

Understanding and Troubleshooting HSRP Problems in Catalyst Switch Networks

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Introduction

Because of the nature of the Hot Standby Router Protocol (HSRP), specific network problems can lead to HSRP instability. This document covers common issues and ways to troubleshoot HSRP problems. Most HSRP-related problems are not true HSRP issues. Instead, they are network problems that affect the behavior of HSRP.

This document covers these most-common issues that relate to HSRP:

- Router report of a duplicate HSRP standby IP address
- Constant HSRP state changes (active, standby, speak)
- Missing HSRP peers
- Switch error messages that relate to HSRP
- Excessive network unicast flooding to the HSRP configuration

Note: This document details how to troubleshoot HSRP in Catalyst switch environments. The document contains many references to software versions and network topology design. Nevertheless, the sole purpose of this document is to facilitate and guide engineers on who to troubleshoot HSRP. This document is not intended to be a design guide, software-recommendation document, or a best practices document.

Prerequisites

Requirements

There are no specific requirements for this document.

Components Used

This document is not restricted to specific software and hardware versions.

The information in this document was created from the devices in a specific lab environment. All of the devices used in this document started with a cleared (default) configuration. If your network is live, make sure that you understand the potential impact of any command.

Conventions

Refer to [Cisco Technical Tips Conventions](#) for more information on document conventions.

Understand HSRP

Background Information

Businesses and consumers that rely on intranet and Internet services for their mission-critical communications require and expect their networks and applications to be continuously available to them. Customers can satisfy their demands for near-100 percent network uptime if they leverage the HSRP in Cisco IOS® Software. HSRP, which is unique to Cisco platforms, provides network redundancy for IP networks in a manner that ensures that user traffic immediately and transparently recovers from

first-hop failures in network edge devices or access circuits.

Two or more routers can act as a single, virtual router if they share an IP address and a MAC (Layer 2 [L2]) address. The address is necessary for host workstation default gateway redundancy. Most host workstations do not contain routing tables and use only a single next hop IP and MAC address. This address is known as a default gateway. With HSRP, members of the virtual router group continually exchange status messages. One router can assume the routing responsibility of another if a router goes out of commission for either planned or unplanned reasons. Hosts are configured with a single default gateway and continue to forward IP packets to a consistent IP and MAC address. The changeover of devices that do the routing is transparent to the end workstations.

Note: You can configure host workstations that run Microsoft OS for multiple default gateways. But, the multiple default gateways are not dynamic. The OS only uses one single default gateway at a time. The system only selects an additional configured default gateway at boot time if the first configured default gateway is determined unreachable by Internet Control Management Protocol (ICMP).

Basic Operation

A set of routers that run HSRP works in concert to present the illusion of a single default gateway router to the hosts on the LAN. This set of routers is known as an HSRP group or standby group. A single router that is elected from the group is responsible for the forwarding of the packets that hosts send to the virtual router. This router is known as the active router. Another router is elected as the standby router. If the active router fails, the standby assumes the packet forwarding duties. Although an arbitrary number of routers may run HSRP, only the active router forwards the packets that are sent to the virtual router IP address.

In order to minimize network traffic, only the active and the standby routers send periodic HSRP messages after the protocol has completed the election process. Additional routers in the HSRP group remain in the `Listen` state. If the active router fails, the standby router takes over as the active router. If the standby router fails or becomes the active router, another router is elected as the standby router.

Each standby group emulates a single virtual router (default gateway). For each group, a single well-known MAC and IP address is allocated to that group. Multiple standby groups can coexist and overlap on a LAN, and individual routers can participate in multiple groups. In this case, the router maintains a separate state and timers for each group.

HSRP Terms

Term	Definition
Active	The router that currently forwards

router	packets for the virtual router
Standby router	The primary backup router
Standby group	The set of routers that participate in HSRP and jointly emulate a virtual router
Hello time	The interval between successive HSRP hello messages from a given router
Hold time	The interval between the receipt of a hello message and the presumption that the sending router has failed

HSRP Addressing

HSRP Router Communication

Routers that run HSRP communicate HSRP information between each other through HSRP hello packets. These packets are sent to the destination IP multicast address 224.0.0.2 on User Datagram Protocol (UDP) port 1985. IP multicast address 224.0.0.2 is a reserved multicast address that is used to communicate to all routers. The active router sources hello packets from its configured IP address and the HSRP virtual MAC address. The standby router sources hellos from its configured IP address and the burned-in MAC address (BIA). This use of source addressing is necessary so that HSRP routers can correctly identify each other.

In most cases, when you configure routers to be part of an HSRP group, the routers listen for the HSRP MAC address for that group as well as their own BIA. The only exception to this behavior is for Cisco 2500, 4000, and 4500 routers. These routers have Ethernet hardware that only recognizes a single MAC address. Therefore, these routers use the HSRP MAC address when they serve as the active router. The routers use their BIA when they serve as the standby router.

HSRP Standby IP Address Communication on All Media Except Token Ring

Because host workstations are configured with their default gateway as the HSRP standby IP address, hosts must communicate with the MAC address that is associated with the HSRP standby IP address. This MAC address is a virtual MAC address that is composed of 0000.0c07.ac**. The ** is the HSRP group number in hexadecimal, based on the respective interface. For example, HSRP group 1 uses the HSRP virtual MAC address of 0000.0c07.ac01. Hosts on the adjoining LAN segment use the normal Address Resolution Protocol (ARP) process in order to resolve the associated MAC addresses.

HSRP Standby IP Address Communication on Token Ring Media

Token Ring interfaces use functional addresses for the HSRP MAC address. Functional addresses are the only general multicast mechanism available. There is a limited number of Token Ring functional addresses available, and many of these addresses are reserved for other functions. These three addresses are the only addresses available for use with HSRP:

```
c000.0001.0000 (group 0)
c000.0002.0000 (group 1)
c000.0004.0000 (group 2)
```

Therefore, you can configure only three HSRP groups on Token Ring interfaces, unless you configure the [standby use-bia](#) parameter.

ICMP Redirects

HSRP peer routers that protect a subnet are able to provide access to all other subnets in the network. This is the basis of HSRP. Therefore, which router becomes the active HSRP router is irrelevant. In Cisco IOS software releases earlier than Cisco IOS Software Release 12.1(3)T, ICMP redirects are automatically disabled on an interface when HSRP is used on that interface. Without this configuration, the hosts can be redirected away from the HSRP virtual IP address and toward an interface IP and MAC address of a single router. Redundancy is lost.

Cisco IOS Software Release 12.1(3)T introduces a method to allow ICMP redirects with HSRP. This method filters outbound ICMP redirect messages through HSRP. The next hop IP address is changed to an HSRP virtual address. The gateway IP address in the outbound ICMP redirect message is compared to a list of HSRP active routers that are present on that network. If the router that corresponds to the gateway IP address is an active router for an HSRP group, the gateway IP address is replaced with that group virtual IP address. This solution allows hosts to learn optimal routes to remote networks and, at the same time, maintain the resilience that HSRP provides.

HSRP Functionality Matrix

Refer to the [Cisco IOS Release and HSRP Functionality Matrix](#) section of [Hot Standby Router Protocol Features and Functionality](#) in order to learn about the features and Cisco IOS Software releases that support HSRP.

HSRP Features

Refer to [Hot Standby Router Protocol Features and Functionality](#) for information on most of the HSRP features. This document provides information on these HSRP features:

- Preemption
- Interface tracking

- Use of a BIA
- Multiple HSRP groups
- Configurable MAC addresses
- Syslog support
- HSRP debugging
- Enhanced HSRP debugging
- Authentication
- IP redundancy
- Simple Network Management Protocol (SNMP) MIB
- HSRP for Multiprotocol Label Switching (MPLS)

Note: You can use your browser Find feature in order to locate these sections within the document.

Packet Format

This table shows the format of the data portion of the UDP HSRP frame:

Version	Op Code	State	Hellotime
Holdtime	Priority	Group	Reserved
Authentication Data			
Authentication Data			
Virtual IP Address			

This table describes each of the fields in the HSRP packet:

Packet Field	Description
Op Code (1 octet)	The Op Code describes the type of message that the packet contains. Possible values are: 0 - hello, 1 - coup, and 2 - resign. Hello messages are sent to indicate that a router runs HSRP and is able to become the active router. Coup messages are sent when a router wishes to become

	the active router. Resign messages are sent when a router no longer wishes to be the active router.
State (1 octet)	Each router in the standby group implements a state machine. The state field describes the current state of the router that sends the message. These are details on the individual states: 0 - initial, 1 - learn, 2 - listen, 4 - speak, 8 - standby, and 16 - active.
Hello time (1 octet)	This field is only meaningful in hello messages. It contains the approximate period between the hello messages that the router sends. The time is given in seconds.
Holdtime (1 octet)	This field is only meaningful in hello messages. It contains the amount of time that the routers wait for a hello message before they initiate a state change.
Priority (1 octet)	This field is used to elect the active and standby routers. In a comparison of the priorities of two routers, the router with the highest value becomes the active router. The tie breaker is the router with the higher IP address.
Group (1 octet)	This field identifies the standby group.
Authentication Data (8 octets)	This field contains a cleartext, eight-character password.
Virtual IP Address (4 octets)	If the virtual IP address is not configured on a router, the address can be learned from the hello message from the active router. An address is only learned if no HSRP standby IP address has been configured, and the hello message is authenticated (if authentication is

configured).

HSRP States

State	Definition
Initial	This is the state at the start. This state indicates that HSRP does not run. This state is entered through a configuration change or when an interface first becomes available.
Learn	The router has not determined the virtual IP address and has not yet seen an authenticated hello message from the active router. In this state, the router still waits to hear from the active router.
Listen	The router knows the virtual IP address, but the router is neither the active router nor the standby router. It listens for hello messages from those routers.
Speak	The router sends periodic hello messages and actively participates in the election of the active and/or standby router. A router cannot enter <code>speak</code> state unless the router has the virtual IP address.
Standby	The router is a candidate to become the next active router and sends periodic hello messages. With the exclusion of transient conditions, there is, at most, one router in the group in <code>standby</code> state.
Active	The router currently forwards packets that are sent to the group virtual MAC address. The router sends periodic hello messages. With the exclusion of transient conditions, there must be, at most, one router in <code>active</code> state in the group.

HSRP Timers

Each router only uses three timers in HSRP. The timers time hello messages. The HSRP converges, when a failure occurs, depend on how the HSRP hello and hold

timers are configured. By default, these timers are set to 3 and 10 seconds, respectively, which means that a hello packet is sent between the HSRP standby group devices every 3 seconds, and the standby device becomes active when a hello packet has not been received for 10 seconds. You can lower these timer settings to speed up the failover or preemption, but, to avoid increased CPU usage and unnecessary standby state flapping, do not set the hello timer below one (1) second or the hold timer below 4 seconds. Note that, if you use the HSRP tracking mechanism and the tracked link fails, the failover or preemption occurs immediately, regardless of the hello and hold timers. When a timer expires, the router transitions to a new HSRP state. The timers can be changed with this command: **standby [group-number] timers hellotime holdtime**: for example, **standby 1 timers 5 15**.

This table provides more information on these timers:

Timer	Description
Active timer	This timer is used to monitor the active router. This timer starts any time an active router receives a hello packet. This timer expires in accordance with the hold time value that is set in the related field of the HSRP hello message.
Standby timer	This timer is used in order to monitor the standby router. The timer starts any time the standby router receives a hello packet. This timer expires in accordance with the hold time value that is set in the respective hello packet.
Hello timer	This timer is used to clock hello packets. All HSRP routers in any HSRP state generate a hello packet when this hello timer expires.

HSRP Events

This table provides the events in the HSRP finite state machine:

Key	Events
1	HSRP is configured on an enabled interface.
2	HSRP is disabled on an interface or the interface is disabled.
	Active timer expiry

3	The active timer is set to the hold time when the last hello message is seen from the active router.
4	Standby timer expiry The standby timer is set to the hold time when the last hello message is seen from the standby router.
5	Hello timer expiry The periodic timer for the send of hello messages is expired.
6	Receipt of a hello message of higher priority from a router in <code>speak</code> state
7	Receipt of a hello message of higher priority from the active router
8	Receipt of a hello message of lower priority from the active router
9	Receipt of a resign message from the active router
10	Receipt of a coup message from a higher priority router
11	Receipt of a hello message of higher priority from the standby router
12	Receipt of a hello message of lower priority from the standby router

HSRP Actions

This table specifies the actions to be taken as part of the state machine:

Initial	Action
A	Start active timer—If this action occurs as the result of the receipt of an authenticated hello message from the active router, the active timer is set to the hold time field in the hello message. Otherwise, the active timer is set to the current hold time value that is in use by this router. The active timer then starts.
	Start standby timer—If this action occurs

B	as the result of the receipt of an authenticated hello message from the standby router, the standby timer is set to the hold time field in the hello message. Otherwise, the standby timer is set to the current hold time value that is in use by this router. The standby timer then starts.
C	Stop active timer—The active timer stops.
D	Stop standby timer—The standby timer stops.
E	Learn parameters—This action is taken when an authenticated message is received from the active router. If the virtual IP address for this group is not manually configured, the virtual IP address can be learned from the message. The router can learn hello time and hold time values from the message.
F	Send hello message—The router sends a hello message with its current state, hello time, and hold time.
G	Send coup message—The router sends a coup message in order to inform the active router that there is a higher-priority router available.
H	Send resign message—The router sends a resign message in order to allow another router to become the active router.
I	Send gratuitous ARP message—The router broadcasts an ARP response packet that advertises the group virtual IP and MAC addresses. The packet is sent with the virtual MAC address as the source MAC address in the link layer header, as well as within the ARP packet.

HSRP State Table

The diagram in this section shows the state transitions of the HSRP state machine. Each time that an event occurs, the associated action results, and the router transitions to the next HSRP state. In the diagram, numbers designate events, and letters designate the associated action. The table in the section [HSRP Events](#) defines the numbers, and the table in the section [HSRP Actions](#) defines the letters. Use this

PC1	0000.0c00.0001	10.1.1.10	255.255.255.0	10.1.1.1
PC2	0000.0c00.1110	10.1.2.10	255.255.255.0	10.1.2.1

Router A Configuration (Active Router)

```
interface ethernet 0
  ip address 10.1.1.2 255.255.255.0
  mac-address 4000.0000.0010
  standby 1 ip 10.1.1.1
  standby 1 priority 200
interface ethernet 1
  ip address 10.1.2.2 255.255.255.0
  mac-address 4000.0000.0011
  standby 1 ip 10.1.2.1
  standby 1 priority 200
```

Router B Configuration (Standby Router)

```
interface ethernet 0
  ip address 10.1.1.3 255.255.225.0
  mac-address 4000.0000.0020
  standby 1 ip 10.1.1.1
interface ethernet 1
  ip address 10.1.2.3 255.255.255.0
  mac-address 4000.0000.0021
  standby 1 ip 10.1.2.1
```

Note: These examples configure static MAC addresses for illustration purposes only. Do not configure static MAC addresses unless you are required to do so.

You must understand the concept behind packet flow when you obtain sniffer traces in order to troubleshoot HSRP problems. Router A uses the priority of 200 and becomes the active router on both interfaces. In the example in this section, packets from the router that are destined for a host workstation have the source MAC address of the router physical MAC address (BIA). Packets from the host machines that are destined for the HSRP IP address have the destination MAC address of the HSRP virtual MAC address. Note that the MAC addresses are not the same for each flow between the router and the host.

This table shows the respective MAC and IP address information per flow on the basis of a sniffer trace that is taken from Switch X.

Packet Flow	Source MAC	Destination MAC	Source IP	Destination IP
Packets from PC1 that are	PC1 (0000.0c00.0001)	HSRP virtual MAC address of Router A interface Ethernet	10.1.1.10	10.1.2.10

destined for PC2		0 (0000.0c07.ac01)		
Packets that return through Router A from PC2 and are destined for PC1	Router A Ethernet 0 BIA (4000.0000.0010)	PC1 (0000.0c00.0001)	10.1.2.10	10.1.1.10
Packets from PC1 that are destined for HSRP standby IP address (ICMP, Telnet)	PC1 (0000.0c00.0001)	HSRP virtual MAC address of Router A interface Ethernet 0 (0000.0c07.ac01)	10.1.1.10	10.1.1.1
Packets that are destined for the actual IP address of the active router (ICMP, Telnet)	PC1 (0000.0c00.0001)	Router A Ethernet 0 BIA (4000.0000.0010)	10.1.1.10	10.1.1.2
Packets that are destined for the actual IP address of the	PC1 (0000.0c00.0001)	Router B Ethernet 0 BIA (4000.0000.0020)	10.1.1.10	10.1.1.3

standby router (ICMP, Telnet)				
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Troubleshoot HSRP Case Studies

Case Study #1: HSRP Standby IP Address Is Reported as a Duplicate IP Address

These error messages can appear:

```
Oct 12 13:15:41: %STANDBY-3-DUPADDR: Duplicate address 10.25.0.1
on Vlan25, sourced by 0000.0c07.ac19
Oct 13 16:25:41: %STANDBY-3-DUPADDR: Duplicate address 10.25.0.1
on Vlan25, sourced by 0000.0c07.ac19
Oct 15 22:31:02: %STANDBY-3-DUPADDR: Duplicate address 10.25.0.1
on Vlan25, sourced by 0000.0c07.ac19
Oct 15 22:41:01: %STANDBY-3-DUPADDR: Duplicate address 10.25.0.1
on Vlan25, sourced by 0000.0c07.ac19
```

These error messages do not necessarily indicate an HSRP problem. Rather, the error messages indicate a possible Spanning Tree Protocol (STP) loop or router/switch configuration issue. The error messages are just symptoms of another problem.

In addition, these error messages do not prevent the proper operation of HSRP. The duplicate HSRP packet is ignored. These error messages are throttled at 30-second intervals. But, slow network performance and packet loss can result from the network instability that causes the STANDBY-3-DUPADDR error messages of the HSRP address.

These error messages can appear:

```
Oct 15 22:41:01: %STANDBY-3-DUPADDR: Duplicate address 10.25.0.1
on Vlan25, sourced by 0000.0c07.ac19
```

These messages specifically indicate that the router received a data packet that was sourced from the HSRP IP address on VLAN 25 with the MAC addresses 0000.0c07.ac19. Since the HSRP MAC address is 0000.0c07.ac19, either the router in question received its own packet back or both routers in the HSRP group went into the active state. Because the router received its own packet, the problem most likely is with the network rather than the router. A variety of problems can cause this behavior. Among the possible network problems that cause the error messages are:

- Momentary STP loops
- EtherChannel configuration issues
- Duplicated frames

When you troubleshoot these error messages, see the troubleshooting steps in the [HSRP Troubleshooting Modules for CatOS Switches](#) section of this document. All the troubleshooting modules are applicable to this section, which includes modules on configuration. In addition, note any errors in the switch log and reference additional case studies as necessary.

You can use an access list in order to prevent the active router from receiving its own multicast hello packet. But, this is only a workaround for the error messages and actually hides the symptom of the problem. The workaround is to apply an extended inbound access list to the HSRP interfaces. The access list blocks all traffic that is sourced from the physical IP address and that is destined to all routers multicast address 224.0.0.2.

```
access-list 101 deny ip host 172.16.12.3 host 224.0.0.2
access-list 101 permit ip any any

interface ethernet 0
 ip address 172.16.12.3 255.255.255.0
 standby 1 ip 172.16.12.1
 ip access-group 101 in
```

Case Study #2: HSRP State Continuously Changes (Active, Standby, Speak) or %HSRP-6-STATECHANGE

These error messages can appear:

```
Jan 9 08:00:42.623: %STANDBY-6-STATECHANGE: Standby: 49:
Vlan149 state Standby -> Active
Jan 9 08:00:56.011: %STANDBY-6-STATECHANGE: Standby: 49:
Vlan149 state Active -> Speak
Jan 9 08:01:03.011: %STANDBY-6-STATECHANGE: Standby: 49:
Vlan149 state Speak -> Standby
Jan 9 08:01:29.427: %STANDBY-6-STATECHANGE: Standby: 49:
Vlan149 state Standby -> Active
Jan 9 08:01:36.808: %STANDBY-6-STATECHANGE: Standby: 49:
Vlan149 state Active -> Speak
Jan 9 08:01:43.808: %STANDBY-6-STATECHANGE: Standby: 49:
Vlan149 state Speak -> Standby
```

These error messages describe a situation in which a standby HSRP router did not receive three successive HSRP hello packets from its HSRP peer. The output shows that the standby router moves from the `standby` state to the `active` state. Shortly thereafter, the router returns to the `standby` state. Unless this error message occurs during the initial installation, an HSRP issue probably does not cause the error message. The error messages signify the loss of HSRP hellos between the peers. When you troubleshoot this issue, you must verify the communication between the HSRP peers. A random, momentary loss of data communication between the peers is the most common problem that results in these messages. HSRP state changes are often due to High CPU Utilization. If the error message is due to high CPU utilization, put a

sniffer on the network and trace the system that causes the high CPU utilization.

There are several possible causes for the loss of HSRP packets between the peers. The most common problems are [physical layer problems](#), excessive network traffic caused by [spanning tree issues](#) or excessive traffic caused by each Vlan. As with [Case Study #1](#), all the troubleshooting modules are applicable to the resolution of HSRP state changes, particularly the [Layer 3 HSRP Debugging](#).

If the loss of HSRP packets between peers is due to excessive traffic caused by each VLAN as mentioned, you can tune or increase the SPD and hold the queue size to overcome the input queue drop problem.

In order to increase the Selective Packet Discard (SPD) size, go to the configuration mode and execute these commands on the Cat6500 switches:

```
(config)# ip spd queue max-threshold 600
```

```
!--- Hidden Command
```

```
(config)# ip spd queue min-threshold 500
```

```
!--- Hidden Command
```

Note: Refer to [Understanding Selective Packet Discard \(SPD\)](#) for more information on the SPD.

In order to increase the hold queue size, go to the VLAN interface mode and execute this command.:

```
(config-if)# hold-queue 500 in
```

After you increase the SPD and hold queue size, you can clear the interface counters if you execute the 'clear counter interface' command.

Case Study #3: HSRP Does Not Recognize Peer

The router output in this section shows a router that is configured for HSRP but does not recognize its HSRP peers. In order for this to occur, the router must fail to receive HSRP hellos from the neighbor router. When you troubleshoot this issue, see the [Verify Physical Layer Connectivity](#) section and the [Verify HSRP Router Configuration](#) section of this document. If the physical layer connectivity is correct, check for the mismatched VTP modes.

```
Vlan8 - Group 8
Local state is Active, priority 110, may preempt
Hellotime 3 holdtime 10
Next hello sent in 00:00:01.168
Hot standby IP address is 10.1.2.2 configured
```

```

Active router is local
Standby router is unknown expired
Standby virtual mac address is 0000.0c07.ac08
5 state changes, last state change 00:05:03

```

Case Study #4: HSRP State Changes and Switch Reports SYS-4-P2_WARN: 1/Host <mac_address> Is Flapping Between Port <port_1> and Port <port_2> in Syslog

These error messages can appear:

```

2001 Jan 03 14:18:43 %SYS-4-P2_WARN: 1/Host 00:00:0c:14:9d:08
is flapping between port 2/4 and port 2/3

```

In software version 5.5.2 and later for the Catalyst 4500/4000 and 2948G, the switch reports a host MAC address that moves if the host MAC address moves twice within 15 seconds. A common cause is an STP loop. The switch discards packets from this host for about 15 seconds in an effort to minimize the impact of an STP loop. If the MAC address move between two ports that is reported is the HSRP virtual MAC address, the problem is most likely an issue in which both HSRP routers go into the active state.

If the MAC address that is reported is not the HSRP virtual MAC address, the issue can indicate the loop, duplication, or reflection of packets in the network. These types of conditions can contribute to HSRP problems. The most common causes for the move of MAC addresses are [spanning tree problems](#) or [physical layer problems](#).

When you troubleshoot this error message, complete these steps:

Note: Also, complete the steps in the [HSRP Troubleshooting Modules for CatOS Switches](#) section of this document.

1. Determine the correct source (port) of the MAC address that the error message reports.
2. Disconnect the port that must not source the host MAC address and check for HSRP stability.
3. Document the STP topology on each VLAN and check for STP failure.
4. Verify the port channel configuration.

An incorrect port channel configuration can result in the flap of error messages by the host MAC address. This is because of the load-balancing nature of port channeling.

Case Study #5: HSRP State Changes and Switch Reports RTD-1-ADDR_FLAP in Syslog

These error messages can appear:

```
*Mar 9 14:51:12: %RTD-1-ADDR_FLAP: Fast Ethernet 0/7
  relearning 21 addrs per min
*Mar 9 14:52:12: %RTD-1-ADDR_FLAP: Fast Ethernet 0/7
  relearning 22 addrs per min
*Mar 9 14:53:12: %RTD-1-ADDR_FLAP: Fast Ethernet 0/7
  relearning 20 addrs per min
*Mar 9 14:54:12: %RTD-1-ADDR_FLAP: Fast Ethernet 0/7
  relearning 20 addrs per min
*Mar 9 14:55:12: %RTD-1-ADDR_FLAP: Fast Ethernet 0/7
  relearning 21 addrs per min
*Mar 9 14:56:12: %RTD-1-ADDR_FLAP: Fast Ethernet 0/7
  relearning 22 addrs per min
*Mar 9 14:57:12: %RTD-1-ADDR_FLAP: Fast Ethernet 0/7
  relearning 21 addrs per min
```

These error message signify that a MAC address moves consistently between different ports. These error messages are only applicable on the Catalyst 2900XL and 3500XL switches. The messages can indicate that two or more HSRP routers have become active. The messages can indicate the source of an STP loop, duplicated frames, or reflected packets.

In order to gather more information about the error messages, issue this **debug** command:

```
switch#debug ethernet-controller address
```

```
Ethernet Controller Addresses debugging is on 1
```

```
*Mar 9 08:06:06: Add address 0000.0c07.ac02, on port 35 vlan 2
*Mar 9 08:06:06: 0000.0c07.ac02 has moved from port 6 to port 35
*Mar 9 08:06:07: Add address 0000.0c07.ac02, on port 6 vlan 2
*Mar 9 08:06:07: 0000.0c07.ac02 has moved from port 35 to port 6
*Mar 9 08:06:08: Add address 0000.0c07.ac02, on port 35 vlan 2
*Mar 9 08:06:08: 0000.0c07.ac02 has moved from port 6 to port 35
*Mar 9 08:06:10: Add address 0000.0c07.ac02, on port 6 vlan 2
*Mar 9 08:06:10: 0000.0c07.ac02 has moved from port 35 to port 6
*Mar 9 08:06:11: Add address 0000.0c07.ac02, on port 35 vlan 2
*Mar 9 08:06:11: 0000.0c07.ac02 has moved from port 6 to port 35
*Mar 9 08:06:12: %RTD-1-ADDR_FLAP: Fast Ethernet 0/7 relearning
*Mar 9 08:06:13: Add address 0000.0c07.ac02, on port 6 vlan 2
*Mar 9 08:06:13: 0000.0c07.ac02 has moved from port 35 to port 6
```

The ports that the **debug** command references are off by one. For example, port 0 is Fast Ethernet 0/1. The error messages indicate the flap of a MAC address between ports 5 and 34 on the respective switch.

Note: The message `RTD-1-ADDR_FLAP` can be incorrect. Refer to these Cisco bug IDs in order to rule out this possibility:

- [CSCdp81680](#) [↗](#) ([registered](#) customers only) —Incorrect RTD-1-ADDR_FLAP message
- [CSCds27100](#) [↗](#) ([registered](#) customers only) and [CSCdr30113](#) [↗](#) ([registered](#) customers only) —Fast EtherChannel issues cause RTD-1-ADDR_FLAP

The most common causes for the move of MAC addresses are [spanning tree problems](#) or [physical layer problems](#).

When you troubleshoot this error message, complete these steps:

Note: Also, complete the steps in the [HSRP Troubleshooting Modules for CatOS Switches](#) section of this document.

1. Determine the correct source (port) of the host MAC address.
2. Disconnect the port that should not source the host MAC address.
3. Document the STP topology on a per-VLAN basis and check for STP failure.
4. Verify the port channeling configuration.

An incorrect port channel configuration can result in the flap of error messages by the host MAC address. This is because of the load-balancing nature of port channeling.

Case Study #6: HSRP State Changes and Switch Reports MLS-4-MOVEOVERFLOW:Too many moves, stop MLS for 5 sec(20000000) in Syslog

These error messages can appear:

```
05/13/2000,08:55:10:MLS-4-MOVEOVERFLOW:Too many moves, stop MLS
05/13/2000,08:55:15:MLS-4:Resume MLS after detecting too many m
```

These messages indicate that the switch learns the same MAC address on two different ports. This message is only reported on Catalyst 5500/5000 switches. Issue these commands in order to gather additional information about the problem:

Note: The commands that this section mentions are not documented. You must enter them completely. The **show mls notification** command provides a table address (TA) value. The **show looktable TA-value** command returns a possible MAC address that you can trace to the root of the problem.

```
Switch (enable) show mls notification

1: (0004e8e6-000202ce) Noti Chg TA e8e6 OI 2ce (12/15) V 1
```

```

!--- This is the mod/port and VLAN. The MAC address is
!--- seen on this module 12, port 15 in VLAN 1.

2: (0004e8e6-000202cd) Noti Chg TA e8e6 OI 2cd (12/14) V 1

!--- This is the mod/port and VLAN. The next is seen on
!--- module 12, port 14 in VLAN 1.

```

Write down the four-digit/letter combination that appears after Chg TA in this command output. The **show looktable** command gives the MAC address that causes the MLS TOO MANY MOVES error message:

```

150S_CR(S2)> (enable) show looktable e8e6

Table address: 0xe8e6, Hash: 0x1d1c, Page: 6
Entry Data[3-0]: 0x000002cd 0x00800108 0x0008c790 0x215d0005, Er

Router-Xtag QOS SwGrp3 Port-Index
0 0 0x0 0x2cd

Fab AgeByte C-Mask L-Mask Static SwSc HwSc EnSc AL Trap R-Mac
0 0x01 0x0000 0x0000 0 0 0 0 0 0 0

MacAge Pri-In Modify Notify IPX-Sw IPX-Hw IPX-En Valid SwGrp2 Pa
0 0 1 0 0 0 0 1 0x0 0

Entry-Mac-Address FID SwGrp1 Parity1
00-08-c7-90-21-5d 1 0x0 1

```

The entry MAC address 00-08-c7-90-21-5d is the MAC address that flaps between ports. You must know the MAC address in order to find the offending device. If the entry MAC address is the virtual HSRP MAC address, the issue can be that both HSRP routers have gone into the active state.

The most common causes for the move of MAC addresses are [spanning tree problems](#) or [physical layer problems](#).

When you troubleshoot this error message, complete these steps:

Note: Also complete the steps in the [HSRP Troubleshooting Modules for CatOS Switches](#) section of this document.

1. Determine the correct source (port) of the host MAC address.
2. Disconnect the port that should not source the host MAC address.
3. Document the STP topology on a per-VLAN basis and check for STP failure.
4. Verify the port channeling configuration.

An incorrect port channel configuration can result in the flap of error messages by the host MAC address. This is because of the load-balancing nature of port channeling.

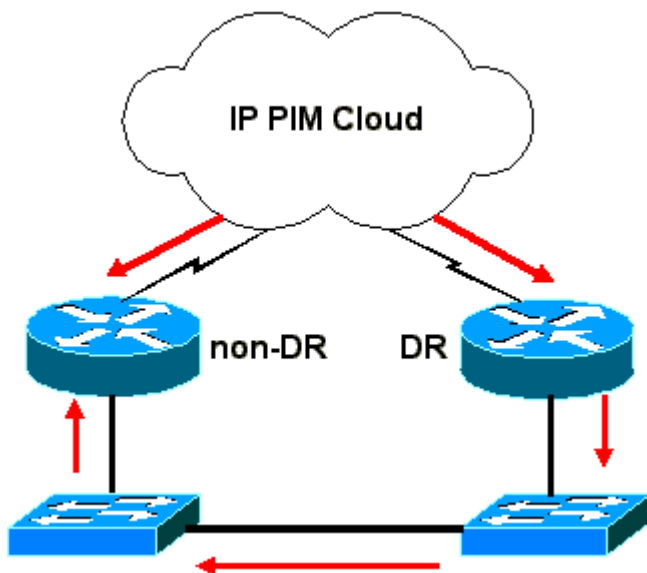
5. Disable PortFast on all of the ports that connect to devices other than a PC or IP phone in order to avoid bridging loops.

Case Study #7: HSRP Intermittent State Changes on Multicast Stub Network

There is a common cause for HSRP anomalous state changes for an HSRP router that is part of a multicast stub network. This common cause deals with the non-Reverse Path Forwarding (RPF) traffic that the non-designated router (DR) sees. This is the router that does not forward the multicast traffic stream.

IP multicast uses one router to forward data onto a LAN in redundant topologies. If multiple routers have interfaces onto a LAN or VLAN, only one router forwards the data. There is no load balancing for multicast traffic on LANs. All multicast traffic is always visible by every router on a LAN. This is also the case if Cisco Group Management Protocol (CGMP) or Internet Group Management Protocol (IGMP) snooping is configured. Both routers need to see the multicast traffic in order to make a forwarding decision.

This diagram provides an example. The red lines indicate multicast feed.



The redundant router, which is the router that does not forward the multicast traffic stream, sees this data on the outbound interface for the LAN. The redundant router must drop this traffic because the traffic arrived on the wrong interface and, therefore, fails the RPF check. This traffic is referred to as non-RPF traffic because it is reflected backward against the flow from the source. For this non-RPF traffic, there is usually no (*,G) or (S,G) state in the redundant router. Therefore, no hardware or software shortcuts can be created in order to drop the packet. The processor must examine each

multicast packet individually. This requirement can cause the CPU on these routers to spike or run at a very high processing rate. Often, a high rate of multicast traffic on the redundant router causes HSRP to lose hello packets from its peer and change states.

Therefore, enable hardware access lists on Catalyst 6500 and 8500 routers that do not handle non-RPF traffic efficiently by default. The access lists prevent the CPU from processing the non-RPF traffic.

Note: Do not attempt to work around this problem with a disablement of the IP Protocol Independent Multicast (PIM) on the redundant router interfaces. This configuration can have an undesirable impact on the redundant router.

On the 6500/8500 routers, there is an access list engine that enables filtering to take place at wire rate. You can use this feature to handle non-RPF traffic for sparse mode groups efficiently.

In software versions 6.2.1 and later, the system software automatically enables filtering so that the non-DR does not receive unnecessary non-RPF traffic. In earlier software versions, you need to configure access lists manually. In order to implement this solution for software versions that are earlier than 6.2.1, place an access list on the inbound interface of the stub network. The access list filters multicast traffic that did not originate from the stub network. The access list is pushed down to the hardware in the switch. This access list ensures that the CPU never sees the packet and allows the hardware to drop the non-RPF traffic.

For example, assume that you have two routers with two VLANs in common. You can expand this number of VLANs to as many VLANs as necessary. Router A is HSRP primary for VLAN 1 and secondary for VLAN 2. Router B is secondary for VLAN 1 and primary for VLAN 2. Give either Router A or Router B a higher IP address in order to make that router the DR. Be sure that only one router is the DR for all segments, as this example shows:

```
Router A
  VLAN1 Physical IP Address
  A.B.C.3
```

```
Router B
  VLAN1 Physical IP Address
  A.B.C.2
  VLAN1 HSRP Address
  A.B.C.1
```

```
Router A
  VLAN2 Physical IP Address
  A.B.D.3
```

```
Router B
  VLAN2 Physical IP Address
  A.B.D.2
  VLAN2 HSRP Address
```

A.B.D.1

Place this access list on the non-DR router:

```
access-list 100 permit ip A.B.C.0 0.0.0.255 any
access-list 100 permit ip A.B.D.0 0.0.0.255 any
access-list 100 permit ip any 224.0.0.0 0.0.0.255
access-list 100 permit ip any 224.0.1.0 0.0.0.255
access-list 100 deny ip any 224.0.0.0 15.255.255.255
```

You should have one permit for each subnet that the two routers share. Other permits allow auto-redirect point (RP) and reserved groups to operate correctly.

Issue these additional commands in order to apply the access control lists (ACLs) to each VLAN interface on the non-DR:

- [ip access-group 100 in](#)
- [no ip redirects](#)
- [no ip unreachable](#)

Note: You must run Catalyst software 5.4(3) or later in order for the ACLs to work in hybrid configuration.

Note: The redundant router designs that this document discusses are externally redundant, which means that there are two physical 6500 routers. Do not use this workaround for internal redundancy, in which two route processors are in one box.

Case Study #8: Asymmetric Routing and HSRP (Excessive Flooding of Unicast Traffic in Network with Routers That Run HSRP)

With asymmetric routing, transmit and receive packets follow different paths between a host and the peer with which it communicates. This packet flow is a result of the configuration of load balancing between HSRP routers, based on HSRP priority, which set the HSRP to active or standby. This type of packet flow in a switching environment can result in excessive unknown unicast flooding. Also, Multilayer Switching (MLS) entries can be absent. Unknown unicast flooding occurs when the switch floods a unicast packet out of all ports. The switch floods the packet because there is no entry for the destination MAC address. This behavior does not break connectivity because packets are still forwarded. But, the behavior does account for the flood of extra packets on host ports. This case studies the behavior of asymmetric routing and why unicast flooding results.

Symptoms of asymmetric routing include:

- Excessive unicast packet flooding
- Absent MLS entry for flows

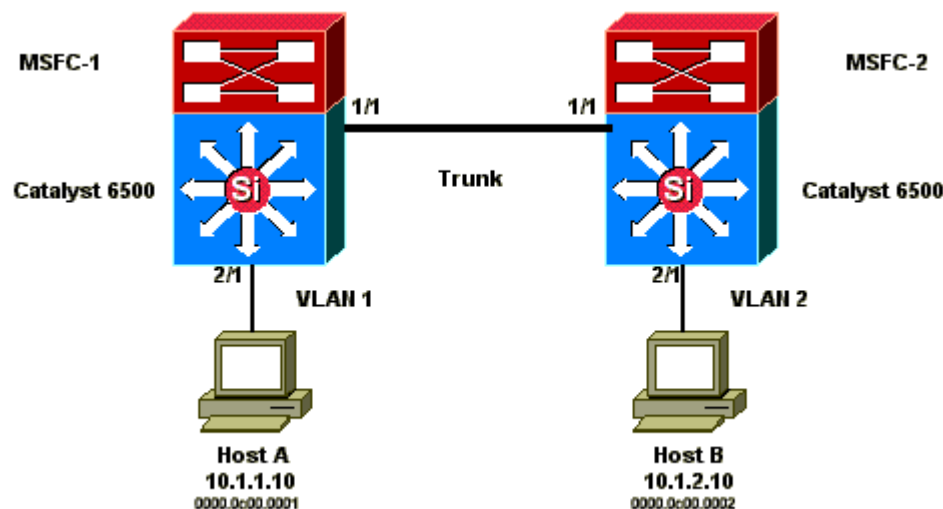
- Sniffer trace that shows that packets on the host port are not destined for the host
- Increased network latency with L2-based packet rewrite engines, such as server load balancers, web cache devices, and network appliances

Examples include the Cisco LocalDirector and Cisco Cache Engine.

- Dropped packets on connected hosts and workstations that cannot handle the additional unicast-flooding traffic load

Note: The default ARP cache aging time on a router is four hours. The default aging time of the switch content-addressable memory (CAM) entry is five minutes. The ARP aging time of the host workstations is not significant for this discussion. but, the example sets the ARP aging time to four hours.

This diagram illustrates this issue. This topology example includes Catalyst 6500s with Multilayer Switch Feature Cards (MSFCs) in each switch. Although this example uses MSFCs, you can use any router instead of the MSFC. Example routers that you can use include the Route Switch Module (RSM), Gigabit Switch Router (GSR), and Cisco 7500. The hosts are directly connected to ports on the switch. The switches are interconnected through a trunk which carries traffic for VLAN 1 and VLAN 2.



These outputs are excerpts from the [show standby](#) command configuration from each MSFC:

MSFC1

```
interface Vlan 1
  mac-address 0003.6bf1.2a01
  ip address 10.1.1.2 255.255.255.0
  no ip redirects
  standby 1 ip 10.1.1.1
  standby 1 priority 110

interface Vlan 2
```

```
mac-address 0003.6bf1.2a01
ip address 10.1.2.2 255.255.255.0
no ip redirects
standby 2 ip 10.1.2.1
```

MSFC1#**show standby**

Vlan1 - Group 1

Local state is **Active**, priority 110

Hellotime 3 holdtime 10

Next hello sent in 00:00:00.696

Hot standby IP address is 10.1.1.1 configured

Active router is local

Standby router is 10.1.1.3 expires in 00:00:07

Standby virtual mac address is 0000.0c07.ac01

2 state changes, last state change 00:20:40

Vlan2 - Group 2

Local state is **Standby**, priority 100

Hellotime 3 holdtime 10

Next hello sent in 00:00:00.776

Hot standby IP address is 10.1.2.1 configured

Active router is 10.1.2.3 expires in 00:00:09, priority 110

Standby router is local

4 state changes, last state change 00:00:51

MSFC1#**exit**

Console> (enable)

MSFC2

```
interface Vlan 1
  mac-address 0003.6bf1.2a02
  ip address 10.1.1.3 255.255.255.0
  no ip redirects
  standby 1 ip 10.1.1.1
```

```
interface Vlan 2
  mac-address 0003.6bf1.2a02
  ip address 10.1.2.3 255.255.255.0
  no ip redirects
  standby 2 ip 10.1.2.1
  standby 2 priority 110
```

MSFC2#**show standby**

Vlan1 - Group 1

Local state is **Standby**, priority 100

Hellotime 3 holdtime 10

Next hello sent in 00:00:01.242

Hot standby IP address is 10.1.1.1 configured

Active router is 10.1.1.2 expires in 00:00:09, priority 110

Standby router is local

7 state changes, last state change 00:01:17

Vlan2 - Group 2

Local state is **Active**, priority 110

Hellotime 3 holdtime 10

```

Next hello sent in 00:00:00.924
Hot standby IP address is 10.1.2.1 configured
Active router is local
Standby router is 10.1.2.2 expires in 00:00:09
Standby virtual mac address is 0000.0c07.ac02
2 state changes, last state change 00:40:08
MSFC2#exit

```

Note: On MSFC1, VLAN 1 is in the HSRP active state, and VLAN 2 is in the HSRP standby state. On MSFC2, VLAN 2 is in the HSRP active state, and VLAN 1 is in the HSRP standby state. The default gateway of each host is the respective standby IP address.

- Initially, all caches are empty. Host A uses MSFC1 as its default gateway. Host B uses MSFC2.

ARP and MAC Address Tables Before Ping Is Initiated

Host A ARP Table	Switch 1	MSFC1 ARP Table	MSFC2 ARP Table	Switch 2	Host B ARP Table
	MAC Address Table MAC VLAN Port			MAC Address Table MAC VLAN Port	
	0003.6bf1.2a01 1 15/1			0003.6bf1.2a02 1 15/1	
	0003.6bf1.2a01 2 15/1			0003.6bf1.2a02 2 15/1	
	0000.0c07.ac01 1 15/1			0000.0c07.ac01 1 1/1	
	0000.0c07.ac02 2 1/1			0000.0c07.ac02 2 15/1	
	0003.6bf1.2a02 1 1/1			0003.6bf1.2a01 1 1/1	
	0003.6bf1.2a02 2 1/1			0003.6bf1.2a01 2 1/1	

Note: For brevity, the Switch 1 MAC address for the router HSRP and MAC address are not included in the other tables that appear in this section.

- Host A pings host B, which means that host A sends an ICMP echo packet. Because each host resides on a separate VLAN, host A forwards its packets that are destined for host B to its default gateway. In order for that process to occur, host A must send an ARP in order to resolve its default gateway MAC address,

10.1.1.1.

ARP and MAC Address Tables After Host A Sends ARP for Default Gateway

Host A ARP Table	Switch 1 MAC Address Table MAC VLAN Port	MSFC1 ARP Table	MSFC2 ARP Table	Switch 2 MAC Address Table MAC VLAN Port	Host B ARP Table
10.1.1.1 : 0000.0c07.ac01	0000.0c00.0001 1 2/1	10.1.1.10 : 0000.0c00.0001			

3. MSFC1 receives the packet, rewrites the packet, and forwards the packet to host B. In order to rewrite the packet, MSFC1 sends an ARP request for host B because the host resides off a directly connected interface. MSFC2 has yet to receive any packets in this flow. When MSFC1 receives the ARP reply from host B, both switches learn the source port that is associated with host B.

ARP and MAC Address Tables After Host A Sends Packet to Default Gateway: MSFC1 Sends ARP for Host B

Host A ARP Table	Switch 1 MAC Address Table MAC VLAN Port	MSFC1 ARP Table	MSFC2 ARP Table	Switch 2 MAC Address Table MAC VLAN Port	F
10.1.1.1 : 0000.0c07.ac01	0000.0c00.0001 1 2/1	10.1.1.10 : 0000.0c00.0001		0000.0c00.0002 2 2/1	10 00
	0000.0c00.0002 2 1/1	10.1.2.10 : 0000.0c00.0002			

4. Host B receives the echo packet from host A, through MSFC1. Host B must now send an echo reply to host A. Since host A resides on a different VLAN, host B forwards the reply through its default gateway, MSFC2. In order to forward the packet through MSFC2, host B must send an ARP for its default gateway IP address, 10.1.2.1.

ARP and MAC Address Tables After Host B Sends ARP for Its Default Gate

Host A ARP Table	Switch 1 MAC Address Table MAC VLAN Port	MSFC1 ARP Table	MSFC2 ARP Table	Switch 2 MAC Address Table MAC VLAN Port	F

	Switch 1			Switch 2
Host A ARP Table	MAC Address Table	MSFC1 ARP Table	MSFC2 ARP Table	MAC Address Table
	MAC VLAN Port			MAC VLAN Port
10.1.1.1 : 0000.0c07.ac01	0000.0c00.0001 1 2/1	10.1.1.10 : 0000.0c00.0001	10.1.2.10 0000.0c00.0002	0000.0c00.0001 2 2/1
	0000.0c00.0002 2 1/1	10.1.2.10 : 0000.0c00.0001		

5. Host B now forwards the echo reply packet to MSFC2. MSFC2 sends an ARP request for host A because it is directly connected on VLAN 1. Switch 2 populates its MAC address table with the MAC address of host B.

ARP and MAC Address Tables After Echo Packet Has Been Received by Host B

	Switch 1			Switch 2
Host A ARP Table	MAC Address Table	MSFC1 ARP Table	MSFC2 ARP Table	MAC Address Table
	MAC VLAN Port			MAC VLAN Port
10.1.1.1 : 0000.0c07.ac01	0000.0c00.0001 1 2/1	10.1.1.10 : 0000.0c00.0001	10.1.2.10 0000.0c00.0002	0000.0c00.0001 2 2/1
10.1.1.3 : 0003.6bf1.2a0	0000.0c00.0002 2 1/1	10.1.2.10 : 0000.0c00.0001	10.1.1.10 0000.0c00.0001	0000.0c00.0002 1 1/1

6. The echo reply reaches host A and the flow is complete.

Consequences of Asymmetric Routing

Consider the case of the continuous ping of host B by host A. Remember that host A sends the echo packet to MSFC1, and host B sends the echo reply to MSFC2, which is in an asymmetric routing state. The only time that Switch 1 learns the source MAC of host B is when host B replies to an ARP request from MSFC1. This is because host B uses MSFC2 as its default gateway and does not send packets to MSFC1 and, consequently, Switch 1. Since the ARP timeout is four hours by default, Switch 1 ages the MAC address of host B after five minutes by default. Switch 2 ages host A after five minutes. As a result, Switch 1 must treat any packet with a destination MAC of host B as an unknown unicast. The switch floods the packet that comes from host A and is destined for host B out all ports. In addition, because there is no MAC address entry for host B in Switch 1, there is no MLS entry as well.

ARP and MAC Address Tables After 5 Minutes of Continuous Ping of Host B by

	Switch 1			Switch 2
Host A ARP Table	MAC Address Table	MSFC1 ARP Table	MSFC2 ARP Table	MAC Address Table
	MAC VLAN Port			MAC VLAN Port
10.1.1.1 : 0000.0c07.ac01	0000.0c00.0001 1 2/1	10.1.1.10 : 0000.0c00.0001	10.1.2.10 0000.0c00.0002	0000.0c00.0002 2 2/1
10.1.1.3 : 0003.6bf1.2a0		10.1.2.10 : 0000.0c00.0001	10.1.1.10 0000.0c00.0001	

The echo reply packets that come from host B experience the same issue after the MAC address entry for host A ages on Switch 2. Host B forwards the echo reply to MSFC2, which in turn routes the packet and sends it out on VLAN 1. The switch does not have an entry host A in the MAC address table and must flood the packet out all ports in VLAN 1.

Asymmetric routing issues do not break connectivity. But, asymmetric routing can cause excessive unicast flooding and MLS entries that are missing. There are three configuration changes that can remedy this situation:

- Adjust the MAC aging time on the respective switches to 14,400 seconds (four hours) or longer.
- Change the ARP timeout on the routers to five minutes (300 seconds).
- Change the MAC aging time and ARP timeout to the same timeout value.

The preferable method is to change the MAC aging time to 14,400 seconds. These are the configuration guidelines:

- CatOS:
[set cam agingtime vlan aging time in msec](#)
- Cisco IOS Software/2900XL/3500XL:

[mac-address-table aging-time seconds \[vlan vlan_id\]](#)

Case Study #9: HSRP Virtual IP Address Is Reported as a Different IP Address

The STANDBY-3-DIFFVIP1 error message occurs when there is interVLAN leakage because of bridging loops in the switch.

If you get this error message and there is interVLAN leakage because of bridging loops in the switch, complete these steps in order to resolve the error:

1. Identify the path that the packets should take between end nodes.

If there is a router on this path, complete these steps:

- a. Troubleshoot the path from the first switch to the router.
 - b. Troubleshoot the path from the router to the second switch.
2. Connect to each switch on the path and check the status of the ports that are used on the path between end nodes.

For more information on this error message and other HSRP error messages, refer to the [STANDBY Messages](#) section of [Cisco IOS System Error Messages, Volume 2 of 2](#).

Case Study #10: HSRP Causes MAC Violation on a Secure Port

When port security is configured on the switch ports that are connected to the HSRP enabled routers, it causes a MAC violation, since you cannot have the same secure MAC address on more than one interface. A security violation occurs on a secure port in one of these situations:

- The maximum number of secure MAC addresses is added to the address table, and a station whose MAC address is not in the address table attempts to access the interface.
- An address that is learned or configured on one secure interface is seen on another secure interface in the same VLAN.

By default, a port security violation causes the switch interface to become error-disabled and to shutdown immediately, which blocks the HSRP status messages between the routers.

Workaround

- Issue the [standby use-bia](#) command on the routers. This forces the routers to use a burned-in address for HSRP instead of the virtual MAC address.
- Disable port security on the switch ports that connect to the HSRP enabled routers.

Case Study #11: %Interface Hardware Cannot Support Multiple Groups

If multiple HSRP groups are created on the interface, this error message is received:

```
%Interface hardware cannot support multiple groups
```

This error message is received due to the hardware limitation on some Routers or switches. It is not possible to overcome the limitation by any software methods. The problem is that each HSRP group uses one additional MAC address on interface, so the Ethernet MAC chip must support multiple programmable MAC addresses in order to enable several HSRP groups.

The workaround is to use the **standby use-bia** interface configuration command, which uses the Burned-In Address (BIA) of the interface as its virtual MAC address, instead of the preassigned MAC address.

HSRP Troubleshooting Modules for CatOS Switches

A. Verify HSRP Router Configuration

1. Verify Unique Router Interface IP Address

Verify that each HSRP router has a unique IP address for each subnet on a per-interface basis. Also, verify that each interface has the line protocol up. In order to quickly verify the current state of each interface, issue the [show ip interface brief](#) command. Here is an example:

```
Router_1#show ip interface brief
Interface                IP-Address      OK?  Method  Status
Vlan1                    192.168.1.1     YES  manual  up
Vlan10                   192.168.10.1    YES  manual  up
Vlan11                   192.168.11.1    YES  manual  up
```

```
Router_2#show ip interface brief
Interface                IP-Address      OK?  Method  Status
Vlan1                    192.168.1.2     YES  manual  up
Vlan10                   192.168.10.2    YES  manual  up
Vlan11                   192.168.11.2    YES  manual  up
```

2. Verify Standby (HSRP) IP Addresses and Standby Group Numbers

Verify that the configured standby (HSRP) IP addresses and standby group numbers match each HSRP-participating router. A mismatch of standby groups or HSRP standby addresses can cause HSRP problems. The [show standby](#) command details the standby group and standby IP address configuration of each interface. Here is an example:

```
Router_1#show standby
Vlan10 - Group 10
  Local state is Active, priority 110, may preempt
  Hellotime 3 holdtime 10
  Next hello sent in 00:00:00.216
  Hot standby IP address is 192.168.10.100 configured
```

```

Active router is local
Standby router is 192.168.10.2 expires in 00:00:08
Standby virtual mac address is 0000.0c07.ac0a
8 state changes, last state change 00:18:04

```

Vlan11 - Group 11

```

Local state is Active, priority 110, may preempt
Hellotime 3 holdtime 10
Next hello sent in 00:00:01.848
Hot standby IP address is 192.168.11.100 configured
Active router is local
Standby router is 192.168.11.2 expires in 00:00:08
Standby virtual mac address is 0000.0c07.ac0b
2 state changes, last state change 00:04:45

```

Router_2#show standby

Vlan10 - Group 10

```

Local state is Standby, priority 109, may preempt
Hellotime 3 holdtime 10
Next hello sent in 00:00:01.710
Hot standby IP address is 192.168.10.100 configured
Active router is 192.168.10.1 expires in 00:00:09, priority 11
Standby router is local
Standby virtual mac address is 0000.0c07.ac0a
9 state changes, last state change 00:20:22

```

Vlan11 - Group 11

```

Local state is Standby, priority 109, may preempt
Hellotime 3 holdtime 10
Next hello sent in 00:00:02.506
Hot standby IP address is 192.168.11.100 configured
Active router is 192.168.11.1 expires in 00:00:09, priority 11
Standby router is local
Standby virtual mac address is 0000.0c07.ac0b
4 state changes, last state change 00:07:07

```

3. Verify That Standby (HSRP) IP Address Is Different per Interface

Verify that the standby (HSRP) IP address is unique from the configured IP address on each interface. The [show standby](#) command is a quick reference in order to view this information. Here is an example:

Router_1#show standby

Vlan10 - Group 10

```

Local state is Active, priority 110, may preempt
Hellotime 3 holdtime 10
Next hello sent in 00:00:00.216
Hot standby IP address is 192.168.10.100 configured
Active router is local
Standby router is 192.168.10.2 expires in 00:00:08
Standby virtual mac address is 0000.0c07.ac0a
8 state changes, last state change 00:18:04

```

```

Vlan11 - Group 11
  Local state is Active, priority 110, may preempt
  Hellotime 3 holdtime 10
  Next hello sent in 00:00:01.848
  Hot standby IP address is 192.168.11.100 configured
  Active router is local
  Standby router is 192.168.11.2 expires in 00:00:08
  Standby virtual mac address is 0000.0c07.ac0b
  2 state changes, last state change 00:04:45

Router_2#show standby
Vlan10 - Group 10
  Local state is Standby, priority 109, may preempt
  Hellotime 3 holdtime 10
  Next hello sent in 00:00:01.710
  Hot standby IP address is 192.168.10.100 configured
  Active router is 192.168.10.1 expires in 00:00:09, priority 11
  Standby router is local
  Standby virtual mac address is 0000.0c07.ac0a
  9 state changes, last state change 00:20:22

Vlan11 - Group 11
  Local state is Standby, priority 109, may preempt
  Hellotime 3 holdtime 10
  Next hello sent in 00:00:02.506
  Hot standby IP address is 192.168.11.100 configured
  Active router is 192.168.11.1 expires in 00:00:09, priority 11
  Standby router is local
  Standby virtual mac address is 0000.0c07.ac0b
  4 state changes, last state change 00:07:07

```

4. When to Use the standby use-bia Command

Unless HSRP is configured on a Token Ring interface, only use the [standby use-bia](#) command in special circumstances. This command tells the router to use its BIA instead of the virtual HSRP MAC address for the HSRP group. On a Token Ring network, if source-route bridging (SRB) is in use, the [standby use-bia](#) command allows the new active router to update the host Routing Information Field (RIF) cache with a gratuitous ARP. But, not all of the host implementations handle the gratuitous ARP correctly. Another caveat for the [standby use-bia](#) command involves proxy ARP. A standby router cannot cover for the lost proxy ARP database of the failed active router.

5. Verify Access List Configuration

Verify that the access lists that are configured on all of the HSRP peers do not filter any HSRP addresses that are configured on their interfaces. Specifically, verify the multicast address that is used in order to send traffic to all of the routers on a subnet (**224.0.0.2**). Also, verify that the UDP traffic that is destined for the HSRP port **1985** is not filtered. HSRP uses this address and port to send hello packets between peers.

Issue the [show access-lists](#) command as a quick reference to note the access lists that are configured on the router. Here is an example:

```
Router_1#show access-lists
Standard IP access list 77
  deny 167.19.0.0, wildcard bits 0.0.255.255
  permit any
Extended IP access list 144
  deny pim 238.0.10.0 0.0.0.255 any
  permit ip any any (58 matches)
```

6. Review Unique Router Configurations (MSM and 4232-L3)

Note: The Multilayer Switch Module (MSM) for the Catalyst 6500/6000 and the 4232-L3 blade for the Catalyst 4000 have unique configurations. When you troubleshoot HSRP issues, verify the configuration of, not only the 4232-L3 or MSM, but also the adjoining switch port configuration. If you neglect to configure the adjoining switch ports correctly, HSRP instability and other connectivity issues can result. The HSRP duplicated IP address error message is the most common message that is associated with incorrect configuration of these hardware modules.

Refer to these documents for more information:

- [Installation and Configuration Note for the Catalyst 4000 Layer 3 Services Module](#)
- [Catalyst 6000 Family MSM Install/Config Note](#)

7. Additional HSRP Sample Configurations

Refer to these documents:

- [Configuring Redundancy](#) (Catalyst 6500 MSFC)
- [Using HSRP for Fault-Tolerant IP Routing](#)

B. Verify Catalyst Fast EtherChannel and Trunking Configuration

1. Verify Trunking Configuration

If a trunk is used in order to connect the HSRP routers, verify the trunking configurations on the routers and switches. There are five possible trunking modes:

- on
- desirable
- auto

- off
- nonegotiate

Verify that the trunking modes that are configured provide the desired trunking method. Refer to [Configuring Ethernet VLAN Trunks](#) for a table that details the possible configuration modes.

Use the `desirable` configuration for switch-to-switch connections when you troubleshoot HSRP issues. This configuration can isolate issues where switch ports are unable to establish trunks correctly. Set a router-to-switch configuration as `nonegotiate` because most Cisco IOS routers do not support negotiation of a trunk.

For IEEE 802.1Q (dot1q) trunking mode, verify that both sides of the trunk are configured to use the same native VLAN. Because Cisco products do not tag the native VLAN by default, a mismatch of native VLAN configurations results in no connectivity on mismatched VLANs. Lastly, verify that the trunk is configured to carry the VLANs that are configured on the router, and verify that the VLANs are not pruned and in the STP state for router-connected ports. Issue the [show trunk mod/port](#) command for a quick reference that shows this information. Here is an example:

```
Switch_1> (enable) show trunk 2/11
Port      Mode           Encapsulation  Status        Native vlan
-----
2/11      desirable     isl            trunking      1

Port      Vlans allowed on trunk
-----
2/11      1-1005

Port      Vlans allowed and active in management domain
-----
2/11      1-2

Port      Vlans in spanning tree forwarding state and not pruned
-----
2/11      1-2

Switch_2> (enable) show trunk 2/10
Port      Mode           Encapsulation  Status        Native vlan
-----
2/10      desirable     isl            trunking      1

Port      Vlans allowed on trunk
-----
2/10      1-1005

Port      Vlans allowed and active in management domain
-----
2/10      1-2
```

```

Port      Vlans in spanning tree forwarding state and not pruned
-----
2/10      1-2

```

```

Switch_1> (enable) show trunk 2/11
Port      Mode          Encapsulation  Status      Native vlan
-----
2/11      nonegotiate isl            trunking    1

```

```

Port      Vlans allowed on trunk
-----
2/11      1-1005

```

```

Port      Vlans allowed and active in management domain
-----
2/11      1-2

```

```

Port      Vlans in spanning tree forwarding state and not pruned
-----
2/11      1-2

```

```

Switch_1> (enable) show trunk 2/11
Port      Mode          Encapsulation  Status      Native vlan
-----
2/11      nonegotiate dot1q          trunking    1

```

```

Port      Vlans allowed on trunk
-----
2/11      1-1005

```

```

Port      Vlans allowed and active in management domain
-----
2/11      1-2

```

```

Port      Vlans in spanning tree forwarding state and not pruned
-----
2/11      1-2

```

2. Verify Fast EtherChannel (Port Channeling) Configuration

If a port channel is used in order to connect the HSRP routers, verify the EtherChannel configuration on both routers and switches. Configure a switch-to-switch port channel as desirable on at least one side. The other side can be in any of these modes:

- on
- desirable
- auto

Here is an example:

```
Switch_1> (enable) show port channel
```

Port	Status	Channel Mode	Admin Group	Ch Id
1/1	connected	desirable silent	16	769
1/2	connected	desirable silent	16	769

Port	Device-ID	Port-ID
1/1	SCA031700TR	1/1
1/2	SCA031700TR	1/2

```
Switch_2> (enable) show port channel
```

Port	Status	Channel Mode	Admin Group	Ch Id
1/1	connected	desirable silent	29	769
1/2	connected	desirable silent	29	769

Port	Device-ID	Port-ID
1/1	TBA03501066	1/1
1/2	TBA03501066	1/2

3 Additional Channeling and Trunking Sample Configurations

Refer to these documents:

- [Configuring EtherChannel Between Catalyst 4500/4000, 5500/5000, and 6500/6000 Switches That Run CatOS System Software](#)
- [Configuring Etherchannel](#) (CatOS software)
- [Configuring Layer 3 and Layer 2 EtherChannel](#) (Cisco IOS Software)

4. Investigate Switch MAC Address Forwarding Table

Verify that the MAC address table entries exist on the switch for the HSRP routers for the HSRP virtual MAC address and the physical BIAs. The [show standby](#) command on the router provides the virtual MAC address. The [show interface](#) command provides the physical BIA. Here are sample outputs:

```
Router_1#show standby
```

```
Vlan1 - Group 1
```

```
Local state is Active, priority 100
```

```
Hellotime 3 holdtime 10
```

```
Next hello sent in 00:00:01.820
```

```
Hot standby IP address is 10.1.1.254 configured
```

```
Active router is local
```

```
Standby router is 10.1.1.2 expires in 00:00:07
```

```
Standby virtual mac address is 0000.0c07.ac01
```

```

    2 state changes, last state change 00:50:15
Vlan2 - Group 2
  Local state is Active, priority 200, may preempt
  Hellotime 3 holdtime 10
  Next hello sent in 00:00:00.724
  Hot standby IP address is 10.2.1.254 configured
  Active router is local
  Standby router is 10.2.1.2 expires in 00:00:09
  Standby virtual mac address is 0000.0c07.ac02
  6 state changes, last state change 00:07:59
Switch_1> (enable) show cam 00-00-0c-07-ac-01
* = Static Entry + = Permanent Entry # = System Entry R = Router
Entry
VLAN  Dest MAC/Route Des      [CoS]  Destination Ports or VCs / [I
----  -
1      00-00-0c-07-ac-01  R           15/1 [ALL]
Total Matching CAM Entries Displayed = 1
Switch_1> (enable) show cam 00-00-0c-07-ac-02
* = Static Entry + = Permanent Entry # = System Entry R = Rout
Entry
VLAN  Dest MAC/Route Des      [CoS]  Destination Ports or VCs / [I
----  -
2      00-00-0c-07-ac-02  R           15/1 [ALL]
Total Matching CAM Entries Displayed = 1

```

Be sure to check the CAM aging time in order to determine how quickly the entries are aged. If the time equals the configured value for STP forward delay, which is 15 seconds by default, there is a strong possibility that there is an STP loop in the network. Here is sample command output:

```

Switch_1> (enable) show cam agingtime
VLAN 1 aging time = 300 sec
VLAN 2 aging time = 300 sec
VLAN 1003 aging time = 300 sec
VLAN 1005 aging time = 300 sec

Switch_2> (enable) show cam agingtime
VLAN 1 aging time = 300 sec
VLAN 2 aging time = 300 sec
VLAN 1003 aging time = 300 sec
VLAN 1005 aging time = 300 sec

```

C. Verify Physical Layer Connectivity

If more than one router in an HSRP group becomes active, those routers do not consistently receive the hello packets from fellow HSRP peers. Physical layer problems can prevent the consistent pass of traffic between peers and cause this scenario. Be sure to verify physical connectivity and IP connectivity between HSRP peers when you troubleshoot HSRP. Issue the [show standby](#) command in order to verify connectivity. Here is an example:

```
Router_1#show standby
```

```
Vlan10 - Group 10
  Local state is Active, priority 110, may preempt
  Hellotime 3 holdtime 10
  Hot standby IP address is 192.168.10.100 configured
  Active router is local
  Standby router is unknown expired
  Standby virtual mac address is 0000.0c07.ac0a
  12 state changes, last state change 00:00:48
```

```
Vlan11 - Group 11
  Local state is Active, priority 110, may preempt
  Hellotime 3 holdtime 10
  Hot standby IP address is 192.168.11.100 configured
  Active router is local
  Standby router is unknown expired
  Standby virtual mac address is 0000.0c07.ac0b
  6 state changes, last state change 00:00:48
```

```
Router_2#show standby
Vlan10 - Group 10
  Local state is Active, priority 109, may preempt
  Hellotime 3 holdtime 10
  Hot standby IP address is 192.168.10.100 configured
  Active router is local
  Standby router is unknown expired
  Standby virtual mac address is 0000.0c07.ac0a
  15 state changes, last state change 00:01:18
```

```
Vlan11 - Group 11
  Local state is Active, priority 109, may preempt
  Hellotime 3 holdtime 10
  Hot standby IP address is 192.168.11.100 configured
  Active router is local
  Standby router is unknown expired
  Standby virtual mac address is 0000.0c07.ac0b
  10 state changes, last state change 00:01:18
```

1. Check Interface Status

Check the interfaces. Verify that all HSRP-configured interfaces are up/up, as this example shows:

```
Router_1#show ip interface brief
Interface                IP-Address      OK? Method Status
Vlan1                    10.1.1.1        YES manual administrative up
Vlan2                    10.2.1.1        YES manual up

Router_2#show ip interface brief
Interface                IP-Address      OK? Method Status
Vlan1                    10.1.1.2        YES manual up
Vlan2                    10.2.1.2        YES manual down
```

If any interfaces are administratively down/down, enter the configuration mode on the

router and issue the [no shutdown](#) interface-specific command. Here is an example:

```
Router_1#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router_1(config)# interface vlan 1
Router_1(config-if)# no shutdown
Router_1(config-if)# ^Z

Router_1#show ip interface brief
Interface                IP-Address      OK? Method Status
Vlan1                    10.1.1.1        YES manual up
Vlan2                    10.2.1.1        YES manual up
```

If any interfaces are down/down or up/down, review the log for any interface change notifications. For Cisco IOS Software-based switches, these messages appear for link up/down situations:

```
%LINK-3-UPDOWN: Interface "interface", changed state to up
%LINK-3-UPDOWN: Interface "interface", changed state to down

Router_1#show log
3d04h: %STANDBY-6-STATECHANGE: Standby: 0: Vlan2 state Active->
3d04h: %LINK-5-CHANGED: Interface Vlan2, changed state to down
3d04h: %LINEPROTO-5-UPDOWN: Line protocol on Interface Vlan2, down
```

Inspect the ports, cables, and any transceivers or other devices that are between the HSRP peers. Has anyone removed or loosened any connections? Are there any interfaces that lose a link repeatedly? Are the proper cable types used? Check the interfaces for any errors, as this example shows:

```
Router_1#show interface vlan2
Vlan2 is down, line protocol is down
Hardware is Cat5k RP Virtual Ethernet, address is 0030.f2c9.56
Internet address is 10.2.1.1/24
MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
ARP type: ARPA, ARP Timeout 04:00:00
Last input 00:00:00, output never, output hang never
Last clearing of "show interface" counters never
Queueing strategy: fifo
Output queue 0/40, 0 drops; input queue 0/75, 0 drops
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  155314 packets input, 8259895 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
  8185 packets output, 647322 bytes, 0 underruns
    0 output errors, 3 interface resets
    0 output buffer failures, 0 output buffers swapped out
```

2. Link Change and Port Errors

Check the switch ports link changes and other errors. Issue these commands and review the output:

- [show logging buffer](#)
- [show port](#)
- [show mac](#)

These commands help you determine if there is a problem with connectivity between switches and other devices.

These messages are normal for link up/down situations:

```
PAGP-5-PORTTOSTP:Port [dec]/[dec] joined bridge port [dec]/[cha
PAGP-5-PORTFROMSTP: Port [dec]/[dec] left bridge port [dec]/[cha
```

```
Switch_1> (enable) show logging buffer
2001 Jan 08 20:37:24 %PAGP-5-PORTTOSTP:Port 2/1 joined bridge po
2001 Jan 08 20:37:25 %PAGP-5-PORTTOSTP:Port 2/2 joined bridge po
2001 Jan 08 20:37:25 %PAGP-5-PORTTOSTP:Port 2/3 joined bridge po
2001 Jan 08 20:37:25 %PAGP-5-PORTTOSTP:Port 2/11 joined bridge p
2001 Jan 08 20:46:39 %PAGP-5-PORTTOSTP:Port 2/12 joined bridge p
2001 Jan 08 20:46:29 %PAGP-5-PORTFROMSTP:Port 2/11 left bridge p
2001 Jan 08 20:46:29 %PAGP-5-PORTFROMSTP:Port 2/12 left bridge p
2001 Jan 08 20:47:05 %DTP-5-TRUNKPORTON:Port 2/11 has become isl
2001 Jan 08 20:52:15 %PAGP-5-PORTTOSTP:Port 2/11 joined bridge p
2001 Jan 08 22:18:24 %DTP-5-TRUNKPORTON:Port 2/12 has become isl
2001 Jan 08 22:18:34 %PAGP-5-PORTTOSTP:Port 2/12 joined bridge p
```

Issue the [show port](#) command in order to determine the general health of a port. Here is an example:

```
Switch_1> (enable) show port status 2/11
Port Name Status Vlan Level Duplex Spe
-----
2/11 connected trunk normal a-full a-10
```

Is the port status `connected`, `notconnect`, or `errdisable`? If the status is `notconnect`, check that the cable is plugged in on both sides. Check that the proper cable is used. If the status is `errdisable`, review the counters for excessive errors. Refer to [Recovering From errDisable Port State on the CatOS Platforms](#) for more information.

For what VLAN is this port configured? Be sure that the other side of the connection is configured for the same VLAN. If the link is configured to be a trunk, be sure that both sides of the trunk carry the same VLANs.

What is the speed and duplex configuration? If the setting is preceded by `a-`, the port is configured to autonegotiate the speed and duplex. Otherwise, the network

administrator has predetermined this configuration. For configuration of the speed and duplex for a link, the settings on both sides of the link must match. If one switch port is configured for autonegotiation, the other side of the link must also be configured for autonegotiation. If one side is hard coded to a specific speed and duplex, the other side must be hard coded as well. If you leave one side to autonegotiate while the other side is hard coded, you break the autonegotiation process.

```
Switch_1> (enable) show port counters 2/11
Port  Align-Err  FCS-Err      Xmit-Err      Rcv-Err      UnderSize
-----
 2/11  0           0           0           0           0

Port  Single-Col  Multi-Coll   Late-Coll     Excess-Col   Carri-Sen   Runt
-----
 2/11          0           0           0           0           0

Last-Time-Cleared
-----
Fri Jan 5 2001, 13:30:45
```

Are there a lot of Align-Err, FCS-Err, or Runts? These indicate a speed or duplex mismatch between the port and the connecting device. Change the speed and duplex settings for that port in order to help correct these errors.

Issue the [show mac](#) command in order to verify that the port is passing traffic. The Rcv- and Xmit- columns indicate the number of unicast, multicast, and broadcast packets that are received and transmitted on a particular port. The bottom counters reveal how many packets are discarded or lost and whether these packets are a part of inbound or outbound traffic. Lrn-Discrd, In-Lost, and Out-Lost count the number of packets that are mistakenly forwarded or dropped due to insufficient buffers.

```
Switch_1> (enable) show mac 2/11
Port      Rcv-Unicast      Rcv-Multicast      Rcv-Broadcast
-----
 2/11          9786              9939
Port      Xmit-Unicast      Xmit-Multicast      Xmit-Broadcas
-----
 2/11          587              55517

Port      Rcv-Octet      Xmit-Octet
-----
 2/11      2354136        7206386

MAC      Dely-Exced  MTU-Exced  In-Discard  Lrn-Discrd  In-Lost
-----
 2/11          0          -          13          0          0

Last-Time-Cleared
-----
Fri Jan 5 2001, 13:30:45
```


Note: Enablement of UDLD without enablement of UDLD aggressive mode only checks for incorrectly wired fiber cable. In this case, UDLD checks where the receive and transmit are crossed among multiple connections.

```
Switch_1> (enable) set udld enable
UDLD enabled globally
```

```
Console> (enable) set udld aggressive-mode enable 1/1-2
Aggressive UDLD enabled on ports 1/1-2.
Console> (enable) show udld
UDLD      : enabled
Message Interval : 15 seconds
```

```
Console> (enable) show udld port 1
UDLD : enabled
Message Interval : 15 seconds
Port Admin Status Aggressive Mode Link State
-----
1/1 enabled enabled undetermined
1/2 enabled enabled undetermined
```

In CatOS 5.4.3 and earlier, in which the switch does not support UDLD, or if the link in question has a router on one end, you can enable Cisco Discovery Protocol (CDP). Enablement of CDP is another way to detect if a unidirectional link exists. If only one side of a link can see its neighbor device, replace the cable between the devices and check for faulty interfaces. Refer to [Configuring CDP](#) for more information.

```
Switch_1> (enable) show cdp
CDP      : enabled
Message Interval : 60
Hold Time      : 180
Switch_1> (enable) show cdp neighbors
* - indicates vlan mismatch.
# - indicates duplex mismatch.
Port      Device-ID                               Port-ID
-----
2/5       066560091(Switch_2)                          2/9
2/6       066560091(Switch_2)                          2/10
15/1      Router_1                                       Vlan1
```

```
Switch_2> (enable) show cdp
CDP      : enabled
Message Interval : 60
Hold Time      : 180
Switch_2> (enable) show cdp neighbors
* - indicates vlan mismatch.
# - indicates duplex mismatch.
Port      Device-ID                               Port-ID
-----
2/9       066565061(Switch_1)                          2/5
2/10      066565061(Switch_1)                          2/6
15/1      Router_2                                       Vlan1
```

5. Additional Physical Layer Troubleshooting References

Refer to these documents:

- [Configuring and Troubleshooting Ethernet 10/100/1000Mb Half/Full Duplex Auto-Negotiation](#)
- [Recovering From errDisable Port State on the CatOS Platforms](#)
- [Troubleshooting Cisco Catalyst Switches to NIC Compatibility Issues](#)
- The [Understanding Data Link Errors](#) section of [Troubleshooting Cisco Catalyst Switches to NIC Compatibility Issues](#)
- [Troubleshooting Switch Port and Interface Problems](#)

D. Layer 3 HSRP Debugging

If the HSRP state changes are frequent, use the HSRP debug commands in enable mode on the router in order to watch HSRP activity. This information helps you determine what HSRP packets are received and sent by the router. Gather this information if you create a service request with [Cisco Technical Support](#). The debug output also shows HSRP state information, along with detailed HSRP hello packet accounts.

1. Standard HSRP Debugging

In Cisco IOS Software Release 12.1 and earlier, the HSRP debug command is simply [debug standby](#). This information is useful where problems are intermittent and affect only a few interfaces. The debug enables you to determine if the HSRP router in question receives and transmits HSRP hello packets at specific intervals. If the router does not receive hello packets, you can infer that either the peer does not transmit the hello packets or the network drops the packets.

Command	Purpose
debug standby	Enables HSRP debugging

Here is sample command output:

```
Router_1#debug standby
```

```
HSRP debugging is on
```

```
Router_1#
```

```
4d01h: SB1: Vlan1 Hello out 10.1.1.1 Active pri 100 ip 10.1.1.1
4d01h: SB1: Vlan1 Hello in 10.1.1.2 Standby pri 100 ip 10.1.1.1
4d01h: SB2: Vlan2 Hello in 10.2.1.2 Standby pri 100 ip 10.2.1.1
4d01h: SB2: Vlan2 Hello out 10.2.1.1 Active pri 100 ip 10.2.1.1
```

2. Conditional HSRP Debugging (Limiting Output Based on Standby Group and/or VLAN)

Cisco IOS Software Release 12.0(3) introduced a debug condition to allow the output from the [debug standby](#) command to be filtered based on interface and group number. The command utilizes the debug condition paradigm that was introduced in Cisco IOS Software Release 12.0.

Command	Purpose
debug condition standby interface_group	Enables HSRP conditional debugging of the group (0–255)

The interface must be a valid interface that can support HSRP. The group can be any group, from 0 through 255. A debug condition can be set for groups that do not exist. This allows debugs to be captured during the initialization of a new group. Debug standby must be enabled in order to produce any debug output. If no standby debug conditions exist, debug output is produced for all groups on all interfaces. If at least one standby debug condition exists, standby debug output is filtered based on all of the standby debug conditions. Here is sample command output:

```
Router_1#debug condition standby vlan 2 2
Condition 1 set
Router_1#
4d01h: V12 SB2 Debug: Condition 1, standby V12 SB2 triggered, c
Router_1#debug standby
HSRP debugging is on
Router_1#
4d01h: SB2: Vlan2 Hello in 10.2.1.2 Standby pri 100 ip 10.2.1.
4d01h: SB2: Vlan2 Hello out 10.2.1.1 Active pri 100 ip 10.2.1.
4d01h: SB2: Vlan2 Hello out 10.2.1.1 Active pri 100 ip 10.2.1.
4d01h: SB2: Vlan2 Hello in 10.2.1.2 Standby pri 100 ip 10.2.1.
```

3. Enhanced HSRP Debugging

Cisco IOS Software Release 12.1(1) added enhanced HSRP debugging. In order to help find useful information, enhanced HSRP debugging limits the noise from periodic hello messages and includes additional state information. This information is particularly useful when you work with a [Cisco Technical Support](#) engineer if you create a service request.

Command	Purpose
debug standby	Displays all HSRP errors, events, and

	packets
debug standby errors	Displays HSRP errors
debug standby events [[all] [hsrp redundancy track]] [detail]	Displays HSRP events
debug standby packets [[all terse] [advertise coup hello resign]] [detail]	Displays HSRP packets

Here is sample command output:

```
Router_2#debug standby terse
HSRP:
  HSRP Errors debugging is on
  HSRP Events debugging is on
  HSRP Packets debugging is on
  (Coup, Resign)
Router_2#
00:39:50: SB2: Vlan2 Standby: c/Active timer expired (10.2.1.1)
00:39:50: SB2: Vlan2 Standby -> Active
00:39:50: %STANDBY-6-STATECHANGE: Standby: 2: Vlan2 state Standby
00:40:30: SB2: Vlan2 Standby router is 10.2.1.1
00:41:12: SB2: Vlan2 Active: d/Standby timer expired (10.2.1.1)
00:42:09: SB2: Vlan2 Coup in 10.2.1.1 Listen pri 200 ip 10.2.1.1
00:42:09: SB2: Vlan2 Active: j/Coup rcvd from higher pri router
00:42:09: SB2: Vlan2 Active -> Speak
00:42:09: %STANDBY-6-STATECHANGE: Standby: 2: Vlan2 state Active
00:42:09: SB2: Vlan2 Active router is 10.2.1.1
00:42:19: SB2: Vlan2 Speak: d/Standby timer expired (unknown)
00:42:19: SB2: Vlan2 Speak -> Standby
00:42:19: %STANDBY-6-STATECHANGE: Standby: 2: Vlan2 state Speak
```

You can use interface and/or HSRP group conditional debugging in order to filter this debug output.

Command	Purpose
debug condition interface interface	Enables interface conditional debugging
debug condition standby interface group	Enables HSRP conditional debugging

In this example, the router joins a preexisting HSRP group:

```
SB1: Ethernet0/2 Init: a/HSRP enabled
SB1: Ethernet0/2 Active: b/HSRP disabled (interface down)
SB1: Ethernet0/2 Listen: c/Active timer expired (unknown)
```

```

SB1: Ethernet0/2 Active: d/Standby timer expired (10.0.0.3)
SB1: Ethernet0/2 Speak: f>Hello rcvd from higher pri Speak route
SB1: Ethernet0/2 Active: g>Hello rcvd from higher pri Active rou
SB1: Ethernet0/2 Speak: h>Hello rcvd from lower pri Active route
SB1: Ethernet0/2 Standby: i/Resign rcvd
SB1: Ethernet0/2 Active: j/Coup rcvd from higher pri router
SB1: Ethernet0/2 Standby: k>Hello rcvd from higher pri Standby r
SB1: Ethernet0/2 Standby: l>Hello rcvd from lower pri Standby rc
SB1: Ethernet0/2 Active: m/Standby mac address changed
SB1: Ethernet0/2 Active: n/Standby IP address configured

```

E. Spanning Tree Troubleshooting

STP loop conditions or instability in a network can prevent proper communication of HSRP peers. Because of this improper communication, each peer becomes an active router. STP loops can cause broadcast storms, duplicated frames, and MAC table inconsistency. All of these problems affect the entire network, and especially HSRP. HSRP error messages can be the first indication of an STP issue.

When you troubleshoot STP, you *must* understand the STP topology of the network on each VLAN. You must determine what switch is the root bridge and which ports on the switch are on blocking and forwarding. Because each VLAN has its own STP topology, this information is very important on each VLAN.

1. Verify Spanning Tree Configuration

Be sure that STP is configured on every switch and bridging device in the network. Take note of where each switch believes the root bridge is located. Also, note the values of these timers:

- Root Max Age
- Hello Time
- Forward Delay

Issue the [show spantree](#) command in order to see all of this information. By default, the command shows this information for VLAN 1. But, you can also see other VLAN information if you supply the VLAN number with the command. This information is very useful when you troubleshoot STP issues.

These three timers that you note in the [show spantree](#) output are learned from the root bridge. These timers do not need to match the timers that are set on that specific bridge. But, be sure that the timers match the root bridge in the case that this switch becomes the root bridge at any point. This match of the timers to the root bridge helps maintain continuity and ease of administration. The match also prevents a switch with incorrect timers from crippling the network.

Note: Enable STP for all VLANs at all times, regardless of whether there are

redundant links in the network. If you enable STP in nonredundant networks, you prevent a breakage. A breakage can occur if someone bridges switches together with hubs or other switches and accidentally creates a physical loop. STP is also very useful in the isolation of specific problems. If the enablement of STP affects the operation of something in the network, there can be an existing problem that you need to isolate.

Here is sample output of the [show spantree](#) command:

```
Switch_1> (enable) show spantree
VLAN 1
Spanning tree enabled
Spanning tree type          ieee

Designated Root             00-01-64-34-90-00
Designated Root Priority    98
Designated Root Cost       0
Designated Root Port       1/0
Root Max Age 20 sec        Hello Time 2 sec    Forward Delay 15

Bridge ID MAC ADDR          00-01-64-34-90-00
Bridge ID Priority          98
Bridge Max Age 20 sec       Hello Time 2 sec    Forward Delay 15

Port                        Vlan Port-State      Cost  Priority PortID
-----
1/1                        1    not-connected      4     32     disa
1/2                        1    not-connected      4     32     disa
2/1                        1    forwarding         100   32     disa
2/2                        1    not-connected      100   32     disa
2/3                        1    not-connected      100   32     disa
2/4                        1    not-connected      100   32     disa
2/5-6                      1    forwarding         12    32     disa
2/10                       1    not-connected      100   32     disa
2/11                       1    not-connected      100   32     disa
2/12                       1    not-connected      100   32     disa
15/1                       1    forwarding         5     32     disa
```

```
Switch_1> (enable) show spantree 2
VLAN 2
Spanning tree enabled
Spanning tree type          ieee

Designated Root             00-30-96-73-74-01
Designated Root Priority    8192
Designated Root Cost       12
Designated Root Port       2/5-6 (agPort 13/35)
Root Max Age 20 sec        Hello Time 2 sec    Forward Delay 15

Bridge ID MAC ADDR          00-01-64-34-90-01
Bridge ID Priority          16384
Bridge Max Age 20 sec       Hello Time 2 sec    Forward Delay 15
```

Port	Vlan	Port-State	Cost	Priority	Portf
2/5-6	2	forwarding	12	32	disa
2/7	2	not-connected	100	32	disa
2/8	2	not-connected	100	32	disa
2/9	2	not-connected	100	32	disa
15/1	2	forwarding	5	32	disa

Switch 1 is the root of VLAN 1 and believes that Switch 2 is the root of VLAN 2.
Switch 2 concurs.

```
Switch_2> (enable) show spantree
```

VLAN 1

Spanning tree enabled

Spanning tree type ieee

Designated Root 00-01-64-34-90-00

Designated Root Priority 98

Designated Root Cost 12

Designated Root Port 2/9-10 (agPort 13/37)

Root Max Age 20 sec Hello Time 2 sec Forward Delay 15 sec

Bridge ID MAC ADDR 00-30-96-73-74-00

Bridge ID Priority 16384

Bridge Max Age 20 sec Hello Time 2 sec Forward Delay 15 sec

Port	Vlan	Port-State	Cost	Priority	Portf
1/1	1	not-connected	4	32	disa
1/2	1	not-connected	4	32	disa
2/6	1	not-connected	100	32	disa
2/7	1	not-connected	100	32	disa
2/8	1	not-connected	100	32	disa
2/9-10	1	forwarding	12	32	disa
2/11	1	not-connected	100	32	disa
2/12	1	not-connected	100	32	disa
15/1	1	forwarding	5	32	disa

```
Switch_2> (enable) show spantree 2
```

VLAN 2

Spanning tree enabled

Spanning tree type ieee

Designated Root 00-30-96-73-74-01

Designated Root Priority 8192

Designated Root Cost 0

Designated Root Port 1/0

Root Max Age 20 sec Hello Time 2 sec Forward Delay 15 sec

Bridge ID MAC ADDR 00-30-96-73-74-01

Bridge ID Priority 8192

Bridge Max Age 20 sec Hello Time 2 sec Forward Delay 15 sec

Port	Vlan	Port-State	Cost	Priority	Portf
2/1	2	not-connected	100	32	disa
2/2	2	not-connected	100	32	disa
2/3	2	not-connected	100	32	disa
2/4	2	not-connected	100	32	disa
2/5	2	not-connected	100	32	disa
2/9-10	2	forwarding	12	32	disa
15/1	2	forwarding	5	32	disa

2. Spanning Tree Loop Conditions

In order for an STP loop to occur, there must be L2 physical redundancy in the network. An STP does not occur if there is no possibility of a physical loop condition. Symptoms of an STP loop condition are:

- Total network outage
- Loss of connectivity
- The report by network equipment of high process and system utilization

The [show system](#) command helps you determine the system utilization of a particular switch. The [show system](#) command denotes these items:

- Current traffic percentage
- Peak traffic percentage
- Date and time of the last peak

System utilization that is above 20 percent usually indicates a loop. Utilization above seven percent indicates a possible loop. But, these percentages are only approximations. The approximations vary somewhat with different hardware, such as Supervisor Engine I versus Supervisor Engine IIG or Catalyst 4000 versus Catalyst 6000.

Here is sample output of the [show system](#) command:

```
Switch_1> (enable) show system
PS1-Status PS2-Status Fan-Status Temp-Alarm Sys-Status Uptime d,
-----
ok         none         ok         off         ok         5,00:58:1
PS1-Type   PS2-Type   Modem   Baud   Traffic Peak Peak-Time
-----
WS-C5008B  none      disable 9600   0%     70% Tue Jan 9 2
System Name           System Location           System Contact
-----
Switch_1
```

This output shows these items:

- The current traffic percentage, 0%
- The peak traffic percentage, 70%
- The date and time of the last peak

The system utilization of 70 percent indicates a possible loop at the time that the [show system](#) command output shows.

A single VLAN that experiences an STP loop condition can congest a link and starve the other VLANs of bandwidth. The [show mac](#) command notes which ports transmit or receive an excessive number of packets. Excessive broadcast and multicast can indicate ports that are part of an STP loop. This example output of the [show mac](#) command shows a high number of multicast and broadcast packets on port 2/11. Investigate this port. As a general rule, suspect a link of an STP loop condition any time that multicast or broadcast exceeds the number of unicast packets.

Note: The switch also counts STP bridge protocol data units (BPDUs) that are received and transmitted as multicast frames. A port that is in the STP blocking state still transmits and receives STP BPDUs.

```
Switch_1> (enable) show mac
```

Port	Rcv-Unicast	Rcv-Multicast	Rcv-Broadcast
1/1	0	0	0
1/2	0	0	0
2/1	551277	296902	0
2/2	0	0	0
2/3	0	0	0
2/4	0	0	0
2/5	0	69541	0
2/6	0	44026	0
2/7	0	0	0
2/8	0	0	0
2/9	0	0	0
2/10	0	0	0
2/11	12836	5911986	0
2/12	6993144	177795414	1

Port	Xmit-Unicast	Xmit-Multicast	Xmit-Broadcast
1/1	0	0	0
1/2	0	0	0
2/1	326122	1151895	0
2/2	0	0	0
2/3	0	0	0
2/4	0	0	0
2/5	0	157414	0
2/6	10	652821	0

2/7	0	0
2/8	0	0
2/9	0	0
2/10	0	0
2/11	20969162	127255514
2/12	13598	7378244

Port	Rcv-Octet	Xmit-Octet
1/1	0	0
1/2	0	0
2/1	544904490	295721712
2/2	0	0
2/3	0	0
2/4	0	0
2/5	6997319	15860816
2/6	4787570	185054891
2/7	0	0
2/8	0	0
2/9	0	0
2/10	0	0
2/11	560753237	8058589649
2/12	6822964273	815810803

MAC	Dely-Exced	MTU-Exced	In-Discard	Lrn-Discrd	In-Lost
1/1	0	0	0	0	0
1/2	0	0	0	0	0
2/1	0	0	718920	0	0
2/2	0	0	0	0	0
2/3	0	0	0	0	0
2/4	0	0	0	0	0
2/5	0	-	3	0	1
2/6	0	-	0	0	0
2/7	0	0	0	0	0
2/8	0	0	0	0	0
2/9	0	0	0	0	0
2/10	0	0	0	0	0
2/11	0	0	67	0	0
2/12	0	0	869	0	3

Issue the [session](#) command in order to see the ATM and router counters.

```
Last-Time-Cleared
-----
Fri Jan 5 2001, 13:30:45
```

3. Toplogy Change Notification

Another command that is vital to the diagnosis of STP issues is the [show spantree statistics](#) command. This command tracks Topology Change Notification (TCN) messages back to the originator. These messages, sent as special BPDUs between

switches, indicate that there has been a topology change on a switch. That switch sends a TCN out its root port. The TCN moves upstream to the root bridge. The root bridge then sends another special BPDU, a Topology Change Acknowledgement (TCA), out all of its ports. The root bridge sets the TCN bit in the configuration BPDU. This causes all nonroot bridges to set their MAC address table aging timer to the configuration STP forward delay.

In order to isolate this problem, access the root bridge for each VLAN and issue the [show spantree statistics](#) command for the switch-connected ports. The `last topology change occurred` entry gives the time that the last TCN was received. In this situation, you are too late to see who issued the TCNs that can have caused the possible STP loop. The `topology change count` entry gives you an idea about the number of TCNs that occur. During an STP loop, this counter can increment every minute. Refer to [Spanning Tree Protocol Problems and Related Design Considerations](#) for more information. This document contains more information on how to interpret the [show spantree statistics](#) command. Other useful information includes:

- Port of the last TCN
- Time of last TCN
- Current count of TCNs

Here is sample command output:

```
Switch_1> (enable) show spantree statistics 2/5 1
Port 2/5 VLAN 1
SpanningTree enabled for vlanNo = 1
                BPDU-related parameters
port spanning tree          enabled
state                       forwarding
port_id                     0x8323
port number                  0x323
path cost                    12
message age (port/VLAN)     20(20)
designated_root               00-01-64-34-90-00
designated_cost                0
designated_bridge             00-01-64-34-90-00
designated_port                0x8323
top_change_ack                FALSE
config_pending                FALSE
port_inconsistency           none
                PORT based information & statistics
config bpdu's xmitted (port/VLAN) 29660(357027)
config bpdu's received (port/VLAN) 2(215721)
tcn bpdu's xmitted (port/VLAN)    0(521)
tcn bpdu's received (port/VLAN)   2(203)
forward trans count           1
scp failure count             0
                Status of Port Timers
```

```

forward delay timer                INACTIVE
forward delay timer value          15
message age timer                  INACTIVE
message age timer value            0
topology change timer              INACTIVE
topology change timer value        35
hold timer                          INACTIVE
hold timer value                    1
delay root port timer              INACTIVE
delay root port timer value        0
      VLAN based information & statistics
spanningtree type                   ieee
spanningtree multicast address      01-80-c2-00-00-00
bridge priority                     98
bridge mac address                  00-01-64-34-90-00
bridge hello time                   2 sec
bridge forward delay                15(15) sec
topology change initiator:      2/2
last topology change occurred:  Wed Jan 10 2001, 18:16:02
topology change                     FALSE
topology change time                 35
topology change detected             FALSE
topology change count           80
topology change last recvd. from 00-10-7b-08-fb-94
      Other port-specific info
dynamic max age transitions          0
port bpdu ok count                  0
msg age expiry count                0
link loading                         1
bpdu in processing                  FALSE
num of similar bpdus to process      1
received_inferior_bpdu              FALSE
next state                           3
src mac count:                       0
total src mac count                  0
curr_src_mac                        00-00-00-00-00-00
next_src_mac                         00-00-00-00-00-00
channel_src_mac                      00-10-7b-08-e1-74
channel src count                    0
channel ok count                     0

```

This output shows that the last topology change occurred from device 00-10-7b-08-fb-94 off port 2/2. Next, issue the same [show spantree statistics](#) command from the 00-10-7b-08-fb-94 device. Here is an excerpt of the [show spantree statistics](#) output from the adjoining device:

```

VLAN based information & statistics
spanningtree type                   ieee
spanningtree multicast address      01-80-c2-00-00-00
bridge priority                     98
bridge mac address                  00-10-7b-08-fb-94
bridge hello time                   2 sec
bridge forward delay                15(15) sec

```

```

topology change initiator:          5/2
last topology change occurred:     Wed Jan 10 2001, 18:16:02
topology change                    FALSE
topology change time                35
topology change detected            FALSE
topology change count               80
topology change last recvd. from    00-00-00-00-00-00

```

The output notes the MAC address with all zeroes, which means that this switch is the topology change initiator. Port 5/2 is the port that transitioned states, which is most likely because the port goes up and down. If this port is attached to a PC or a single host, be sure that STP PortFast is enabled on this port. STP PortFast suppresses STP TCNs when a port transitions states.

Refer to these documents for information about STP and how to troubleshoot link transitions that are associated with network interface cards (NICs):

- [Troubleshooting Cisco Catalyst Switches to NIC Compatibility Issues](#)
- [Using PortFast and Other Commands to Fix Workstation Startup Connectivity Delays](#)
- [Configuring and Troubleshooting Ethernet 10/100/1000Mb Half/Full Duplex Auto-Negotiation](#)
- [Understanding Spanning-Tree Protocol Topology Changes](#)
- [Spanning Tree Protocol Problems and Related Design Considerations](#)

4. Disconnected Blocked Ports

Because of the load-balancing nature of Fast EtherChannel (FEC) (port-channeling), FEC issues can contribute to both HSRP and STP problems. When you troubleshoot STP or HSRP, remove the configuration for any FEC connections. After the configuration changes are in place, issue the **show spantree blockedports** command on both switches. Ensure that at least one of the ports starts blocking on either side of the connection. Here is sample command output:

```

Switch_1> (enable) show spantree blockedports
T = trunk
g = group
Ports      Vlans
-----
  2/6 (T)   2
Number of blocked ports (segments) in the system : 1

Switch_2> (enable) show spantree blockedports
T = trunk
g = group
Ports      Vlans

```

```

-----
2/10 (T) 1
Number of blocked ports (segments) in the system : 1

```

Refer to these documents for information about Fast EtherChannel:

- [Understanding EtherChannel Load Balancing and Redundancy on Catalyst Switches](#)
- [Configure EtherChannel Between Catalyst 4500/4000, 5500/5000, and 6500/6000 Switches That Run CatOS System Software](#)

5. Broadcast Suppression

Enable broadcast suppression in order to help cut down the impact from a broadcast storm. A broadcast storm is one of the main side effects of an STP loop. Refer to [Configuring Broadcast Suppression](#) for more information. Here is sample command output:

```

Switch_1> (enable) set port broadcast 2/5 ?
                        Packets per second
                        Percentage
Switch_1> (enable) set port broadcast 2/5 10%
Port(s) 2/1-12 broadcast traffic limited to 10%.
Switch_1> (enable) show port broadcast 2/5
Port      Broadcast-Limit Broadcast-Drop
-----
2/5      10 %           -

```

6. Console and Telnet Access

Console or Telnet traffic to the switch often becomes too sluggish to properly track down an offending device during an STP loop. In order to force the network to recover instantly, remove all redundant physical links. After STP is allowed to reconverge on the new nonredundant topology, reattach one redundant link at a time. If the STP loop returns after you add one particular segment, you have identified the offending devices.

7. Spanning Tree Features: Portfast, UplinkFast, and BackboneFast

Verify that PortFast, UplinkFast, and BackboneFast are configured properly. When you troubleshoot STP issues, disable all advanced STP (UplinkFast and BackboneFast). In addition, verify that STP PortFast is only enabled on ports that are directly connected to nonbridging hosts. Nonbridging hosts include user workstations and routers without bridge groups. Do not enable PortFast on ports that are connected to hubs or other switches. Here is sample command output:

```

Switch_2> (enable) show port spantree
Port(s)          Vlan Port-State      Cost  Priority Portf
-----

```

1/1	1	not-connected	4	32	disabl
1/2	1	not-connected	4	32	disabl
2/1	2	not-connected	100	32	disabl
2/2	2	not-connected	100	32	disabl
2/3	2	not-connected	100	32	disabl
2/4	2	not-connected	100	32	disabl
2/5	2	not-connected	100	32	disabl
2/6	1	forwarding	19	32	disabl
2/7	1	not-connected	100	32	disabl
2/8	1	not-connected	100	32	disabl
2/9	1	blocking	19	32	disabl
2/9	2	forwarding	19	32	disabl
2/9	3	forwarding	19	32	disabl
2/9	1003	not-connected	19	32	disabl
2/9	1005	not-connected	19	4	disabl
2/10	1	blocking	19	32	disabl
2/10	2	forwarding	19	32	disabl
2/10	3	blocking	19	32	disabl
2/10	1003	not-connected	19	32	disabl
2/10	1005	not-connected	19	4	disabl
2/11	2	forwarding	100	32	enable
2/12	1	not-connected	100	32	disabl
15/1	1	forwarding	5	32	disabl
15/1	2	forwarding	5	32	disabl

Only enable UplinkFast on leaf-node switches. Leaf-node switches are closet switches to which users directly connect. UplinkFast is an STP optimization that is meant only for uplink ports to the distribution or core layer of the network. Here is sample command output:

```
Switch_1> (enable) set spantree uplinkfast enable
VLANs 1-1005 bridge priority set to 49152.
The port cost and portvlancost of all ports set to above 3000.
Station update rate set to 15 packets/100ms.
uplinkfast all-protocols field set to off.
uplinkfast enabled for bridge.
```

```
Switch_1> (enable) show spantree uplinkfast
Station update rate set to 15 packets/100ms.
uplinkfast all-protocols field set to off.
```

```
VLAN          port list
-----
1              2/2(fwd) ,2/5-6
2              2/5(fwd) ,2/6
```

Configure BackboneFast on all switches in the network. BackboneFast is an STP optimization that alters the Max Age timer at the receipt of an inferior BPDU that the designated bridge sends. Here is sample command output:

```
Switch_1> (enable) set spantree backbonefast enable
Backbonefast enabled for all VLANs
```

```
Switch_1> (enable) show spantree backbonefast
Backbonefast is enabled.
```

Refer to [Configuring Spanning Tree PortFast, UplinkFast, BackboneFast, and Loop Guard](#) for more information about these CatOS features.

8. BPDU Guard

When you enable PortFast BPDU guard, a nontrunking, PortFast-enabled port is moved into an errdisable state at the receipt of a BPDU on that port. This feature helps you find ports that are incorrectly configured for PortFast. The feature also detects where devices may reflect packets or interject STP BPDUs into the network. When you troubleshoot STP issues, enable this feature on all ports. Here is an example on CatOS:

```
Switch_1>(enable) set spantree portfast bpdu-guard enable
Spantree PortFast bpdu-guard enabled on this switch.
```

9. VTP Pruning

When VTP Pruning is enabled in the network, it can cause the devices of an HSRP group to go active. This results in IP conflicts among the gateways and cause traffic issues. Make sure the VLAN of any HSRP group is not pruned by VTP in the network.

F. CGMP Leave Processing and HSRP Interoperability

HSRP communicates to the destination MAC address of 01-00-5e-00-00-02, which is the same destination MAC address that IGMP fast-leave processing uses. IGMP fast-leave processing is an IGMP Version 2 feature. With CGMP leave processing enabled on Cisco switches, all multicast traffic with the destination MAC address of 01-00-5e-00-00-02 is forwarded to the switch CPU. If the packet is not an IGMP message, the switch CPU regenerates the packet and sends the packet to all router ports. Because HSRP uses the same destination multicast address, all HSRP packets must first be sent to the switch CPU, which then regenerates and sends the packets to all router ports. Therefore, when you troubleshoot HSRP problems, disable CGMP leave processing between HSRP peers.

Note: The use of IGMP snooping on the Catalyst 6500 and 5500 with NetFlow Feature Card (NFFC) II does not have this issue.

In order to determine if CGMP leave processing is enabled on CatOS switches, issue the [show cgmp leave](#) command. Here is an example:

```
Switch> (enable) show cgmp leave
CGMP: disabled
CGMP leave: disabled
For Catalyst 2900XL/3500XL switches, issue the show cgmp state c
```

```
s-2924xl-27a#show cgmp state
CGMP is running.
CGMP Fast Leave is not running.
Default router timeout is 300 sec.
```

G. Divide and Conquer

If all other attempts to isolate or resolve HSRP fail, the "divide and conquer" method is the next approach. This method helps isolate the network and components that make up the network. Divide and conquer involves any one of the guidelines in this list:

Note: This list repeats some guidelines from other sections of this document.

- Create a test VLAN for HSRP and isolated VLAN to switch with HSRP routers.
- Disconnect all redundant ports.
- Break FEC ports into single connected ports.
- Reduce HSRP group members to only two members.
- Prune trunk ports such that only necessary VLANs propagate across those ports.
- Disconnect connected switches in the network until the problems cease.

Known Issues

Number of HSRP Groups Supported for Catalyst 6500/6000 Series PFC2/MSFC2 and Catalyst 3550

The Policy Feature Card 2 (PFC2)/MSFC2 for the Catalyst 6500/6000 series supports a maximum of 16 unique HSRP groups. If you need more than 16 HSRP groups, you can reuse the same HSRP group numbers in different VLANs. For more information on HSRP group limitations for the Catalyst 6500/6000 series, refer to [HSRP Group Limitation on Catalyst 6500/6000 Series Switches Frequently Asked Questions](#).

A similar limitation exists for the Catalyst 3550 series, which supports a maximum of 16 HSRP groups. This is a hardware limitation and there is no workaround.

HSRP State Flapping/Unstable When You Use Cisco 2620/2621, Cisco 3600 with Fast Ethernet, or PA-2FEISL

This problem can occur with Fast Ethernet interfaces at the disruption of network connectivity or at the addition of an HSRP router with higher priority to a network. When the HSRP state changes from active to speaking, the router resets the interface in order to remove the HSRP MAC address from the interfaces MAC address filter. Only specific hardware that is used on the Fast Ethernet interfaces for Cisco 2600s,

3600s, and 7500s have this issue. The router interface reset causes a link state change on Fast Ethernet interfaces, and the switch detects the change. If the switch runs STP, the change causes an STP transition. The STP takes 30 seconds to transition the port into the forwarding state. This time is twice the default forward delay time of 15 seconds. At the same time, the speaking router transitions to the standby state after 10 seconds, which is the HSRP hold time. STP is not forwarding yet, so no HSRP hello messages are received from the active router. This causes the standby router to become active after about 10 seconds. Both routers are now active. When the STP ports become forwarding, the lower-priority router changes from active to speaking, and the whole process repeats.

Platform	Description	Cisco Bug ID	Fix	Workaround
Cisco 2620/2621	Fast Ethernet interface starts to flap when HSRP is configured and the cable is unplugged.	CSCdp57792 ☞ (registered customers only)	A software upgrade; refer to the bug for revision details.	Enables spanning tree PortFast on the connected switch port.
Cisco 2620/2621	HSRP state is flapping on 2600 with Fast Ethernet.	CSCdr02376 ☞ (registered customers only)	Cisco IOS Software Release 12.1.3	Enables spanning tree PortFast on the connected switch port.
Cisco 3600 with NM-1FE-TX ¹	HSRP state is flapping on 2600 and 3600 Fast Ethernet.	CSCdr02376 ☞ (registered customers only)	Cisco IOS Software Release 12.1.3	Enables spanning tree PortFast on the connected switch port.
Cisco 4500 with Fast Ethernet interface	HSRP state is flapping on 4500 Fast Ethernet.	CSCds16055 ☞ (registered customers only)	Cisco IOS Software Release 12.1.5	Enables spanning tree PortFast on the connected switch port.
Cisco 7200/7500 with PA-2FEISL ²	HSRP state is flapping on PA-2FEISL.	CSCdm89593 ☞ (registered customers only)	Cisco IOS Software Release 12.1.5	Enables spanning tree PortFast on the connected switch port.

¹NM-1FE-TX = one-port Fast Ethernet (10/100BASE-TX interface) network module.

¹ PA-2FEISL = two-port Fast Ethernet InterSwitch Link [ISL] port adapter.

An alternative workaround is to adjust the HSRP timers so that the STP forward delay is less than half of the default HSRP hold time. The default STP forward delay is 15 seconds, and the default HSRP hold time is 10 seconds.

HSRP Stuck in Initial or Active State on Cisco 2620/2621, Cisco 3600 with Fast Ethernet, or PA-2FEISL

Fast Ethernet interfaces on the Cisco 2600, 3600, and 7200 routers can experience these issues when HSRP is configured:

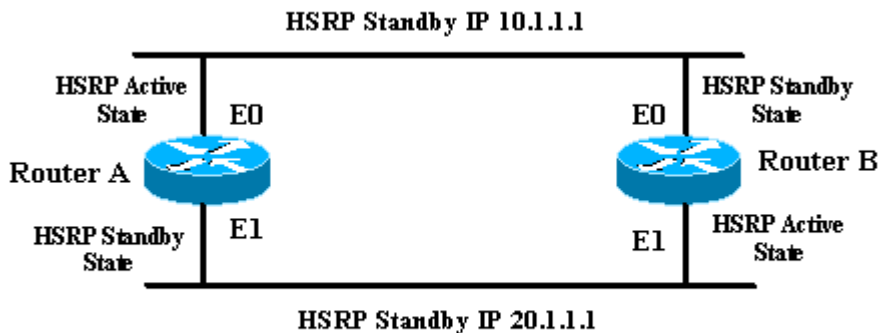
- HSRP remains in `active` state when the interface goes down or is unplugged.
- HSRP remains in `initial` state when the interface goes up.
- Interface tracking does not work.

A timing-sense problem of interface `up/down` causes these HSRP issues. The timing problem is that there is a delay between the occurrence of the interface event and the update of the interface state of the router.

Platform	Description	Cisco Bug ID	Fix	Workaround
Cisco 2620/2621	HSRP gets stuck in <code>initial</code> state.	CSCdp24680 ☞ (registered customers only)	A software upgrade; refer to the bug for revision details.	Issue the shutdown and no shutdown commands in order to reset the interface.
Cisco 3600 with NM-1FE-TX	HSRP gets stuck in <code>initial</code> state on the NM-1FE-TX module in 3600.	CSCdp24680 ☞ (registered customers only)	A software upgrade; refer to the bug for revision details.	Issue the shutdown and no shutdown commands in order to reset the interface.
Cisco 7200/7500 with PA-	HSRP gets stuck in <code>initial</code> state on the	CSCdr01156 ☞ (registered customers	A software upgrade; refer to the bug	Issue the shutdown and no shutdown

2FEISL	PA-2FEISL module in 7200/7500.	only)	for revision details.	commands in order to reset the interface.
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Unable to Ping HSRP Standby Address on Cisco 2500 and 4500 Series Routers



In this diagram, Router A represents a Cisco 2500 series router, and Router B represents a Cisco 4500 series router. If Router A pings the virtual IP address on LAN 1, 10.1.1.1, the router first sends out an ARP request. Router B responds with an ARP reply that contains the virtual MAC address. Router B ignores this ARP reply because the virtual MAC address is the same as the Router B E1 interface address.

There is a known restriction with the 10 MB Ethernet controller on the Cisco 2500 and 4500 series routers. The Ethernet controller only supports a single MAC address in its address filter. As a result, only one HSRP group can be configured in an interface. The HSRP MAC address is also used as the interface MAC address. This causes problems when the same HSRP group is configured on different Ethernets on the same router. The [show standby](#) command shows use of the MAC address as the HSRP MAC address.

There are two workarounds to this issue:

- Configure different HSRP groups on different interfaces.
- Issue the [standby use-bia](#) command on one or both interfaces.

MLS Flows Are Not Created for Devices That Use HSRP Standby IP Address as Default Gateway

MLS switching can fail when HSRP is enabled and you use Cisco IOS Software Release 12.1(4)E on one of these:

- Supervisor Engine 1/MSFC1
- Supervisor Engine 2/MSFC2
- Supervisor Engine 1/MSFC2

The symptoms are different for each combination, as this list shows:

- For Supervisor Engine 1/MSFC1 and Supervisor Engine 1/MSFC2 (which use Netflow-MLS)—The MLS shortcuts can fail to be created when traffic is sent to an HSRP MAC address. Any client that uses the HSRP standby IP address as the default gateway uses the HSRP MAC address.
- For Supervisor Engine 2/MSFC2 (which uses Cisco Express Forwarding-MLS)—The Cisco Express Forwarding adjacency table can fail to be populated correctly on the switch.

Refer to Cisco bug ID [CSCds89040](#) [↗](#) ([registered](#) customers only) . The fix is available with Cisco IOS Software Release 12.1(5a)E for the CatOS (c6msfc) images, and with Cisco IOS Software Release 12.1(5a)E1 for the Cisco IOS Software (c6sup) images.

Catalyst 2948G, 2980G, 4912G, 4003, and 4006 HSRP-CGMP Interoperability Issues

The Catalyst 4000 product line (2948G, 2980G, 4912G, 4003, and 4006) software has several issues that relate to HSRP and CGMP interoperability. All the issues are resolved in software versions 6.3.6 and 7.2.1.

Enablement of CGMP can cause problems with HSRP. This problem is resolved in software release 6.3(6). A router in HSRP `standby` status is changed to `active` status. When the status is restored, the router does not go back to `standby` status from `active` status. This problem is resolved in software release 6.3(6).

If you run HSRP and have enabled CGMP `leave`, `mcastRx` use can show at 25 percent CPU usage. This problem occurs because CGMP `leave` and HSRP hello packets share the same destination MAC address. The problem is resolved in software release 6.3(6).

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Related Information

- [Hot Standby Router Protocol \(HSRP\) Support Page](#)
- [LAN Product Support](#)
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