i>vlan_num</i> Example: Router(config-if)#switchport access vlan 1	For access ports, specifies the access vlan.
Step 5	no shutdown Example: Router(config-if)#no shutdown	Activates the interface. (Required only if you shut down the interface.)
Step 6	end Example: Router(config-if)#end	Exits interface configuration mode.

Verifying a GigabitEthernet Interface as Layer 2 Access

Use the **show running-config interface** command to verify the running configuration of the interface, as shown below:

```
Router#show running-config interface gigabitethernet 0/1/2
Building configuration...
Current configuration: 76 bytes
!
interface gigabitethernet 0/1/2
    switchport access vlan 3
    no ip address
end
```

Use the **show interfaces** command to verify the switchport configuration of the interface, as shown below:

```
Router#show interfaces gigabitethernet 0/1/0 switchport
Name: Gi0/1/2
Switchport: Enabled
Administrative Mode: trunk
Operational Mode: down
Administrative Trunking Encapsulation: dot1q
Negotiation of Trunking: Disabled
Access Mode VLAN: 0 ((Inactive))
Trunking Native Mode VLAN: 1 (default)
Trunking VLANs Enabled: ALL
Trunking VLANs Active: none
Protected: false
Priority for untagged frames: 0
Override vlan tag priority: FALSE
Voice VLAN: none
Appliance trust: none
router#
```

Configuring 802.1x Authentication

This section describes how to configure 802.1x port-based authentication on an EtherSwitch EHWIC:

- [Understanding the Default 802.1x Configuration, page 19](#)
- [Enabling 802.1x Authentication, page 20](#)
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Understanding the Default 802.1x Configuration

Table 2 shows the default 802.1x configuration.

Table 2 **Default 802.1x Configuration**

Feature	Default Setting
Authentication, authorization, and accounting (AAA)	Disabled.
RADIUS server <ul style="list-style-type: none"> • IP address • UDP authentication port • Key 	<ul style="list-style-type: none"> • None specified • 1645 • None specified
Per-interface 802.1x enable state	Disabled (force-authorized). The port transmits and receives normal traffic without 802.1x-based authentication of the client.
Periodic reauthentication	Disabled.
Number of seconds between reauthentication attempts	3600 seconds.
Quiet period	60 seconds (number of seconds that the switch remains in the quiet state following a failed authentication exchange with the client).
Retransmission time	30 seconds (number of seconds that the switch waits for a response to an EAP request/identity frame from the client before retransmitting the request).
Maximum retransmission number	2 times (number of times that the switch sends an EAP-request/identity frame before restarting the authentication process).
Multiple host support	Disabled.

Table 2 **Default 802.1x Configuration (continued)**

Feature	Default Setting
Client timeout period	30 seconds (when relaying a request from the authentication server to the client, the amount of time the switch waits for a response before retransmitting the request to the client). This setting is not configurable.
Authentication server timeout period	30 seconds (when relaying a response from the client to the authentication server, the amount of time the switch waits for a reply before retransmitting the response to the server). This setting is not configurable.

802.1x Configuration Guidelines

Follow these guidelines to configure 802.1x authentication:

- When the 802.1x protocol is enabled, ports are authenticated before any other Layer 2 feature is enabled.
- The 802.1x protocol is supported on Layer 2 static-access ports, but it is not supported on these port types:
 - Trunk port—If you try to enable 802.1x on a trunk port, an error message appears, and 802.1x is not enabled. If you try to change the mode of an 802.1x-enabled port to trunk, the port mode is not changed.
 - Switch Port Analyzer (SPAN) destination port—You can enable 802.1x on a port that is a SPAN destination port; however, 802.1x is disabled until the port is removed as a SPAN destination.

Enabling 802.1x Authentication

To enable 802.1x port-based authentication, you must enable AAA and specify the authentication method list. A method list describes the sequence and authentication methods to be queried to authenticate a user.

The software uses the first method listed to authenticate users; if that method fails to respond, the software selects the next authentication method in the method list. This process continues until there is successful communication with a listed authentication method or until all defined methods are exhausted. If authentication fails at any point in this cycle, the authentication process stops, and no other authentication methods are attempted.

Beginning in privileged EXEC mode, follow these steps to configure 802.1x port-based authentication. This procedure is required.

SUMMARY STEPS

1. **configure terminal**
2. **aaa new-model**
3. **aaa authentication dot1x {default | listname} method1 [method2...]**
4. **interface gigabitethernet 0/slot/port**
5. **dot1x port-control auto**
6. **end**
7. **show dot1x**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	aaa new-model Example: Router(config)#aaa new-model	Enables AAA.
Step 3	aaa authentication dot1x {default listname} method1 [method2...] Example: Router(config)#aaa authentication dot1x {default listname} method1 [method2...]	Creates an 802.1x authentication method list. To create a default list that is used when a named list is <i>not</i> specified in the authentication command, use the default keyword followed by the methods that are to be used in default situations. The default method list is automatically applied to all interfaces. Enter at least one of these keywords: <ul style="list-style-type: none"> • group radius—Use the list of all RADIUS servers for authentication. • none—Use no authentication. The client is automatically authenticated without the switch using the information supplied by the client.
Step 4	interface gigabitethernet 0/slot/port Example: Router(config)#interface gigabitethernet 0/1/2	Enters interface configuration mode, and specifies the interface to be enabled for 802.1x authentication.
Step 5	dot1x port-control auto Example: Router(config-if)#dot1x port-control auto	Enables 802.1x on the interface. For feature interaction information with trunk, dynamic, dynamic-access, EtherChannel, secure, and SPAN ports, see the “802.1x Configuration Guidelines” section on page 20 .
Step 6	end Example: Router(config-if)#end	Returns to privileged EXEC mode.
Step 7	show dot1x Example: Router#show dot1x	Verifies your entries. Check the Status column in the 802.1x Port Summary section of the display. An <i>enabled</i> status means the port-control value is set either to auto or to force-unauthorized .

To disable AAA, use the **no aaa new-model** command in global configuration mode. To disable 802.1x AAA authentication, use the **no aaa authentication dot1x {default | list-name} method1 [method2...]** command in global configuration mode. To disable 802.1x, use either the **dot1x port-control force-authorized** command or the **no dot1x port-control** command in interface configuration mode.

Configuring the Switch-to-RADIUS-Server Communication

RADIUS security servers are identified by their host name or IP address, host name and specific UDP port numbers, or IP address and specific UDP port numbers. The combination of the IP address and UDP port number creates a unique identifier, which enables RADIUS requests to be sent to multiple UDP ports on a server at the same IP address. If two different host entries on the same RADIUS server are configured for the same service—for example, authentication—the second host entry configured acts as the failover backup to the first one. The RADIUS host entries are tried in the order that they were configured.

Beginning in privileged EXEC mode, follow these steps to configure the RADIUS server parameters on the switch. This procedure is required.

SUMMARY STEPS

1. **configure terminal**
2. **radius-server host** {*hostname* | *ip-address*} **auth-port** *port-number* **key** *string*
3. **end**
4. **show running-config**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	radius-server host { <i>hostname</i> <i>ip-address</i> } auth-port <i>port-number</i> key <i>string</i> Example: Router(config)#radius-server host {hostname ip-address} auth-port port-number key string	Configures the RADIUS server parameters on the switch. For <i>hostname</i> <i>ip-address</i> , specify the host name or IP address of the remote RADIUS server. For auth-port <i>port-number</i> , specify the UDP destination port for authentication requests. The default is 1645. For key <i>string</i> , specify the authentication and encryption key used between the switch and the RADIUS daemon running on the RADIUS server. The key is a text string that must match the encryption key used on the RADIUS server. Note Always configure the key as the last item in the radius-server host command syntax because leading spaces are ignored, but spaces within and at the end of the key are used. If you use spaces in the key, do not enclose the key in quotation marks unless the quotation marks are part of the key. This key must match the encryption used on the RADIUS daemon. To use multiple RADIUS servers, repeat this command.

	Command	Purpose
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.
Step 4	show running-config Example: Router#show running-config	Verifies your entries.

To delete the specified RADIUS server, use the **no radius-server host** *{hostname | ip-address}* command in global configuration mode.

To configure the timeout, retransmission, and encryption key values for all RADIUS servers, use the **radius-server host** command in global configuration mode. To configure these options on a per-server basis, use the **radius-server timeout**, **radius-server retransmit**, and **radius-server key** commands in global configuration mode.

You also need to configure some settings on the RADIUS server. These settings include the IP address of the switch and the key string to be shared by both the server and the switch. For more information, refer to the RADIUS server documentation.

Enabling Periodic Reauthentication

You can enable periodic 802.1x client reauthentication and specify how often it occurs. If you do not specify a time period before enabling reauthentication, the time between reauthentication attempts is 3600 seconds.

Automatic 802.1x client reauthentication is a global setting and cannot be set for clients connected to individual ports.

Beginning in privileged EXEC mode, follow these steps to enable periodic reauthentication of the client and to configure the number of seconds between reauthentication attempts.

SUMMARY STEPS

1. **configure terminal**
2. **dot1x re-authentication**
3. **dot1x timeout re-authperiod** *seconds*
4. **end**
5. **show dot1x**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	dot1x re-authentication Example: Router(config)#dot1x re-authentication	Enables periodic reauthentication of the client, which is disabled by default.
Step 3	dot1x timeout re-authperiod seconds Example: Router(config)#dot1x timeout re-authperiod seconds	Sets the number of seconds between reauthentication attempts. The range is from 1 to 4294967295; the default is 3600. This command affects the behavior of the switch only if periodic reauthentication is enabled.
Step 4	end Example: Router(config)#end	Returns to privileged EXEC mode.
Step 5	show dot1x Example: Router#show dot1x	Verifies your entries.

To disable periodic reauthentication, use the **no dot1x re-authentication** command in global configuration mode. To return to the default number of seconds between reauthentication attempts, use the **no dot1x timeout re-authperiod** global configuration command.

Changing the Quiet Period

When the switch cannot authenticate the client, the switch remains idle for a set period of time, and then tries again. The idle time is determined by the quiet-period value. A failed authentication of the client might occur because the client provided an invalid password. You can provide a faster response time to the user by entering smaller number than the default.

Beginning in privileged EXEC mode, follow these steps to change the quiet period:

SUMMARY STEPS

1. **configure terminal**
2. **dot1x timeout quiet-period seconds**
3. **end**
4. **show dot1x**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	dot1x timeout quiet-period seconds Example: Router(config)#dot1x timeout quiet-period seconds	Sets the number of seconds that the switch remains in the quiet state following a failed authentication exchange with the client. The range is from 0 to 65535; the default is 60.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.
Step 4	show dot1x Example: Router#show dot1x	Verifies your entries.

To return to the default quiet time, use the **no dot1x timeout quiet-period** command in global configuration mode.

Changing the Switch-to-Client Retransmission Time

The client responds to the EAP-request/identity frame from the switch with an EAP-response/identity frame. If the switch does not receive this response, it waits a set period of time (known as the retransmission time), and then retransmits the frame.

**Note**

You should change the default value of this command only to adjust for unusual circumstances such as unreliable links or specific behavioral problems with certain clients and authentication servers.

Beginning in privileged EXEC mode, follow these steps to change the amount of time that the switch waits for client notification:

SUMMARY STEPS

1. **configure terminal**
2. **dot1x timeout tx-period seconds**
3. **end**
4. **show dot1x**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	dot1x timeout tx-period seconds Example: Router(config)#dot1x timeout tx-period 40	Sets the number of seconds that the switch waits for a response to an EAP-request/identity frame from the client before retransmitting the request. The range is from 1 to 65535; the default is 30.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.
Step 4	show dot1x Example: Router#show dot1x	Verifies your entries.

To return to the default retransmission time, use the **no dot1x timeout tx-period** command in global configuration mode.

Setting the Switch-to-Client Frame-Retransmission Number

In addition to changing the switch-to-client retransmission time, you can change the number of times that the switch sends an EAP-request/identity frame (assuming no response is received) to the client before restarting the authentication process.

**Note**

You should change the default value of this command only to adjust for unusual circumstances, such as unreliable links or specific behavioral problems with certain clients and authentication servers.

Beginning in privileged EXEC mode, follow these steps to set the switch-to-client frame-retransmission number.

SUMMARY STEPS

1. **configure terminal**
2. **dot1x max-req count**
3. **end**
4. **show dot1x**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	dot1x max-req count Example: Router(config)#dot1x max-req 3	Sets the number of times that the switch sends an EAP-request/identity frame to the client before restarting the authentication process. The range is 1 to 10; the default is 2.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.
Step 4	show dot1x Example: Router#show dot1x	Verifies your entries.

To return to the default retransmission number, use the **no dot1x max-req** command in global configuration mode.

Enabling Multiple Hosts

You can attach multiple hosts to a single 802.1x-enabled port. In this mode, only one of the attached hosts must be successfully authorized for all hosts to be granted network access. If the port becomes unauthorized (reauthentication fails, and an EAPOL-logoff message is received), all attached clients are denied access to the network.

Beginning in privileged EXEC mode, follow these steps to allow multiple hosts (clients) on an 802.1x-authorized port that has the **dot1x port-control** interface configuration command set to **auto**.

To disable multiple hosts on the port, use the **no dot1x multiple-hosts** command in interface configuration mode.

SUMMARY STEPS

1. **configure terminal**
2. **interface type 0/slot/port**
3. **dot1x multiple-hosts**
4. **end**
5. **show dot1x interface type 0/slot/port**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface gigabitethernet 0/slot/port Example: Router(config)#interface gigabitethernet 0/1/2	Enters interface configuration mode, and specify the interface to which multiple hosts are indirectly attached.
Step 3	dot1x multiple-hosts Example: Router(config-if)#dot1x multiple-hosts	Allows multiple hosts (clients) on an 802.1x-authorized port. Make sure that the dot1x port-control interface configuration command is set to auto for the specified interface.
Step 4	end Example: Router(config-if)#end	Returns to privileged EXEC mode.
Step 5	show dot1x interface type 0/slot/port Example: Router#show dot1x interface type 0/1/2	Verifies your entries.

Resetting the 802.1x Configuration to the Default Values

You can reset the 802.1x configuration to the default values with a single command.

Beginning in privileged EXEC mode, follow these steps to reset the 802.1x configuration to the default values.

SUMMARY STEPS

1. **configure terminal**
2. **dot1x default**
3. **end**
4. **show dot1x**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	dot1x default Example: Router(config)#dot1x default	Resets the configurable 802.1x parameters to the default values.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.
Step 4	show dot1x Example: Router#show dot1x	Verifies your entries.

Displaying 802.1x Statistics and Status

To display 802.1x statistics for all interfaces, use the **show dot1x statistics** command in privileged EXEC mode. To display 802.1x statistics for a specific interface, use the **show dot1x statistics interface type 0/slot/port** in privileged EXEC mode.

To display the 802.1x administrative and operational status for the switch, use the **show dot1x** in privileged EXEC mode. To display the 802.1x administrative and operational status for a specific interface, use the **show dot1x interface type 0/slot/port** command in privileged EXEC mode.

Configuring Spanning Tree

- [Enabling Spanning Tree, page 30](#)
- [Configuring Spanning Tree Port Priority, page 30](#)
- [Configuring Spanning Tree Port Cost, page 31](#)
- [Configuring the Bridge Priority of a VLAN, page 33](#)
- [Configuring the Hello Time, page 34](#)
- [Configuring the Forward-Delay Time for a VLAN, page 34](#)
- [Configuring the Maximum Aging Time for a VLAN, page 34](#)
- [Disabling Spanning Tree, page 35](#)

Enabling Spanning Tree

You can enable spanning tree on a per-VLAN basis. The switch maintains a separate instance of spanning tree for each VLAN (except on VLANs on which you disable spanning tree).



Note

Spanning tree is enabled by default on all VLANs when they are created and the ports become members of that VLAN.

To enable spanning tree on a per-VLAN basis, use the **spanning-tree vlan *vlan_ID*** command in global configuration mode.

Verifying Spanning Tree

Use the **show spanning-tree vlan** to verify spanning tree configuration.

```
Router#show spanning-tree vlan 1
```

```
VLAN1 is executing the ieee compatible Spanning Tree protocol
Bridge Identifier has priority 32768, address 0025.451b.b22a
Configured hello time 2, max age 20, forward delay 15
Current root has priority 32768, address 0008.e36d.9f70
Root port is 18 (GigabitEthernet0/1/4), cost of root path is 38
Topology change flag not set, detected flag not set
Number of topology changes 11 last change occurred 02:43:01 ago
from GigabitEthernet0/1/2
Times: hold 1, topology change 35, notification 2
      hello 2, max age 20, forward delay 15
Timers: hello 0, topology change 0, notification 0, aging 300

Port 16 (GigabitEthernet0/1/2) of VLAN1 is forwarding
  Port path cost 4, Port priority 128, Port Identifier 128.16.
  Designated root has priority 32768, address 0008.e36d.9f70
  Designated bridge has priority 32768, address 0025.451b.b22a
  Designated port id is 128.16, designated path cost 38
  Timers: message age 0, forward delay 0, hold 0
  Number of transitions to forwarding state: 1
  BPDU: sent 9810, received 1
```

```
Router#
```

Configuring Spanning Tree Port Priority

Beginning in global configuration mode, follow these steps to configure the spanning tree port priority of an interface.

SUMMARY STEPS

1. **interface gigabitethernet *0/slot/port***
2. **spanning-tree port-priority *port_priority***
3. **spanning-tree vlan *vlan_ID* port-priority *port_priority***
4. **end**

DETAILED STEPS

	Command	Purpose
Step 1	interface gigabitethernet <i>0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/slot/port	Selects an interface to configure.
Step 2	spanning-tree port-priority <i>port_priority</i> Example: Router(config-if)#spanning-tree port-priority port_priority	Configures the port priority for an interface. The port_priority value can be from 0 to 255, in increments of 8. Use the no form of this command to restore the defaults.
Step 3	spanning-tree vlan <i>vlan_ID</i> port-priority <i>port_priority</i> Example: Router(config-if)#spanning-tree vlan <i>vlan_ID</i> port-priority <i>port_priority</i>	Configures the VLAN port priority for an interface. The port_priority value can be from 0 to 255, in increments of 8. Use the no form of this command to restore the defaults.
Step 4	end Example: Router(config-if)#end	Exits configuration mode.

Verifying Spanning Tree Port Priority

Use the **show spanning-tree interface** command to verify spanning-tree interface and the spanning-tree port priority configuration.

```
Router#show spanning-tree interface gigabitethernet 0/1/2

Port 16 (GigabitEthernet0/1/2) of VLAN1 is forwarding
Port path cost 4, Port priority 128, Port Identifier 128.16.
Designated root has priority 32768, address 0008.e36d.9f70
Designated bridge has priority 32768, address 0025.451b.b22a
Designated port id is 128.16, designated path cost 38
Timers: message age 0, forward delay 0, hold 0
Number of transitions to forwarding state: 1
BPDUs: sent 9096, received 1
Router#
```

Configuring Spanning Tree Port Cost

Beginning in global configuration mode, follow these steps to configure the spanning tree port cost of an interface.

SUMMARY STEPS

1. **interface gigabitethernet** *0/slot/port*
2. **spanning-tree cost** *port_cost*

3. `spanning-tree vlan vlan_ID cost port_cost`
4. `end`

DETAILED STEPS

	Command	Purpose
Step 1	<code>interface gigabitethernet <i>0/slot/port</i></code> Example: <code>Router(config)#interface gigabitethernet 0/1/2</code>	Selects an interface to configure.
Step 2	<code>spanning-tree cost <i>port_cost</i></code> Example: <code>Router(config-if)#spanning-tree cost 50</code>	Configures the port cost for an interface. The value of <code>port_cost</code> can be from 1 to 65535. Use the no form of this command to restore the defaults.
Step 3	<code>spanning-tree vlan <i>vlan_ID</i> cost <i>port_cost</i></code> Example: <code>Router(config-if)#spanning-tree vlan 1 cost 50</code>	Configures the VLAN port cost for an interface. The value of <code>port_cost</code> can be from 1 to 65535. Use the no form of this command to restore the defaults.
Step 4	<code>end</code> Example: <code>Router(config-if)#end</code>	Exits configuration mode.

Calculating Port Cost

Port cost value calculations are based on the bandwidth of the port. There are two classes of values. Short (16-bit) values are specified by the IEEE 802.1D specification, and range in value from 1 to 65535. Long (32-bit) values are specified by the IEEE 802.1t specification, and range in value from 1 to 200,000,000.

Assigning Short Port Cost Values

You can manually assign short port costs in the range of 1 to 65535. [Table 3](#) lists the default short port cost values.

Table 3 Default Short Port Cost Values

Port Speed	Default Cost Value
10 Mbps	100
100 Mbps	19
1000 Mbps	4

Assigning Long Port Cost Values

You can manually assign long port costs in the range of 1 to 200,000,000. [Table 4](#) lists the recommended cost values.

Table 4 Recommended Long Port Cost Values

Port Speed	Recommended Value	Recommended Range
10 Mbps	2,000,000	200,000 to 20,000,000
100 Mbps	200,000	20,000 to 2,000,000
1000 Mbps	20,000	2,000 to 200,000

Verifying Spanning Tree Port Cost

Use the **show spanning-tree vlan** command to verify the spanning-tree port cost configuration.

```
Router#show spanning-tree vlan 200

Port 264 (GigabitEthernet0/1/2) of VLAN200 is forwarding
Port path cost 17, Port priority 64, Port Identifier 129.8.
  Designated root has priority 32768, address 0010.0d40.34c7
  Designated bridge has priority 32768, address 0010.0d40.34c7
  Designated port id is 128.1, designated path cost 0
  Timers: message age 2, forward delay 0, hold 0
  Number of transitions to forwarding state: 1
  BPDU: sent 0, received 13513
Router#
```

Configuring the Bridge Priority of a VLAN

To configure the spanning tree bridge priority of a VLAN, use the **spanning-tree vlan *vlan_ID* priority *bridge_priority*** command in global configuration mode. The *bridge_priority* value can be from 1 to 65535.

Use the **no** form of this command to restore the defaults.

```
Router(config)#spanning-tree vlan 1 priority 25
```



Caution

Exercise care when using this command. For most situations, the **spanning-tree vlan *vlan_ID* root primary** command and the **spanning-tree vlan *vlan_ID* root secondary** command are the preferred commands to modify the bridge priority.

Verifying the Bridge Priority of a VLAN

Use the **show spanning-tree vlan bridge** command to verify the bridge priority, as illustrated below:

```
Router#show spanning-tree vlan 200 bridge brief
                    Hello Max Fwd
Vlan                Bridge ID      Time  Age Delay  Protocol
-----
VLAN200             33792 0050.3e8d.64c8  2   20   15  ieee
Router#
```

Configuring the Hello Time

To configure the hello interval for the spanning tree, use the **spanning-tree vlan *vlan_ID* hello-time *hello_time*** command in global configuration mode. The **hello_time** value can be from 1 to 10 seconds. Use the **no** form of this command to restore the defaults.

```
Router(config)#spanning-tree vlan 1 hello-time 5
```

Configuring the Forward-Delay Time for a VLAN

To configure the forward delay for the spanning tree, use the **spanning-tree vlan *vlan_ID* forward-time *forward_time*** command in global configuration mode. The value of **forward_time** can be from 4 to 30 seconds. Use the **no** form of this command to restore the defaults.

```
Router(config)#spanning-tree vlan 1 forward-time 4
```

Configuring the Maximum Aging Time for a VLAN

To configure the maximum age interval for the spanning tree, use the **spanning-tree vlan *vlan_ID* max-age *max_age*** command in global configuration mode. The value of **max_age** can be from 6 to 40 seconds. Use the **no** form of this command to restore the defaults.

```
Router(config)#spanning-tree vlan 1 max-age 20
```

Configuring the Root Bridge

The EtherSwitch EHWIC maintains a separate instance of spanning tree for each active VLAN configured on the switch. A bridge ID, consisting of the bridge priority and the bridge MAC address, is associated with each instance. For each VLAN, the switch with the lowest bridge ID becomes the root bridge for that VLAN.

To configure a VLAN instance to become the root bridge, the bridge priority can be modified from the default value (32768) to a significantly lower value so that the bridge becomes the root bridge for the specified VLAN. Use the **spanning-tree vlan *vlan-ID* root** command to alter the bridge priority.

The switch checks the bridge priority of the current root bridges for each VLAN. The bridge priority for the specified VLANs is set to 8192 if this value will cause the switch to become the root for the specified VLANs.

If any root switch for the specified VLANs has a bridge priority lower than 8192, the switch sets the bridge priority for the specified VLANs to 1 less than the lowest bridge priority.

For example, if all switches in the network have the bridge priority for VLAN 100 set to the default value of 32768, entering the **spanning-tree vlan 100 root primary** command on a switch will set the bridge priority for VLAN 100 to 8192, causing the switch to become the root bridge for VLAN 100.



Note

The root switch for each instance of a spanning tree should be a backbone or distribution switch. Do not configure an access switch as the spanning tree primary root.

Use the **diameter** keyword to specify the Layer 2 network diameter (that is, the maximum number of bridge hops between any two end stations in the Layer 2 network). When you specify the network diameter, the switch automatically picks an optimal hello time, forward delay time, and maximum age time for a network of that diameter, which can significantly reduce the spanning tree convergence time. Use the **hello** keyword to override the automatically calculated hello time.

**Note**

We recommend that you avoid configuring the hello time, forward delay time, and maximum age time manually after configuring the switch as the root bridge.

To configure the switch as the root, use the **spanning-tree vlan *vlan_ID* root primary** [diameter *net-diameter* [**hello-time seconds**]] command in global configuration mode. Use the **no** form of this command to restore the defaults.

Disabling Spanning Tree

To disable spanning tree on a per-VLAN basis, use the **no spanning-tree vlan *vlan_ID*** command in global configuration mode.

Verifying that Spanning Tree is Disabled

Use the **show spanning-tree vlan** command to verify that the spanning tree is disabled, as shown in the example below:

```
Router#show spanning-tree vlan 200
<output truncated>
Spanning tree instance for VLAN 200 does not exist.
Router#
```

Configuring MAC Table Manipulation

Port security is implemented by providing the user with the option to make a port secure by allowing only well-known MAC addresses to send in data traffic. Up to 200 secure MAC addresses per platform are supported.

- [Enabling Known MAC Address Traffic, page 35](#)
- [Creating a Static Entry in the MAC Address Table, page 36](#)
- [Configuring the Aging Timer, page 37](#)

Enabling Known MAC Address Traffic

Beginning in privileged EXEC mode, follow these steps to enable the MAC address secure option.

SUMMARY STEPS

1. **configure terminal**
2. **mac-address-table secure *mac-address* gi *0/slot/port* [vlan *vlan id*]**
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	mac-address-table secure <i>mac-address</i> gi <i>0/slot/port</i> [vlan <i>vlan id</i>] Example: Router(config)#mac-address-table secure 0000.0002.0001 gi 0/1/2 vlan 1	Secures the MAC address traffic on the port.
Step 3	end Example: Router(config)#end	Exits global configuration mode.

Verifying the MAC Address Table Secure Option

Use the **show mac-address-table secure** command to verify the configuration, as illustrated below:

```
Router#show mac-address-table secure
```

```
Secure Address Table:
```

```
Destination Address  Address Type  VLAN  Destination Port
-----
0000.0002.0001      Secure        2     GigabitEthernet0/1/2
```

Creating a Static Entry in the MAC Address Table

Beginning in privileged EXEC mode, follow these steps to create a static entry in the MAC address table.

SUMMARY STEPS

1. **configure terminal**
2. **mac-address-table static** *mac-address* **gi** *0/slot/port* [**vlan** *vlan id*]
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	mac-address-table static <i>mac-address</i> gi <i>0/slot/port</i> [vlan <i>vlan id</i>] Example: Router(config)#mac-address-table static 0025.451b.b22e gi 0/1/2 vlan 1	Creates static entry in the MAC address table.
Step 3	end Example: Router(config)#end	Exits global configuration mode.

Use the **show mac-address-table** command in privileged EXEC mode to verify the configuration.

Configuring the Aging Timer

Beginning in privileged EXEC mode, follow these steps to configure the aging timer.

SUMMARY STEPS

1. **configure terminal**
2. **mac-address-table aging-time** *aging timer*
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	mac-address-table aging-time <i>aging timer</i> Example: Router(config)#mac-address-table aging-time 320	Configures the MAC address aging timer age, in seconds.
Step 3	end Example: Router(config)#end	Exits configuration mode.

**Caution**

Do not change the aging timer. If you change the aging timer, the EtherSwitch EHWIC could go out of synchronization.

Verifying the Aging Time

Use the **show mac-address-table aging-time** command to verify the MAC address table aging timer, as shown below:

```
Router#show mac-address-table aging-time
Mac address aging time 320
```

Configuring Cisco Discovery Protocol

Cisco Discovery Protocol (CDP) is primarily used to obtain protocol addresses of neighboring devices and discover the platform of those devices. CDP can also be used to display information about the interfaces your router uses. CDP is media- and protocol-independent, and runs on all Cisco-manufactured equipment including routers, bridges, access servers, and switches.

For information on how to configure CDP, see *Using Cisco Discovery Protocol* at

http://www.cisco.com/en/US/docs/ios/netmgmt/configuration/guide/nm_cdp_discover.html

Configuring the Switched Port Analyzer

This section describes how to configure a Switched Port Analyzer (SPAN) session for an EtherSwitch EHWIC.

**Note**

An EtherSwitch EHWIC supports only one SPAN session.

**Note**

Tx, Rx, or both Tx and Rx monitoring is supported.

- [Configuring the SPAN Sources, page 39](#)
- [Configuring SPAN Destinations, page 39](#)
- [Verifying the SPAN Session, page 39](#)
- [Removing Sources or Destinations from a SPAN Session, page 39](#)

Configuring the SPAN Sources

To configure the source for a SPAN session, use the **monitor session session source** {**interface type** *0/slot/port* | **vlan** *vlan_ID* [, | - | **rx** | **tx** | **both**]} command in global configuration mode. This command specifies the SPAN session, the source interfaces or VLANs, and the traffic direction to be monitored.

```
Router(config)#monitor session 1 source interface gigabitethernet 0/1/0
```

Configuring SPAN Destinations

To configure the destination for a SPAN session, use the **monitor session session destination** {**interface type** *0/slot/port* | **vlan** *vlan_ID* [, | - | **rx** | **tx** | **both**]} command in global configuration mode.

```
Router(config)#monitor session 1 destination interface gigabitethernet 0/1/1
```

Verifying the SPAN Session

Use the **show monitor session** command to verify the sources and destinations configured for the SPAN session.

```
Router#show monitor session 1
Session 1
-----
Source Ports:
  RX Only: None
  TX Only: None
  Both: Gi0/1/0
Source VLANs:
  RX Only: None
  TX Only: None
  Both: None
Destination Ports: Gi0/1/1
Filter VLANs: None
```

Removing Sources or Destinations from a SPAN Session

To remove sources or destinations from the SPAN session, use the **no monitor session session** command in global configuration mode as shown in the following example:

```
Router(config)#no monitor session 1
```

Configuring Power Management on the Interface

This section describes how to configure power management on the interface and contains the following topics:

- [Configuring Power to Cisco IP Phones, page 40](#)
- [Configuring Maximum Inline Power Supply to a Port, page 41](#)
- [Verifying Power Management on the Interface, page 41](#)

Configuring Power to Cisco IP Phones

Beginning in privileged EXEC mode, follow these steps to manage power to Cisco IP phones.

SUMMARY STEPS

1. **configure terminal**
2. **interface gigabitethernet 0/slot/port**
3. **power inline auto**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface gigabitethernet 0/slot/port Example: Router(config)#interface gigabitethernet 0/1/2	Selects a particular GigabitEthernet interface for configuration.
Step 3	power inline auto Example: Router(config-if)#power inline auto	Configures the port to supply inline power automatically to a Cisco IP phone. Use the power inline never command to permanently disable inline power on the port. Note On the Cisco ISR G2, the Cisco Gigabit EtherSwitch EHWICs with POE modules does not provide inline power to devices unless their speed and duplex settings are both set to auto .

Configuring Maximum Inline Power Supply to a Port

The default power limit per port is 20 watts. Use the **power inline port max** *max-wattage* command to configure the maximum inline power supply to a port the EHWIC.

Beginning in privileged EXEC mode, follow these steps to configure the maximum inline power for a port on the EHWIC:

SUMMARY STEPS

1. **configure terminal**
2. **interface gigabitethernet 0/slot/port**
3. **power inline port max** *max-wattage*

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface gigabitethernet 0/slot/port Example: Router(config)#interface gigabitethernet 0/1/3	Selects a particular GigabitEthernet interface for configuration.
Step 3	power inline port max <i>max-wattage</i> Example: Router(config-if)#power inline port max 6300	Sets the maximum power to a device connected to the EHWIC port. The maximum power can be set between 4,000 and 20,000 milliwatts.

Verifying Power Management on the Interface

Use the **show power inline** command to verify the power configuration on the ports.

```
Router#show power inline
```

```
PowerSupply  SlotNum.  Maximum  Allocated  Status
-----
INT-PS      0          200.000  32.100    PS GOOD  RPS ABSENT
Interface   Config    Device   Powered   PowerAllocated  State
-----
Gi0/1/3    auto     Cisco   On        6.300 Watts     PHONE
Gi0/1/2    auto     Unknown Off        0.000 Watts     NOT_PHONE
Gi0/1/1    auto     Unknown Off        0.000 Watts     UNKNOWN
Gi0/1/0    auto     IEEE-3  On        12.900 Watts    PHONE
Gi0/3/7    auto     Unknown Off        0.000 Watts     NOT_PHONE
Gi0/3/6    auto     IEEE-3  On        12.900 Watts    PHONE
```

Use the **show power inline actual** command to show the actual power used by the device at that time.

```
Router#show power inline actual
Interface                Power
-----
Gi1/0                    no
Gi0/1/3                  yes ( 3.599 Watts)
Gi0/1/2                  yes ( 5.758 Watts)
Gi0/1/1                  no
Gi0/1/0                  no
Gi0/3/7                  no
Gi0/3/6                  yes ( 6.838 Watts)
Gi0/3/5                  no
Gi0/3/4                  no
Gi0/3/3                  no
Gi0/3/2                  no
Gi0/3/1                  no
Gi0/3/0                  no
```

Ethernet Switch Network Modules with PoE support should be reloaded to function properly upon PoE Power Supply OIR insertion/removal.

Configuring IP Multicast Layer 3 Switching

These sections describe how to configure IP multicast Layer 3 switching:

- [Enabling IP Multicast Routing Globally, page 42](#)
- [Enabling IP Protocol-Independent Multicast \(PIM\) on Layer 3 Interfaces, page 43](#)
- [Verifying IP Multicast Layer 3 Switching Summary, page 43](#)
- [Verifying the IP Multicast Routing Table, page 45](#)

Enabling IP Multicast Routing Globally

You must enable IP multicast routing globally before you can enable IP multicast Layer 3 switching on Layer 3 interfaces.

For complete information and procedures, see these publications:

- *Cisco IOS IP Multicast Configuration Guide, Release 15.1*
http://www.cisco.com/en/US/docs/ios/ipmulti/configuration/guide/15_1/imc_15_1_book.html
- *Cisco IOS IP Addressing Services Command Reference*
http://www.cisco.com/en/US/docs/ios/ipaddr/command/reference/iad_book.html
- *Cisco IOS IP Multicast Command Reference*
http://www.cisco.com/en/US/docs/ios/ipmulti/command/reference/imc_book.html

To enable IP multicast routing globally, use the **ip multicast-routing** command in global configuration mode.

Enabling IP Protocol-Independent Multicast (PIM) on Layer 3 Interfaces

You must enable PIM on the Layer 3 interfaces before enabling IP multicast Layer 3 switching functions on those interfaces.

Beginning in global configuration mode, follow these steps to enable IP PIM on a Layer 3 interface.

SUMMARY STEPS

1. **interface vlan *vlan-id***
2. **ip pim {dense-mode | sparse-mode | sparse-dense-mode}**

DETAILED STEPS

	Command	Purpose
Step 1	interface vlan <i>vlan-id</i> Example: Router(config)#interface vlan 1	Selects the interface to be configured.
Step 2	ip pim {dense-mode sparse-mode sparse-dense-mode} Example: Router(config-if)#ip pim dense-mode	Enables IP PIM on a Layer 3 interface.

The following example shows how to enable PIM on an interface using the default mode (**sparse-dense-mode**):

```
Router(config-if)#ip pim sparse-dense-mode
Router(config-if)#
```

The following example shows how to enable PIM sparse mode on an interface:

```
Router(config-if)#ip pim sparse-mode
Router(config-if)#
```

Verifying IP Multicast Layer 3 Switching Summary



Note

The **show interface statistics** command does not verify hardware-switched packets. It only verifies packets switched by software.

The **show ip pim interface count** command verifies the IP multicast Layer 3 switching enable state on IP PIM interfaces and the number of packets received and sent on the interface.

Use the following **show** commands to verify IP multicast Layer 3 switching information for an IP PIM Layer 3 interface.

Step 1 Router#**show ip pim interface count**

```
State:* - Fast Switched, D - Distributed Fast Switched
```

```

      H - Hardware Switching Enabled
Address      Interface      FS  Mpackets In/Out
10.0.0.1     VLAN1           *   151/0
Router#

```

Step 2 Router#**show ip mroute count**

```

IP Multicast Statistics
5 routes using 2728 bytes of memory
4 groups, 0.25 average sources per group
Forwarding Counts:Pkt Count/Pkts per second/Avg Pkt Size/Kilobits per second
Other counts:Total/RPF failed/Other drops(OIF-null, rate-limit etc)

Group:224.9.9.9, Source count:1, Packets forwarded: 0, Packets received: 66
  Source:10.0.0.2/32, Forwarding:0/0/0/0, Other:66/0/66
Group:224.10.10.10, Source count:0, Packets forwarded: 0, Packets received: 0
Group:224.0.1.39, Source count:0, Packets forwarded: 0, Packets received: 0
Group:224.0.1.40, Source count:0, Packets forwarded: 0, Packets received: 0
Router#

```

**Note**

A negative counter means that the outgoing interface list of the corresponding entry is NULL, and this indicates that this flow is still active.

Step 3 Router#**show ip interface vlan 1**

```

Vlan1 is up, line protocol is up
  Internet address is 10.0.0.1/24
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  Helper address is not set
  Directed broadcast forwarding is disabled
  Multicast reserved groups joined: 224.0.0.1 224.0.0.2 224.0.0.22 224.0.0.13
  Outgoing access list is not set
  Inbound access list is not set
  Proxy ARP is enabled
  Local Proxy ARP is disabled
  Security level is default
  Split horizon is enabled
  ICMP redirects are always sent
  ICMP unreachable are always sent
  ICMP mask replies are never sent
  IP fast switching is enabled
  IP fast switching on the same interface is disabled
  IP Flow switching is disabled
  IP CEF switching is enabled
  IP CEF Fast switching turbo vector
  IP multicast fast switching is enabled
  IP multicast distributed fast switching is disabled
  IP route-cache flags are Fast, CEF
  Router Discovery is disabled
  IP output packet accounting is disabled
  IP access violation accounting is disabled
  TCP/IP header compression is disabled
  RTP/IP header compression is disabled
  Policy routing is disabled
  Network address translation is disabled
  WCCP Redirect outbound is disabled
  WCCP Redirect inbound is disabled
  WCCP Redirect exclude is disabled
  BGP Policy Mapping is disabled
Router#

```

Verifying the IP Multicast Routing Table

Use the **show ip mroute** command to verify the IP multicast routing table:

```
Router#show ip mroute 224.10.103.10

IP Multicast Routing Table
Flags:D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
      L - Local, P - Pruned, R - RP-bit set, F - Register flag,
      T - SPT-bit set, J - Join SPT, M - MSDP created entry,
      X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
      U - URD, I - Received Source Specific Host Report, Z - Multicast Tunnel,
      Y - Joined MDT-data group, y - Sending to MDT-data group
Outgoing interface flags:H - Hardware switched, A - Assert winner
Timers:Uptime/Expires
Interface state:Interface, Next-Hop or VCD, State/Mode

(*, 224.10.10.10), 00:09:21/00:02:56, RP 0.0.0.0, flags:DC
  Incoming interface:Null, RPF nbr 0.0.0.0
  Outgoing interface list:
    Vlan1, Forward/Sparse-Dense, 00:09:21/00:00:00, H

Router#
```



Note

The RPF-MFD flag indicates that the flow is completely hardware switched. The H flag indicates that the flow is hardware switched on the outgoing interface.

Configuring IGMP Snooping

This section describes how to configure IGMP snooping on your router and consists of the following configuration information and procedures:

- [Enabling or Disabling IGMP Snooping, page 45](#)
- [Enabling IGMP Immediate-Leave Processing, page 47](#)
- [Statically Configuring an Interface to Join a Group, page 48](#)
- [Configuring a Multicast Router Port, page 49](#)

Enabling or Disabling IGMP Snooping

By default, IGMP snooping is globally enabled on the EtherSwitch EHWIC. When globally enabled or disabled, it is also enabled or disabled in all existing VLAN interfaces. By default, IGMP snooping is enabled on all VLANs, but it can be enabled and disabled on a per-VLAN basis.

Global IGMP snooping overrides the per-VLAN IGMP snooping capability. If global snooping is disabled, you cannot enable VLAN snooping. If global snooping is enabled, you can enable or disable snooping on a VLAN basis.

Beginning in privileged EXEC mode, follow these steps to globally enable IGMP snooping on the EtherSwitch EHWIC.

SUMMARY STEPS

1. **configure terminal**
2. **ip igmp snooping**

3. **end**
4. **show ip igmp snooping**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	ip igmp snooping Example: Router(config)#ip igmp snooping	Globally enables IGMP snooping in all existing VLAN interfaces.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.
Step 4	show ip igmp snooping Example: Router#show ip igmp snooping	Displays snooping configuration.

To globally disable IGMP snooping on all VLAN interfaces, use the **no ip igmp snooping** global command.

Beginning in privileged EXEC mode, follow these steps to enable IGMP snooping on a VLAN interface.

SUMMARY STEPS

1. **configure terminal**
2. **ip igmp snooping vlan *vlan-id***
3. **end**
4. **show ip igmp snooping [vlan *vlan-id*]**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	ip igmp snooping vlan <i>vlan-id</i> Example: Router(config)#ip igmp snooping vlan 1	Enables IGMP snooping on the VLAN interface.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.
Step 4	show ip igmp snooping [vlan <i>vlan-id</i>] Example: show ip igmp snooping vlan 1	Displays snooping configuration. (Optional) <i>vlan-id</i> is the number of the VLAN.

To disable IGMP snooping on a VLAN interface, use the **no ip igmp snooping vlan *vlan-id*** command in global configuration mode for the specified VLAN number (for example, vlan1).

Enabling IGMP Immediate-Leave Processing

When you enable IGMP Immediate-Leave processing, the EtherSwitch EHWIC immediately removes a port from the IP multicast group when it detects an IGMP version 2 leave message on that port. Immediate-Leave processing allows the switch to remove an interface that sends a leave message from the forwarding table without first sending out group-specific queries to the interface. You should use the Immediate-Leave feature only when there is only a single receiver present on every port in the VLAN. Beginning in privileged EXEC mode, follow these steps to enable IGMP Immediate-Leave processing.

SUMMARY STEPS

1. **configure terminal**
2. **ip igmp snooping vlan *vlan-id* immediate-leave**
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	ip igmp snooping vlan <i>vlan-id</i> immediate-leave Example: Router(config)#ip igmp snooping vlan 1 immediate-leave	Enables IGMP Immediate-Leave processing on the VLAN interface.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

To disable Immediate-Leave processing, follow Steps 1 and 2 to enter interface configuration mode, and use the **no ip igmp snooping vlan *vlan-id* immediate-leave** command in global configuration mode.

Statically Configuring an Interface to Join a Group

Ports normally join multicast groups through the IGMP report message, but you can also statically configure a host on an interface.

Beginning in privileged EXEC mode, follow these steps to add a port as a member of a multicast group.

SUMMARY STEPS

1. **configure terminal**
2. **ip igmp snooping vlan *vlan-id* static *mac-address* interface *interface-id***
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode
Step 2	ip igmp snooping vlan <i>vlan-id</i> static <i>mac-address</i> interface <i>interface-id</i> Example: Router(config)#ip igmp snooping vlan 1 static 0100.5e02.0203 interface gigabitethernet 0/1/2	Statically configures a port as a member of a multicast group: <ul style="list-style-type: none"> • <i>vlan-id</i> is the multicast group VLAN ID. • <i>mac-address</i> is the group MAC address. • <i>interface-id</i> is the member port.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

Use the **show mac-address-table multicast [vlan *vlan-id*] [user | igmp-snooping] [count]** command in privileged EXEC mode to view the MAC address table entries for a VLAN.

Configuring a Multicast Router Port

Beginning in privileged EXEC mode, follow these steps to enable a static connection to a multicast router.

SUMMARY STEPS

1. **configure terminal**
2. **ip igmp snooping vlan *vlan-id* mrouter {interface *interface-id* | learn pim-dvmrp}**
3. **end**
4. **show ip igmp snooping [vlan *vlan-id*]**
5. **show ip igmp snooping mrouter [vlan *vlan-id*]**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal	Enters global configuration mode.
	Example: Router#configure terminal	
Step 2	ip igmp snooping vlan <i>vlan-id</i> mrouter { interface <i>interface-id</i> learn pim-dvmrp }	Specifies the multicast router VLAN ID (1 to 1001). Specifies the interface to the multicast router.
	Example: Router(config)#ip igmp snooping vlan 1 mrouter interface gigabitethernet0/1/2	
Step 3	end	Returns to privileged EXEC mode.
	Example: Router(config)#end	
Step 4	show ip igmp snooping [vlan <i>vlan-id</i>]	Verifies that IGMP snooping is enabled on the VLAN interface.
	Example: Router#show ip igmp snooping vlan 1	
Step 5	show ip igmp snooping mrouter [vlan <i>vlan-id</i>]	Displays information on dynamically learned and manually configured multicast router interfaces.
	Example: Router#show ip igmp snooping mrouter vlan 1	

Configuring Per-Port Storm-Control

You can use these techniques to block the forwarding of unnecessary flooded traffic. This section describes how to configure per-port storm-control and characteristics on your router and consists of the following configuration procedures:

- [Enabling Per-Port Storm-Control, page 50](#)
- [Disabling Per-Port Storm-Control, page 52](#)

By default, unicast, broadcast, and multicast suppression is disabled.

Enabling Per-Port Storm-Control

Beginning in privileged EXEC mode, follow these steps to enable per-port storm-control.

SUMMARY STEPS

1. **configure terminal**
2. **interface *type 0/slot/port***
3. **storm-control {broadcast | multicast | unicast} level *level-high* [*level-low*]**

4. **storm-control action shutdown**
5. **end**
6. **show storm-control** [*interface-type interface-number*] [**broadcast** | **multicast** | **unicast** | **history**]

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface <i>type 0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/1/2	Enters interface configuration mode, and enter the port to configure.
Step 3	storm-control { broadcast multicast unicast } level <i>level-high</i> [<i>level-low</i>] Example: Router(config-if)#storm-control {broadcast multicast unicast} level level-high [level-low]	Configures broadcast, multicast, or unicast per-port storm-control. Specify the rising threshold level for either broadcast, multicast, or unicast traffic. The storm control action occurs when traffic utilization reaches this level. (Optional) Specify the falling threshold level. The normal transmission restarts (if the action is filtering) when traffic drops below this level.
Step 4	storm-control action shutdown Example: Router(config-if)#storm-control action shutdown	Selects the shutdown keyword to disable the port during a storm. The default is to filter out the traffic.
Step 5	end Example: Router(config-if)#end	Returns to privileged EXEC mode.
Step 6	show storm-control [<i>interface-type interface-number</i>] [broadcast multicast unicast history] Example: Router#show storm-control gigabitethernet 0/1/2 history	Verifies your entries.



Note

If any type of traffic exceeds the upper threshold limit, all of the other types of traffic are stopped.

Disabling Per-Port Storm-Control

Beginning in privileged EXEC mode, follow these steps to disable per-port storm-control.

SUMMARY STEPS

1. **configure terminal**
2. **interface** *type 0/slot/port*
3. **no storm-control** { **broadcast** | **multicast** | **unicast** } **level** | **action shutdown** }
4. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface <i>type 0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/1/2	Enters interface configuration mode, and enter the port to configure.
Step 3	no storm-control { broadcast multicast unicast } level action shutdown } Example: Router(config-if)#no storm-control action shutdown	Disables per-port storm control or the specified storm control action.
Step 4	end Example: Router(config-if)#end	Returns to privileged EXEC mode.

Use the **show storm-control** [*interface-type interface-number*] [**broadcast** | **multicast** | **unicast** | **history**] command in privileged EXEC mode to verify your entries.

Configuring Fallback Bridging

This section describes how to configure fallback bridging on your switch. It contains the following configuration information:

- [Understanding the Default Fallback Bridging Configuration, page 53](#)
- [Creating a Bridge Group, page 53](#)
- [Preventing the Forwarding of Dynamically Learned Stations, page 55](#)

- [Configuring the Bridge Table Aging Time, page 56](#)
- [Filtering Frames by a Specific MAC Address, page 56](#)
- [Adjusting Spanning-Tree Parameters, page 57](#)
- [Monitoring and Maintaining the Network, page 64](#)

Understanding the Default Fallback Bridging Configuration

Table 5 shows the default fallback bridging configuration.

Table 5 **Default Fallback Bridging Configuration**

Feature	Default Setting
Bridge groups	None are defined or assigned to an interface. No VLAN-bridge STP is defined.
Switch forwards frames for stations that it has dynamically learned	Enabled.
Bridge table aging time for dynamic entries	300 seconds.
MAC-layer frame filtering	Disabled.
Spanning tree parameters:	
Switch priority	32768.
Interface priority	128.
Interface path cost	10 Mbps: 100. 100 Mbps: 19. 1000 Mbps: 4.
Hello BPDU interval	2 seconds.
Forward-delay interval	20 seconds.
Maximum idle interval	30 seconds.

Creating a Bridge Group

To configure fallback bridging for a set of SVIs, these interfaces must be assigned to bridge groups. All interfaces in the same group belong to the same bridge domain. Each SVI can be assigned to only one bridge group.

Beginning in privileged EXEC mode, follow these steps to create a bridge group and assign an interface to it.

SUMMARY STEPS

1. **configure terminal**
2. **no ip routing**
3. **bridge** *bridge-group* **protocol** **vlan-bridge**
4. **interface** **vlan** *vlan-id*
5. **bridge-group** *bridge-group*
6. **end**

7. show vlan-bridge

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	no ip routing Example: Router(config)#no ip routing	Disables IP routing.
Step 3	bridge <i>bridge-group</i> protocol vlan-bridge Example: Router(config)#bridge 1 protocol vlan-bridge	Assigns a bridge group number, and specifies the VLAN-bridge spanning-tree protocol to run in the bridge group. The ibm and dec keywords are not supported. For <i>bridge-group</i> , specify the bridge group number. The range is from 1 to 255. Frames are bridged only among interfaces in the same group.
Step 4	interface vlan <i>vlan-id</i> Example: Router(config)#interface vlan 1	Enters interface configuration mode and specifies the interface on which you want to assign the bridge group. The specified interface must be an SVI: A VLAN interface that you created by using the interface vlan <i>vlan-id</i> global configuration command. These ports must have IP addresses assigned to them.
Step 5	bridge-group <i>bridge-group</i> Example: Router(config-if)#bridge-group 1	Assigns the interface to the bridge group created in Step 3. By default, the interface is not assigned to any bridge group. An interface can be assigned to only one bridge group.
Step 6	end Example: Router(config-if)#end	Returns to privileged EXEC mode.
Step 7	show vlan-bridge Example: Router#show vlan-bridge	(Optional) Verifies forwarding mode.

To remove a bridge group, use the **no bridge *bridge-group* protocol vlan-bridge** global configuration command. To remove an interface from a bridge group, use the **no bridge-group *bridge-group*** command in interface configuration mode.

Preventing the Forwarding of Dynamically Learned Stations

By default, the switch forwards any frames for stations that it has dynamically learned. By disabling this activity, the switch only forwards frames whose addresses have been statically configured into the forwarding cache.

Beginning in privileged EXEC mode, follow these steps to prevent the switch from forwarding frames for stations that it has dynamically learned.

SUMMARY STEPS

1. **configure terminal**
2. **no bridge *bridge-group* acquire**
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	no bridge <i>bridge-group</i> acquire Example: Router(config)#no bridge 1 acquire	Enables the switch to stop forwarding any frames for stations that it has dynamically learned through the discovery process and to limit frame forwarding to statically configured stations. The switch filters all frames except those whose destined-to addresses have been statically configured into the forwarding cache. To configure a static address, use the bridge <i>bridge-group</i> address <i>mac-address</i> {forward discard} command in global configuration mode. For <i>bridge-group</i> , specify the bridge group number. The range is 1 to 255.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

To cause the switch to forward frames to stations that it has dynamically learned, use the **bridge *bridge-group* acquire** command in global configuration mode.

Configuring the Bridge Table Aging Time

A switch forwards, floods, or drops packets based on the bridge table. The bridge table maintains both static and dynamic entries. Static entries are entered by you. Dynamic entries are entered by the bridge learning process. A dynamic entry is automatically removed after a specified length of time, known as aging time, from the time the entry was created or last updated.

If you are likely to move hosts on a switched network, decrease the aging-time to enable the switch to quickly adapt to the change. If hosts on a switched network do not continuously send packets, increase the aging time to keep the dynamic entries for a longer time and thus reduce the possibility of flooding when the hosts send again.

Beginning in privileged EXEC mode, follow these steps to configure the aging time.

SUMMARY STEPS

1. **configure terminal**
2. **bridge *bridge-group* aging-time seconds**
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	bridge <i>bridge-group</i> aging-time seconds Example: Router(config)#bridge 1 aging-time 50	Specifies the length of time that a dynamic entry remains in the bridge table from the time the entry was created or last updated. <ul style="list-style-type: none"> • For <i>bridge-group</i>, specify the bridge group number. The range is 1 to 255. • For <i>seconds</i>, enter a number from 0 to 1000000. The default is 300.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

To return to the default aging-time interval, use the **no bridge *bridge-group* aging-time** command in global configuration mode.

Filtering Frames by a Specific MAC Address

A switch examines frames and sends them through the internetwork according to the destination address; a switch does not forward a frame back to its originating network segment. You can use the software to configure specific administrative filters that filter frames based on information other than the paths to their destinations.

You can filter frames with a particular MAC-layer station destination address. Any number of addresses can be configured in the system without a performance penalty.

Beginning in privileged EXEC mode, follow these steps to filter by the MAC-layer address.

SUMMARY STEPS

1. **configure terminal**
2. **bridge** *bridge-group* **address** *mac-address* { **forward** | **discard** } [*interface*]
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal	Enters global configuration mode.
	Example: Router#configure terminal	
Step 2	bridge <i>bridge-group</i> address <i>mac-address</i> { forward discard } [<i>interface</i>]	Specifies the MAC address to discard or forward. <ul style="list-style-type: none"> • For <i>bridge-group</i>, specify the bridge group number. The range is from 1 to 255. • For <i>mac-address</i>, specify the MAC-layer destination address to be filtered. • Specify forward to forward the frame destined for the specified interface. Specify discard to discard the frame. • (Optional) For <i>interface</i>, specify the interface on which the address can be reached.
	Example: Router(config)#bridge 1 address 0025.451b.b22e forward	
Step 3	end	Returns to privileged EXEC mode.
	Example: Router(config)#end	

To disable the frame forwarding ability, use the **no bridge** *bridge-group* **address** *mac-address* command in global configuration mode.

Adjusting Spanning-Tree Parameters

Parameters affecting the entire spanning tree are configured with variations of the **bridge** command in global configuration mode. Interface-specific parameters are configured with variations of the **bridge-group** command in interface configuration mode.

To adjust spanning-tree parameters, perform the tasks in these sections:

- [Changing the Switch Priority, page 58](#)
- [Changing the Interface Priority, page 58](#)
- [Assigning a Path Cost, page 59](#)
- [Adjusting BPDU Intervals, page 60](#)
- [Disabling the Spanning Tree on an Interface, page 63](#)

**Note**

Only network administrators with a good understanding of how switches and STP function should make adjustments to spanning-tree parameters. Poorly planned adjustments can have a negative impact on performance. A good source on switching is the IEEE 802.1d specification.

Changing the Switch Priority

You can globally configure the priority of an individual switch when two switches tie for position as the root switch, or you can configure the likelihood that a switch will be selected as the root switch. This priority is determined by default; however, you can change it.

Beginning in privileged EXEC mode, follow these steps to change the switch priority.

SUMMARY STEPS

1. **configure terminal**
2. **bridge *bridge-group* priority number**
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	bridge <i>bridge-group</i> priority number Example: Router(config)#bridge 1 priority 50	Changes the priority of the switch. <ul style="list-style-type: none"> • For <i>bridge-group</i>, specify the bridge group number. The range is 1 to 255. • For <i>number</i>, enter a number from 0 to 65535. The default is 32768. The lower the number, the more likely the switch will be chosen as the root.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

No **no** form of this command exists. To return to the default setting, use the **bridge *bridge-group* priority number** command in global configuration mode, and set the priority to the default value. To change the priority on an interface, use the **bridge-group priority** command in interface configuration mode (described in the next section).

Changing the Interface Priority

You can change the priority for an interface. When two switches tie for position as the root switch, you configure an interface priority to break the tie. The switch with the lowest interface value is selected.

Beginning in privileged EXEC mode, follow these steps to change the interface priority.

SUMMARY STEPS

1. **configure terminal**
2. **interface** *type 0/slot/port*
3. **bridge-group** *bridge-group priority number*
4. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface <i>type 0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/1/2	Enters interface configuration mode, and specifies the interface to set the priority.
Step 3	bridge-group <i>bridge-group priority number</i> Example: Router(config-if)#bridge-group 1 priority 100	Changes the priority of an interface. <ul style="list-style-type: none"> • For <i>bridge-group</i>, specify the bridge group number. The range is 1 to 255. • For <i>number</i>, enter a number from 0 to 255. The lower the number, the more likely that the interface on the switch will be chosen as the root. The default is 128.
Step 4	end Example: Router(config-if)#end	Returns to privileged EXEC mode.

To return to the default setting, use the **bridge-group** *bridge-group priority number* command in interface configuration mode.

Assigning a Path Cost

Each interface has a path cost associated with it. By convention, the path cost is 1000/data rate of the attached LAN, in Mbps.

Beginning in privileged EXEC mode, follow these steps to assign a path cost.

SUMMARY STEPS

1. **configure terminal**
2. **interface** *type 0/slot/port*
3. **bridge-group** *bridge-group path-cost cost*
4. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface <i>type 0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/1/2	Enters interface configuration mode, and specifies the interface to set the path cost.
Step 3	bridge-group <i>bridge-group</i> path-cost <i>cost</i> Example: Router(config-if)#bridge-group 1 path-cost 5	Assigns the path cost of an interface. <ul style="list-style-type: none"> For <i>bridge-group</i>, specify the bridge group number. The range is 1 to 255. For <i>cost</i>, enter a number from 1 to 65536. The higher the value, the higher the cost. <ul style="list-style-type: none"> For 10 Mbps, the default path cost is 100. For 100 Mbps, the default path cost is 19. For 1000 Mbps, the default path cost is 4.
Step 4	end Example: Router(config-if)#end	Returns to privileged EXEC mode.

To return to the default path cost, use the **no bridge-group** *bridge-group* **path-cost** *cost* command in interface configuration mode.

Adjusting BPDU Intervals

You can adjust BPDU intervals as described in these sections:

- [Adjusting the Interval between Hello BPDUs, page 60](#)
- [Changing the Forward-Delay Interval, page 61](#)
- [Changing the Maximum-Idle Interval, page 62](#)

**Note**

Each switch in a spanning tree adopts the interval between hello BPDUs, the forward delay interval, and the maximum idle interval parameters of the root switch, regardless of its individual configuration.

Adjusting the Interval between Hello BPDUs

Beginning in privileged EXEC mode, follow these step to adjust the interval between hello BPDUs.

SUMMARY STEPS

1. **configure terminal**

2. **bridge** *bridge-group* **hello-time** *seconds*
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	bridge <i>bridge-group</i> hello-time <i>seconds</i> Example: Router(config)#bridge <i>bridge-group</i> hello-time <i>seconds</i>	Specifies the interval between hello BPDUs. <ul style="list-style-type: none"> • For <i>bridge-group</i>, specify the bridge group number. The range is 1 to 255. • For <i>seconds</i>, enter a number from 1 to 10. The default is 2 seconds.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

To return to the default setting, use the **no bridge** *bridge-group* **hello-time** global configuration command.

Changing the Forward-Delay Interval

The forward-delay interval is the amount of time spent listening for topology change information after an interface has been activated for switching and before forwarding actually begins.

Beginning in privileged EXEC mode, follow these steps to change the forward-delay interval.

SUMMARY STEPS

1. **configure terminal**
2. **bridge** *bridge-group* **forward-time** *seconds*
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	bridge <i>bridge-group</i> forward-time <i>seconds</i> Example: Router(config)#bridge 1 forward-time 12	Specifies the forward-delay interval. <ul style="list-style-type: none"> For <i>bridge-group</i>, specify the bridge group number. The range is 1 to 255. For <i>seconds</i>, enter a number from 10 to 200. The default is 20 seconds.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

To return to the default setting, use the **no bridge *bridge-group* forward-time *seconds*** command in global configuration mode.

Changing the Maximum-Idle Interval

If a switch does not hear BPDUs from the root switch within a specified interval, it recomputes the spanning-tree topology.

Beginning in privileged EXEC mode, follow these steps to change the maximum-idle interval (maximum aging time).

SUMMARY STEPS

1. **configure terminal**
2. **bridge *bridge-group* max-age *seconds***
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	bridge <i>bridge-group</i> max-age seconds Example: Router(config)#bridge 1 max-age 50	Specifies the interval the switch waits to hear BPDUs from the root switch. <ul style="list-style-type: none"> For <i>bridge-group</i>, specify the bridge group number. The range is 1 to 255. For <i>seconds</i>, enter a number from 10 to 200. The default is 30.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

To return to the default setting, use the **no bridge *bridge-group* max-age** command in global configuration mode.

Disabling the Spanning Tree on an Interface

When a loop-free path exists between any two switched subnetworks, you can prevent BPDUs generated in one switching subnetwork from impacting devices in the other switching subnetwork and still permit switching throughout the network as a whole. For example, when switched LAN subnetworks are separated by a WAN, BPDUs can be prevented from traveling across the WAN link.

Beginning in privileged EXEC mode, follow these steps to disable spanning tree on an interface.

SUMMARY STEPS

1. **configure terminal**
2. **interface *type 0/slot/port***
3. **bridge-group *bridge-group* spanning-disabled**
4. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface <i>type 0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/1/2	Enters interface configuration mode, and specifies the interface ID.
Step 3	bridge-group <i>bridge-group</i> spanning-disabled Example: Router(config-if)#bridge-group 1 spanning-disabled	Disables spanning tree on the interface. For <i>bridge-group</i> , specify the bridge group number. The range is from 1 to 255.
Step 4	end Example: Router(config-if)#end	Returns to privileged EXEC mode.

To reenabling spanning tree on the interface, use the **no bridge-group** *bridge-group* **spanning-disabled** command in interface configuration mode.

Monitoring and Maintaining the Network

To monitor and maintain the network, use one or more of the following commands in privileged EXEC mode.

Command	Purpose
clear bridge <i>bridge-group</i>	Removes any learned entries from the forwarding database and clears the transmit and receive counts for any statically configured entries.
show bridge [<i>bridge-group</i>] [<i>interface</i>] [<i>address</i>] [<i>group</i>] [<i>verbose</i>]	Displays classes of entries in the bridge forwarding database.

Configuring Separate Voice and Data Subnets

For ease of network administration and increased scalability, network managers can configure the Cisco Gigabit EtherSwitch EHWIC to support Cisco IP phones such that the voice and data traffic reside on separate subnets. You should always use separate VLANs when you are able to segment the existing IP address space of your branch office.

User priority bits in the 802.1p portion of the 802.1Q standard header are used to provide prioritization in Ethernet switches. This is a vital component in designing Cisco AVVID networks.

The Cisco Gigabit EtherSwitch EHWIC provides the performance and intelligent services of Cisco IOS software for branch office applications. The Cisco Gigabit EtherSwitch EHWIC can identify user applications—such as voice or multicast video—and classify traffic with the appropriate priority levels.



Note

See *Cisco AVVID QoS Design Guide* for more information on how to implement end-to-end QoS as you deploy Cisco AVVID solutions.

Beginning in EXEC mode, follow these steps to automatically configure Cisco IP phones to send voice traffic on the voice VLAN ID (VVID) on a per-port basis (see the “[Voice Traffic and VVID](#)” section on page 66).

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type 0/slot/port*
4. **switchport mode trunk**
5. **switchport voice vlan** *vlan-id*
6. **end**

DETAILED STEPS

	Command	Purpose
Step 1	enable Example: Router> enable	Enters the privileged EXEC mode. A preset password may be required to enter this mode.
Step 2	configure terminal Example: Router#configure terminal	Enters global configuration mode.

	Command	Purpose
Step 3	interface <i>type 0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/3/1	Enters the interface configuration mode and the port to be configured.
Step 4	switchport mode trunk Example: Router(config-if)#switchport mode trunk	Configures the port to trunk mode.
Step 5	switchport voice vlan <i>vlan-id</i> Example: Router(config-if)#switchport voice vlan 1	Configures the voice port with a VVID that will be used exclusively for voice traffic.
Step 6	end Example: Router(config-if)#end	Returns to privileged EXEC mode.

Voice Traffic and VVID

The Cisco Gigabit EtherSwitch EHWIC can automatically configure voice VLAN. This capability overcomes the management complexity of overlaying a voice topology onto a data network while maintaining the quality of voice traffic. With the automatically configured voice VLAN feature, network administrators can segment phones into separate logical networks, even though the data and voice infrastructure is physically the same. The voice VLAN feature places the phones into their own VLANs without the need for end-user intervention. A user can plug the phone into the switch, and the switch provides the phone with the necessary VLAN information.

Configuring a Single Subnet for Voice and Data

For network designs with incremental IP telephony deployment, network managers can configure the Cisco Gigabit EtherSwitch EHWIC so that the voice and data traffic coexist on the same subnet. This might be necessary when it is impractical either to allocate an additional IP subnet for IP phones or to divide the existing IP address space into an additional subnet at the remote branch. It might be necessary to use a single IP address space for branch offices. (This is one of the simpler ways to deploy IP telephony.)

This configuration approach must address two key considerations:

- Network managers should ensure that existing subnets have enough available IP addresses for the new Cisco IP phones, each of which requires a unique IP address.
- Administering a network with a mix of IP phones and workstations on the same subnet might pose a challenge.

Beginning in privileged EXEC mode, follow these steps to automatically configure Cisco IP phones to send voice and data traffic on the same VLAN.

SUMMARY STEPS

1. **configure terminal**
2. **interface** *type 0/slot/port*
3. **switchport access vlan** *vlan-id*
4. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface <i>type 0/slot/port</i> Example: Router(config)#interface gigabitethernet 0/3/1	Enters the interface configuration mode and the port to be configured.
Step 3	switchport access vlan <i>vlan-id</i> Example: Router(config-if)#switchport access vlan 1	Sets the native VLAN for untagged traffic. The value of <i>vlan-id</i> represents the ID of the VLAN that is sending and receiving untagged traffic on the port. Valid IDs are from 1 to 1001. Leading zeroes are not accepted.
Step 4	end Example: Router(config-if)#end	Returns to the privileged EXEC mode.

Verifying Switchport Configuration

Use the **show run interface** command to verify the switchport configuration.

```
Router#show run interface gigabitethernet 0/3/1
```

Use the **write memory** command to save the current configuration in flash memory.

```
Router#write memory
```

Managing the EtherSwitch EHWIC

This section describes how to perform basic management tasks on the Cisco Gigabit EtherSwitch EHWIC with the Cisco IOS CLI. You might find this information useful when you configure the switch for the previous scenarios.

The following topics are included:

- [Adding Trap Managers, page 68](#)
- [Configuring IP Information, page 69](#)

- [Enabling Switch Port Analyzer, page 72](#)
- [Managing the ARP Table, page 73](#)
- [Managing the MAC Address Tables, page 73](#)
- [Removing Dynamic Addresses, page 75](#)
- [Adding Secure Addresses, page 76](#)
- [Configuring Static Addresses, page 77](#)
- [Clearing MAC Address Tables, page 78](#)
- [Configuring Port Security, page 78](#)

Adding Trap Managers

A trap manager is a management station that receives and processes traps. When you configure a trap manager, community strings for each member switch must be unique. If a member switch has an IP address assigned to it, the management station accesses the switch by using its assigned IP address.

By default, no trap manager is defined, and no traps are issued.

Beginning in privileged EXEC mode, follow these steps to add a trap manager and community string.

SUMMARY STEPS

1. **configure terminal**
2. **snmp-server host {hostname | ip-address} traps version 1 community string**
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	snmp-server host {hostname ip-address} traps version 1 community string Example: Router(config)#snmp-server host 172.2.128.263 traps version 1 snmp vlan-membership	Enters the trap manager IP address, community string, and traps to generate.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

Verifying Trap Managers

Use the **show running-config** command in privileged EXEC mode to verify that the information was entered.

Configuring IP Information

This section describes how to assign IP information on the Cisco Gigabit EtherSwitch EHWIC. The following topics are included:

- [Assigning IP Information to the Switch, page 69](#)
- [Specifying a Domain Name and Configuring the DNS, page 71](#)

Assigning IP Information to the Switch

You can use a BOOTP server to automatically assign IP information to the switch; however, the BOOTP server must be set up in advance with a database of physical MAC addresses and corresponding IP addresses, subnet masks, and default gateway addresses. In addition, the switch must be able to access the BOOTP server through one of its ports. At startup, a switch without an IP address requests the information from the BOOTP server; the requested information is saved in the switch running the configuration file. To ensure that the IP information is saved when the switch is restarted, save the configuration by entering the **write memory** command in privileged EXEC mode.

You can change the information in these fields. The mask identifies the bits that denote the network number in the IP address. When you use the mask to subnet a network, the mask is then referred to as a subnet mask. The broadcast address is reserved for sending messages to all hosts. The CPU sends traffic to an unknown IP address through the default gateway.

Beginning in privileged EXEC mode, follow these steps to enter the IP information.

SUMMARY STEPS

1. **configure terminal**
2. **interface vlan** *vlan-id*
3. **ip address** *ip-address subnet-mask*
4. **exit**
5. **ip default-gateway** *ip-address*
6. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	interface vlan <i>vlan-id</i> Example: Router(config)#interface vlan 1	Enters interface configuration mode, and enters the VLAN to which the IP information is assigned. VLAN 1 is the management VLAN, but you can configure any VLAN from IDs 1 to 1001.
Step 3	ip address <i>ip-address subnet-mask</i> Example: Router(config-if)#ip address 192.108.1.27 255.255.255.0	Enters the IP address and subnet mask.
Step 4	exit Example: Router(config)#exit	Returns to global configuration mode.
Step 5	ip default-gateway <i>ip-address</i> Example: Router#ip default-gateway 192.31.7.18	Enters the IP address of the default router.
Step 6	end Example: Router#end	Returns to privileged EXEC mode.

Use the following procedure to remove the IP information from a switch.

**Note**

Using the **no ip address** command in configuration mode disables the IP protocol stack and removes the IP information. Cluster members without IP addresses rely on the IP protocol stack being enabled.

Beginning in global configuration mode, follow these steps to remove an IP address.

SUMMARY STEPS

1. **interface vlan *vlan-id***
2. **no ip address**
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	interface vlan <i>vlan-id</i> Example: Router(config)#interface vlan 1	Enters interface configuration mode, and enters the VLAN to which the IP information is assigned. VLAN 1 is the management VLAN, but you can configure any VLAN from IDs 1 to 1001.
Step 2	no ip address Example: Router(config-subif)#no ip address	Removes the IP address and subnet mask.
Step 3	end Example: Router(config-subif)#end	Returns to privileged EXEC mode.



Caution

If you are removing the IP address through a telnet session, your connection to the switch will be lost.

Specifying a Domain Name and Configuring the DNS

Each unique IP address can have a host name associated with it. The Cisco IOS software maintains an EC mode, and related Telnet support operations. This cache speeds the process of converting names to addresses.

IP defines a hierarchical naming scheme that allows a device to be identified by its location or domain. Domain names are pieced together with periods (.) as the delimiting characters. For example, Cisco Systems, Inc. is a commercial organization that IP identifies by a *com* domain name, so its domain name is *cisco.com*. A specific device in this domain, the FTP system, for example, is identified as *ftp.cisco.com*.

To track domain names, IP has defined the concept of a domain name server (DNS), the purpose of which is to hold a cache (or database) of names mapped to IP addresses. To map domain names to IP addresses, you must first identify the host names and then specify a name server and enable the DNS, the Internet global naming scheme that uniquely identifies network devices.

Specifying the Domain Name

You can specify a default domain name that the software uses to complete domain name requests. You can specify either a single domain name or a list of domain names. When you specify a domain name, any IP host name without a domain name has that domain name appended to it before being added to the host table.

Specifying a Name Server

You can specify up to six hosts that can function as a name server to supply name information for the DNS.

Enabling the DNS

If your network devices require connectivity with devices in networks for which you do not control name assignment, you can assign device names that uniquely identify your devices within the entire internetwork. The Internet global naming scheme, the DNS, accomplishes this task. This service is enabled by default.

Enabling Switch Port Analyzer

You can monitor traffic on a given port by forwarding incoming and outgoing traffic on the port to another port in the same VLAN. A Switch Port Analyzer (SPAN) port cannot monitor ports in a different VLAN, and a SPAN port must be a static-access port. Any number of ports can be defined as SPAN ports, and any combination of ports can be monitored. SPAN is supported for up to two sessions.

Beginning in privileged EXEC mode, follow these steps to enable SPAN.

SUMMARY STEPS

1. **configure terminal**
2. **monitor session** *session-id* {**destination** | **source**} {**interface type** *0/slot/port* | **vlan** *vlan-id*} [, | - | **both** | **tx** | **rx**]
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	monitor session <i>session-id</i> { destination source } { interface type <i>0/slot/port</i> vlan <i>vlan-id</i> } [, - both tx rx] Example: Router(config)#monitor session 1 destination interface gigabitethernet 0/1/2	Enables port monitoring for a specific session (“ <i>number</i> ”). (Optional) Supply a SPAN <i>destination</i> interface or <i>source</i> interface.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

Use the **no monitor session** *session-id* command in global configuration mode to disable SPAN.

Managing the ARP Table

To communicate with a device (on Ethernet, for example), the software first must determine the 48-bit MAC or local data link address of that device. The process of determining the local data link address from an IP address is called *address resolution*.

The Address Resolution Protocol (ARP) associates a host IP address with the corresponding media or MAC addresses and VLAN ID. Taking an IP address as input, ARP determines the associated MAC address. After a MAC address is determined, the IP-MAC address association is stored in an ARP cache for rapid retrieval. Then the IP datagram is encapsulated in a link-layer frame and sent over the network. Encapsulation of IP datagrams and ARP requests and replies on IEEE 802 networks other than Ethernet is specified by the Subnetwork Access Protocol (SNAP). By default, standard Ethernet-style ARP encapsulation (represented by the **arpa** keyword) is enabled on the IP interface.

When you manually add entries to the ARP Table by using the CLI, you must be aware that these entries do not age and must be manually removed.

Managing the MAC Address Tables

This section describes how to manage the MAC address tables on the Cisco Gigabit EtherSwitch EHWIC. The following topics are included:

- [Understanding MAC Addresses and VLANs, page 74](#)
- [Changing the Address Aging Time, page 74](#)
- [Configuring the Aging Time, page 74](#)
- [Verifying Aging-Time Configuration, page 75](#)

The switch uses the MAC address tables to forward traffic between ports. All MAC addresses in the address tables are associated with one or more ports. These MAC tables include the following types of addresses:

- Dynamic address—Source MAC address that the switch learns and then drops when it is not in use.
- Secure address—Manually entered unicast address that is usually associated with a secured port. Secure addresses do not age.
- Static address—Manually entered unicast or multicast address that does not age and that is not lost when the switch resets.

The address tables list the destination MAC address and the associated VLAN ID, module, and port number associated with the address. The following shows an example of a list of addresses as they would appear in the dynamic, secure, or static address table.

```
Router#show mac-address-table
```

Destination Address	Address Type	VLAN	Destination Port
000a.000b.000c	Secure	1	GigabitEthernet0/1/2
000d.e105.cc70	Self	1	Vlan1
00aa.00bb.00cc	Static	1	GigabitEthernet0/1/0

Understanding MAC Addresses and VLANs

All addresses are associated with a VLAN. An address can exist in more than one VLAN and have different destinations in each. Multicast addresses, for example, could be forwarded to port 1 in VLAN 1 and ports 9, 10, and 11 in VLAN 5.

Each VLAN maintains its own logical address table. A known address in one VLAN is unknown in another until it is learned or statically associated with a port in the other VLAN. An address can be secure in one VLAN and dynamic in another. Addresses that are statically entered in one VLAN must be static addresses in all other VLANs.

Changing the Address Aging Time

Dynamic addresses are source MAC addresses that the switch learns and then drops when they are not in use. Use the Aging Time field to define how long the switch retains unseen addresses in the table. This parameter applies to all VLANs.

Configuring the Aging Time

Setting too short an aging time can cause addresses to be prematurely removed from the table. When the switch receives a packet for an unknown destination, it floods the packet to all ports in the same VLAN as the receiving port. This unnecessary flooding can impact performance. Setting too long an aging time can cause the address table to be filled with unused addresses; it can cause delays in establishing connectivity when a workstation is moved to a new port.

The aging timer may be configured from 10 to 630 seconds, in 10-second intervals.

Beginning in global configuration mode, follow these steps to configure the dynamic address table aging time.

SUMMARY STEPS

1. **configure terminal**
2. **mac-address-table aging-time** *seconds*
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal	Enters global configuration mode.
	Example: Router(config)#configure terminal	

	Command	Purpose
Step 2	mac-address-table aging-time <i>seconds</i> Example: Router(config)#mac-address-table aging-time 300	Enters the number of seconds that dynamic addresses are to be retained in the address table. Valid entries are from 10 to 1000000. Note The aging timer may be configured from 10 to 630, in 10-second intervals.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

Verifying Aging-Time Configuration

Use the **show mac-address-table aging-time** command to verify the configuration:

```
Router#show mac-address-table aging-time
Mac address aging time 300
Router#
```

Removing Dynamic Addresses

Beginning in privileged EXEC mode, follow these steps to remove a dynamic address entry.

SUMMARY STEPS

1. **configure terminal**
2. **no mac-address-table dynamic** *hw-addr*
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router(config)#configure terminal	Enters global configuration mode.
Step 2	no mac-address-table dynamic <i>hw-addr</i> Example: Router(config)#no mac-address-table dynamic 001e.4a96.b8cd	Enters the MAC address to be removed from dynamic MAC address table.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

Use the **clear mac-address-table dynamic** command in privileged EXEC mode to remove all dynamic entries.

Use the **show mac-address-table dynamic** command in privileged EXEC mode to verify configuration.

Adding Secure Addresses

The secure address table contains secure MAC addresses and their associated ports and VLANs. A secure address is a manually entered unicast address that is forwarded to only one port per VLAN. If you enter an address that is already assigned to another port, the switch reassigns the secure address to the new port.

You can enter a secure port address even when the port does not yet belong to a VLAN. When the port is later assigned to a VLAN, packets destined for that address are forwarded to the port.

Beginning in privileged EXEC mode, follow these steps to add a secure address.

SUMMARY STEPS

1. **configure terminal**
2. **mac-address-table secure *hw-address* interface gi *0/slot/port* vlan *vlan-id***
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router(config)#configure terminal	Enters global configuration mode.
Step 2	mac-address-table secure <i>hw-address</i> interface gi <i>0/slot/port</i> vlan <i>vlan-id</i> Example: Router(config)#mac-address-table secure 00c0.00a0.03gi interface gi 0/1/2 vlan 1	Enters the MAC address, its associated port, and the VLAN ID.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

Use the **no mac-address-table secure *hw-address* interface gi *0/slot/port* vlan *vlan-id*** command in global configuration mode to remove a secure address.

To remove all secure addresses, use the **clear mac-address-table secure** command in privileged EXEC mode.

Use the **show mac-address-table secure** command in privileged EXEC mode to verify configuration.

Configuring Static Addresses

A static address has the following characteristics:

- It is manually entered in the address table and must be manually removed.
- It can be a unicast or multicast address.
- It does not age and is retained when the switch restarts.

Because all ports are associated with at least one VLAN, the switch acquires the VLAN ID for the address from the ports that you select on the forwarding map. A static address in one VLAN must be a static address in other VLANs. A packet with a static address that arrives on a VLAN where it has not been statically entered is flooded to all ports and not learned.

Beginning in privileged EXEC mode, follow these steps to add a static address.

SUMMARY STEPS

1. **configure terminal**
2. **mac-address-table static** *mac-address* **vlan** *vlan-id* **interface** *type slot/port*
3. **end**

DETAILED STEPS

	Command	Purpose
Step 1	configure terminal Example: Router#configure terminal	Enters global configuration mode.
Step 2	mac-address-table static <i>mac-address</i> vlan <i>vlan-id</i> interface <i>type slot/port</i> Example: Router(config)#mac-address-table static 000a.000b.000c vlan 1 interface gigabitethernet 0/1/2	Enters the static MAC address, the interface, and the VLAN ID of those ports.
Step 3	end Example: Router(config)#end	Returns to privileged EXEC mode.

To remove a static addresses, use the **mac-address-table static** *mac-address* **vlan** *vlan-id* **interface** *type slot/port* command in global configuration mode.

To remove all static addresses, use the **clear mac-address-table static** command in privileged EXEC mode.

Verifying Static Addresses

Use the **show mac-address-table static** command to verify configuration:

```
Router#show mac-address-table static
Static Address Table
Destination Address  Address Type  VLAN  Destination Port
-----
000a.000b.000c      Static       1     GigabitEthernet0/1/2
```

Clearing MAC Address Tables

To remove a MAC address table, use the **clear mac-address-table [dynamic | secure | static] [address mac-address] [interface type slot/port] [vlan vlan-id]** command in privileged EXEC mode as shown in the following example.

```
Router#clear mac-address-table static address 0040.C80A.2F07 interface gigabitethernet
0/1/2
```

Configuring Port Security

Port security can be either static or dynamic.

Static port security allows the user to specify which devices are allowed access through a given switch port. The specification is done manually by placing allowed device MAC addresses in the MAC address table. Static port security is also known as MAC address filtering.

Dynamic port security is similar. However, instead of specifying the MAC address of the devices, the user specifies the maximum number of devices that will be allowed on the port. If the maximum number specified is more than the number of MAC addresses specified manually, the switch will learn the MAC address automatically, up to the maximum specified. If the maximum number specified is less than the number of MAC addresses already specified statically, an error message will be produced.

Use the **mac-address-table secure [mac-address | maximum maximum addresses] gigabitethernet 0/slot/port [vlan vlan id]** command in global configuration mode to specify static or dynamic port security. *mac-address* enables static port security. **maximum maximum addresses** enables dynamic port security.

Configuration Examples for Gigabit EtherSwitch EHWICs

This section provides the following configuration examples:

- [Range of Interface: Examples, page 79](#)
- [Optional Interface Feature: Examples, page 79](#)
- [VLAN Configuration: Example, page 80](#)
- [VLAN Trunking Using VTP: Example, page 80](#)
- [Spanning Tree: Examples, page 81](#)
- [MAC Table Manipulation: Example, page 83](#)
- [Switched Port Analyzer \(SPAN\) Source: Examples, page 84](#)
- [IGMP Snooping: Example, page 84](#)

- [Storm-Control: Example, page 86](#)
- [Ethernet Switching: Examples, page 86](#)

Range of Interface: Examples

This section provides the following configuration examples:

- [Single Range Configuration: Example, page 79](#)
- [Range Macro Definition: Example, page 79](#)

Single Range Configuration: Example

The following example shows all Gigabit Ethernet interfaces on an HWIC-4ESW in slot 1 being reenabled:

```
Router(config)#int range gigabitethernet 0/1/0 - 3
Router(config-if-range)#no shut
Router(config-if-range)#
*Mar 21 14:01:21.474: %LINK-3-UPDOWN: Interface GigabitEthernet0/1/0, changed state to up
*Mar 21 14:01:21.490: %LINK-3-UPDOWN: Interface GigabitEthernet0/1/1, changed state to up
*Mar 21 14:01:21.502: %LINK-3-UPDOWN: Interface GigabitEthernet0/1/2, changed state to up
*Mar 21 14:01:21.518: %LINK-3-UPDOWN: Interface GigabitEthernet0/1/3, changed state to up
Router(config-if-range)#
```

Range Macro Definition: Example

The following example shows an interface-range macro named enet_list being defined to select interfaces 0/1/0 through 0/1/3:

```
Router(config)#define interface-range enet_list gigabitethernet 0/1/0 - 0/1/3
Router(config)#
```

The following example shows how to change to the interface-range configuration mode using the interface-range macro enet_list:

```
Router(config)#interface range macro enet_list
```

Optional Interface Feature: Examples

- [Interface Speed: Example, page 79](#)
- [Setting the Interface Duplex Mode: Example, page 80](#)
- [Adding a Description for an Interface: Example, page 80](#)

Interface Speed: Example

The following example shows the interface speed being set to 100 Mbps on GigabitEthernet interface 0/3/7:

```
Router(config)#interface gigabitethernet 0/3/7
Router(config-if)#speed 100
```

Setting the Interface Duplex Mode: Example

The following example shows the interface duplex mode being set to full on GigabitEthernet interface 0/3/7:

```
Router(config)#interface gigabitethernet 0/3/7
Router(config-if)#duplex full
```

Adding a Description for an Interface: Example

The following example shows how to add a description of GigabitEthernet interface 0/3/7:

```
Router(config)#interface gigabitethernet 0/3/7
Router(config-if)#description Link to root switch
```

VLAN Configuration: Example

The following example shows how to configure inter-VLAN routing:

```
Router#configure terminal
Router(config)#vlan 1
Router(config)#vlan 2
Router(config)#interface vlan 1
Router(config-if)#ip address 1.1.1.1 255.255.255.0
Router(config-if)#no shut
Router(config-if)#interface vlan 2
Router(config-if)#ip address 2.2.2.2 255.255.255.0
Router(config-if)#no shut
Router(config-if)#interface gigabitethernet 0/1/0
Router(config-if)#switchport access vlan 1
Router(config-if)#interface gigabitethernet 0/1/1
Router(config-if)#switchport access vlan 2
Router(config-if)#exit
```

VLAN Trunking Using VTP: Example

The following example shows how to configure the switch as a VTP server:

```
Router#configure terminal
Router(config)#vtp mode server
Setting device to VTP SERVER mode.
Router(config)#vtp domain Lab_Network
Setting VTP domain name to Lab_Network
Router(config)#vtp password WATER
Setting device VLAN database password to WATER.
Router(config)#exit
APPLY completed.
Exiting...
Router#
```

The following example shows how to configure the switch as a VTP client:

```
Router#configure terminal
Router(config)#vtp client
Setting device to VTP CLIENT mode.
Router(config)#exit

In CLIENT state, no apply attempted.
Exiting...
```

```
Router#
```

The following example shows how to configure the switch as VTP transparent:

```
Router#configure terminal
Router(config)#vtp transparent
Setting device to VTP TRANSPARENT mode.
Router(config)#exit
APPLY completed.
Exiting....
Router#
```

Spanning Tree: Examples

- [Spanning-Tree Interface and Spanning-Tree Port Priority: Example, page 81](#)
- [Spanning-Tree Port Cost: Example, page 82](#)
- [Bridge Priority of a VLAN: Example, page 82](#)
- [Hello Time: Example, page 82](#)
- [Forward-Delay Time for a VLAN: Example, page 83](#)
- [Maximum Aging Time for a VLAN: Example, page 83](#)
- [Spanning Tree: Examples, page 83](#)
- [Spanning Tree Root: Example, page 83](#)

Spanning-Tree Interface and Spanning-Tree Port Priority: Example

The following example shows the VLAN port priority of an interface being configured:

```
Router#configure terminal
Router(config)#interface gigabitethernet 0/1/2
Router(config-if)#spanning-tree vlan 1 port-priority 64
Router(config-if)#end
Router#
```

The following example shows how to verify the configuration of VLAN 1 on the interface when it is configured as a trunk port:

```
Router#show spanning-tree vlan 1

VLAN1 is executing the ieee compatible Spanning Tree protocol
Bridge Identifier has priority 32768, address 0025.451b.b22a
Configured hello time 2, max age 20, forward delay 15
Current root has priority 32768, address 0008.e36d.9f70
Root port is 18 (GigabitEthernet0/1/4), cost of root path is 38
Topology change flag not set, detected flag not set
Number of topology changes 18 last change occurred 22:36:19 ago
    from GigabitEthernet0/1/2
Times: hold 1, topology change 35, notification 2
    hello 2, max age 20, forward delay 15
Timers: hello 0, topology change 0, notification 0, aging 300

Port 18 (GigabitEthernet0/1/2) of VLAN1 is forwarding
Port path cost 19, Port priority 128, Port Identifier 128.18.
Designated root has priority 32768, address 0008.e36d.9f70
Designated bridge has priority 32768, address 0022.bdc5.2233
Designated port id is 128.35, designated path cost 19
```

```

Timers: message age 2, forward delay 0, hold 0
Number of transitions to forwarding state: 1
BPDU: sent 19, received 89512
Router#

```

Spanning-Tree Port Cost: Example

The following example shows how to change the spanning-tree port cost of a Gigabit Ethernet interface:

```

Router#configure terminal
Router(config)#interface gigabitethernet 0/1/2
Router(config-if)#spanning-tree cost 18
Router(config-if)#end
Router#

```

```

Router#show run interface gigabitethernet0/1/2
Building configuration...

```

```

Current configuration: 140 bytes
!
interface GigabitEthernet0/1/2
  switchport access vlan 1
  no ip address
  spanning-tree vlan 1 port-priority 64
  spanning-tree cost 18
end

```

The following example shows how to verify the configuration of the interface when it is configured as an access port:

```

Router#show spanning-tree interface gigabitethernet 0/1/2
Port 33 (GigabitEthernet0/1/2) of VLAN1 is forwarding
  Port path cost 18, Port priority 64, Port Identifier 64.33
  Designated root has priority 32768, address 00ff.ff10.37b7
  Designated bridge has priority 32768, address 00ff.ff10.37b7
  Designated port id is 128.13, designated path cost 0
  Timers: message age 2, forward delay 0, hold 0
  Number of transitions to forwarding state: 1

  BPDU: sent 1, received 175
Router#

```

Bridge Priority of a VLAN: Example

The following example shows the bridge priority of VLAN 20 being configured to 33792:

```

Router#configure terminal
Router(config)#spanning-tree vlan 20 priority 33792
Router(config)#end
Router#

```

Hello Time: Example

The following example shows the hello time for VLAN 20 being configured to 7 seconds:

```

Router#configure terminal
Router(config)#spanning-tree vlan 20 hello-time 7
Router(config)#end
Router#

```

Forward-Delay Time for a VLAN: Example

The following example shows the forward delay time for VLAN 20 being configured to 21 seconds:

```
Router#configure terminal
Router(config)#spanning-tree vlan 20 forward-time 21
Router(config)#end
Router#
```

Maximum Aging Time for a VLAN: Example

The following example configures the maximum aging time for VLAN 20 to 36 seconds:

```
Router#configure terminal
Router(config)#spanning-tree vlan 20 max-age 36
Router(config)#end
Router#
```

Spanning Tree: Examples

The following example shows spanning tree being enabled on VLAN 20:

```
Router#configure terminal
Router(config)#spanning-tree vlan 20
Router(config)#end
Router#
```



Note

Because spanning tree is enabled by default, the **show running** command does not display the command you entered to enable spanning tree.

The following example shows spanning tree being disabled on VLAN 20:

```
Router#configure terminal
Router(config)#no spanning-tree vlan 20
Router(config)#end
Router#
```

Spanning Tree Root: Example

The following example shows the switch being configured as the root bridge for VLAN 10, with a network diameter of 4:

```
Router#configure terminal
Router(config)#spanning-tree vlan 10 root primary diameter 4
Router(config)#exit
Router#
```

MAC Table Manipulation: Example

The following example shows a static entry being configured in the MAC address table:

```
Router(config)#mac-address-table static beef.beef.beef int Gi0/1/5
Router(config)#end
```

The following example shows port security being configured in the MAC address table.

```
Router(config)#mac-address-table secure 0000.1111.2222 Gi0/1/2 vlan 3
Router(config)#end
```

Switched Port Analyzer (SPAN) Source: Examples

This section provides the following configuration examples:

- [SPAN Source Configuration: Example, page 84](#)
- [SPAN Destination Configuration: Example, page 84](#)
- [Removing Sources or Destinations from a SPAN Session: Example, page 84](#)

SPAN Source Configuration: Example

The following example shows SPAN session 1 being configured to monitor bidirectional traffic from source interface Gigabit Ethernet 0/1/1:

```
Router(config)#monitor session 1 source interface gigabitethernet 0/1/1
```

SPAN Destination Configuration: Example

The following example shows interface Gigabit Ethernet 0/1/7 being configured as the destination for SPAN session 1:

```
Router(config)#monitor session 1 destination interface gigabitethernet 0/1/7
```

Removing Sources or Destinations from a SPAN Session: Example

This following example shows interface Gigabit Ethernet 0/1/2 being removed as a SPAN source for SPAN session 1:

```
Router(config)#no monitor session 1 source interface gigabitethernet 0/1/2
```

IGMP Snooping: Example

The following example shows the output from configuring IGMP snooping:

```
Router#show mac-address-table multicast igmp-snooping
```

```

EHWIC Slot: 1
-----
      MACADDR          VLANID    INTERFACES
-----
0100.5e05.0505        1         Gi0/1/1
0100.5e06.0606        2
-----
EHWIC Slot: 2
-----
      MACADDR          VLANID    INTERFACES
-----
0100.5e05.0505        1         Gi0/3/4
0100.5e06.0606        2         Gi0/3/0

```

```
Router#
```

The following is an example of output from the **sh run int** privileged EXEC command for VLAN 1:

```
Router#show run int vlan 1

Building configuration...
```

```

Current configuration :82 bytes
!
interface Vlan1
 ip address 192.168.4.90 255.255.255.0
 ip pim sparse-mode
end

```

```
Router#show run int vlan 2
```

```
Building configuration...
```

```

Current configuration :82 bytes
!
interface Vlan2
 ip address 192.168.5.90 255.255.255.0
 ip pim sparse-mode
end

```

```
Router#
```

```
Router#sh ip igmp group
```

```
IGMP Connected Group Membership
```

Group Address	Interface	Uptime	Expires	Last Reporter
239.255.255.255	Vlan1	01:06:40	00:02:20	192.168.41.101
224.0.1.40	Vlan2	01:07:50	00:02:17	192.168.5.90
224.5.5.5	Vlan1	01:06:37	00:02:25	192.168.41.100
224.5.5.5	Vlan2	01:07:40	00:02:21	192.168.31.100
224.6.6.6	Vlan1	01:06:36	00:02:22	192.168.41.101
224.6.6.6	Vlan2	01:06:39	00:02:20	192.168.31.101

```
Router#
```

```
Router#show ip mroute
```

```
IP Multicast Routing Table
```

```
Flags:D - Dense, S - Sparse, B - Bidir Group, s - SSM Group, C - Connected,
```

```

L - Local, P - Pruned, R - RP-bit set, F - Register flag,
T - SPT-bit set, J - Join SPT, M - MSDP created entry,
X - Proxy Join Timer Running, A - Candidate for MSDP Advertisement,
U - URD, I - Received Source Specific Host Report

```

```
Outgoing interface flags:H - Hardware switched
```

```
Timers:Uptime/Expires
```

```
Interface state:Interface, Next-Hop or VCD, State/Mode
```

```
(* , 239.255.255.255), 01:06:43/00:02:17, RP 0.0.0.0, flags:DC
```

```
Incoming interface:Null, RPF nbr 0.0.0.0
```

```
Outgoing interface list:
```

```
Vlan1, Forward/Sparse, 01:06:43/00:02:17
```

```
(* , 224.0.1.40), 01:12:42/00:00:00, RP 0.0.0.0, flags:DCL
```

```
Incoming interface:Null, RPF nbr 0.0.0.0
```

```
Outgoing interface list:
```

```
Vlan2, Forward/Sparse, 01:07:53/00:02:14
```

```
(* , 224.5.5.5), 01:07:43/00:02:22, RP 0.0.0.0, flags:DC
```

```
Incoming interface:Null, RPF nbr 0.0.0.0
```

```
Outgoing interface list:
```

```
Vlan1, Forward/Sparse, 01:06:40/00:02:22
```

```
Vlan2, Forward/Sparse, 01:07:44/00:02:17
```

```
(* , 224.6.6.6), 01:06:43/00:02:18, RP 0.0.0.0, flags:DC
```

```
Incoming interface:Null, RPF nbr 0.0.0.0
```

```
Outgoing interface list:
```

```
Vlan1, Forward/Sparse, 01:06:40/00:02:18
Vlan2, Forward/Sparse, 01:06:43/00:02:16
```

```
Router#
```

Storm-Control: Example

The following example shows bandwidth-based multicast suppression being enabled at 70 percent on Gigabit Ethernet interface 2:

```
Router#configure terminal
Router(config)#interface gigabitethernet0/1/2
Router(config-if)#storm-control multicast level 70.0 30.0
Router(config-if)#end
```

```
Router#show storm-control multicast
Interface  Filter State  Upper   Lower   Current
-----  -
Gi0/1/0    inactive  100.00% 100.00% N/A
Gi0/1/1    inactive  100.00% 100.00% N/A
Gi0/1/2    Forwarding  70.00%  30.00%  0.00%
Gi0/1/3    inactive  100.00% 100.00% N/A
```

Ethernet Switching: Examples

- [Subnets for Voice and Data: Example, page 86](#)
- [Inter-VLAN Routing: Example, page 87](#)
- [Single Subnet Configuration: Example, page 87](#)
- [Ethernet Ports on IP Phones with Multiple Ports: Example, page 87](#)

Subnets for Voice and Data: Example

The following example shows separate subnets being configured for voice and data on the EtherSwitch EHWIC:

```
interface GigabitEthernet0/1/2
  description DOT1Q port to IP Phone
  switchport native vlan 50
  switchport mode trunk
  switchport voice vlan 150

interface Vlan 150
  description voice vlan
  ip address 10.150.1.1 255.255.255.0
  ip helper-address 172.20.73.14

interface Vlan 50
  description data vlan
  ip address 10.50.1.1 255.255.255.0
```

This configuration instructs the IP phone to generate a packet with an 802.1Q VLAN ID of 150 with an 802.1p value of 5 (default for voice bearer traffic).

**Note**

In a centralized CallManager deployment model, the DHCP server might be located across the WAN link. If so, an **ip helper-address** command pointing to the DHCP server should be included on the voice VLAN interface for the IP phone. This is done to obtain its IP address as well as the address of the TFTP server required for its configuration.

Be aware that IOS supports a DHCP server function. If this function is used, the EtherSwitch EHWIC serves as a local DHCP server and a helper address would not be required.

Inter-VLAN Routing: Example

Configuring inter-vlan routing is identical to the configuration on an EtherSwitch EHWIC with an MSFC. Configuring an interface for WAN routing is consistent with other IOS platforms.

The following example provides a sample configuration:

```
interface Vlan 160
  description voice vlan
  ip address 10.6.1.1 255.255.255.0

interface Vlan 60
  description data vlan
  ip address 10.60.1.1 255.255.255.0

interface Serial0/3/0
  ip address 160.3.1.2 255.255.255.0
```

**Note**

Standard IGP routing protocols such as RIP, IGRP, EIGRP, and OSPF are supported on the EtherSwitch EHWIC. Multicast routing is also supported for PIM dense mode, sparse mode and sparse-dense mode.

Single Subnet Configuration: Example

The EtherSwitch EHWIC supports the use of an 802.1p-only option when configuring the voice VLAN. Using this option allows the IP phone to tag VoIP packets with a CoS of 5 on the native VLAN, while all PC data traffic is sent untagged.

The following example shows a single subnet configuration for the EtherSwitch EHWIC:

```
Router#gigabitethernet 0/1/2
description Port to IP Phone in single subnet
switchport access vlan 40
```

The EtherSwitch EHWIC instructs the IP phone to generate an 802.1Q frame with a null VLAN ID value but with an 802.1p value (default is COS of 5 for bearer traffic). The voice and data vlans are both 40 in this example.

Ethernet Ports on IP Phones with Multiple Ports: Example

The following example illustrates the configuration for the IP phone:

```
interface GigabitEthernet0/x/x
  switchport voice vlan x
  switchport mode trunk
```

The following example illustrates the configuration for the PC:

```
interface GigabitEthernet0/x/y
  switchport mode access
  switchport access vlan y
```

**Note**

Using a separate subnet, and possibly a separate IP address space, may not be an option for some small branch offices due to the IP routing configuration. If the IP routing can handle an additional subnet at the remote branch, use Cisco Network Registrar and secondary addressing.

Additional References

The following sections provide references related to EtherSwitch EHWICs.

Related Documents

Related Topic	Document Title
Connecting Cisco Gigabit EtherSwitch EHWICs	Connecting Cisco Gigabit EtherSwitch EHWICs
Installing Cisco interface cards in Cisco access routers.	Installing Cisco Interface Cards in Cisco Access Routers.
Information about configuring Voice over IP features	Cisco IOS Voice, Video, and Fax Configuration Guide
Voice over IP commands	Cisco IOS Voice, Video, and Fax Command Reference, Release 12.3 T

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards have not been modified by this feature.	—

MIBs

MIBs	MIBs Link
CISCO-ENTITY-VENDORTYPE-OID-MIB	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs
OLD-CISCO-CHASSIS-MIB	

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs have not been modified by this feature.	—

Technical Assistance

Description	Link
Technical Assistance Center (TAC) home page, containing 30,000 pages of searchable technical content, including links to products, technologies, solutions, technical tips, and tools. Registered Cisco.com users can log in from this page to access even more content.	http://www.cisco.com/public/support/tac/home.shtml

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