



Router-Shelf Redundancy for the Cisco AS5800

Feature History

Release	Modification
12.1(5) XV1	This feature was introduced.
12.2(11)T	This feature was integrated into Cisco IOS Release 12.2(11)T and support was added for the the Cisco AS5800 platform.

This document describes router-shelf redundancy for the Cisco AS5800 universal access server. It includes the following sections:

- [Feature Overview, page 1](#)
- [Supported Platforms, page 4](#)
- [Supported Standards, MIBs, and RFCs, page 5](#)
- [Prerequisites, page 5](#)
- [Configuration Tasks, page 5](#)
- [Command Reference, page 8](#)
- [Glossary, page 15](#)

Feature Overview

This feature provides router-shelf redundancy by using a second router shelf that automatically takes over the other shelf's dial-shelf cards (DSCs) if it appears that the other router shelf has died. Failover is disruptive in that there is no attempt to maintain calls that were established on the failing router shelf; the DSCs controlled by the failing router shelf are restarted under control of the backup router shelf and hence become available again.

Two router shelves are connected to the same DSC (as in split mode), but with only one router shelf active at a time. Both router shelves are configured for normal mode as opposed to split mode. Each router shelf contains the same configuration, being whatever configuration is appropriate for the full set of DSCs. The active router shelf controls all the DSCs, while the other router shelf functions purely as a backup. If the active router shelf fails, all DSCs restart under the control of the backup router shelf, which then functions as the active router shelf.

Only one router shelf has control of the DSCs at a time; the other keeps trying to take control but is unable to, and does not interfere with operation of the active router shelf. If, however, the active router shelf crashes, then it relinquishes control of all DSCs to the other router shelf, which restarts the DSCs and commences normal operation. If the crashed router shelf recovers or is restarted, it does not take back control of the DSCs, but instead functions as a backup, and takes control again only if the other router shelf fails.

External interfaces cannot share the same IP address between the two routers shelves, to prevent duplicate IP address errors.


Note

Triggers for a failover to occur are those that lead to a hub switchover. The main trigger is loss of the link between the active router shelf (the one with control of the cards) and its DSC *as detected by link monitoring on the DSC*. Any router-shelf failures that do not result in this link going down do not cause failover—for example, the active router's egress interface going down does not trigger failover. Conversely, any temporary loss of the link between the active router and a DSC *does* cause failover, even if the router shelf itself does not crash and connectivity is quickly reestablished—for example, if the BIC cable is knocked out and then quickly replaced. In addition, failover is triggered if a DSC connected to the active router shelf goes down and fails to recover within 90 seconds.

Additional Considerations

System Controller

When a system controller is used with a redundant router shelf, router-shelf failover should look like a single router shelf going down briefly and then recovering. With the current system-controller code, this does not work. The Cisco SC3640 expects only a single router shelf to be configured with any given shelf ID. To get around this, a router in backup mode must be prevented from sending Session Definition Protocol (SDP) packets to the Cisco SC3640. In addition, the SDP packets sent by the router shelves to the Cisco SC3640 currently include a field identifying the MAC address of the sending router. The Cisco SC3640 stores this MAC address and, if it subsequently receives another SDP packet containing the same shelf ID but not the same MAC address, it concludes that multiple routers are configured with the same shelf ID and treats this as an error. This is precisely the situation after a failover, when the backup router shelf starts sending SDP packets with the same shelf ID but different MAC address.

To get around this, you must configure a failover group code—an integer that identifies a redundant pair of router shelves. Each member of the pair must be configured with the same group code. When failover mode is enabled, this group code is sent in place of the router MAC address. These changes are all made to the system-controller code that runs on the router shelf itself, rather than on the Cisco SC3640.

Load Sharing

There is no load sharing between the two routers shelves—no calls can go through the backup router shelf. One disadvantage of this is that you cannot split the load between the routers to reduce the number of calls that are lost when a router crashes. There are, however, also some advantages: with load sharing, you must ensure that each router can support the entire dial shelf, since upon failure of a router shelf the surviving router shelf owns all the dial-shelf resources, and therefore has a sudden change in the amount of traffic it is supporting. If care had not been taken to test under failover conditions, at full load the surviving router shelf might be overwhelmed, and perhaps provide degraded service. With a redundant

router shelf instead acting purely as a standby, provided that the backup router shelf is the same model as the active router shelf, the load is unchanged after switchover—so no change is expected to the router-shelf performance.

Having a single router shelf active at a time is simpler, and makes it easier to support failover when dealing with external servers such as signaling controllers for SS7, RPMS server, and system controllers.

Hitless Redundancy

When router-shelf failover occurs, all calls associated with the failed router shelf are lost. To maintain calls through router-shelf failure requires mirroring call state and fast failure detection. This shelf-redundancy feature ensures only that resources (particularly trunk lines) do not remain unusable while the router shelf that was controlling them is down.

Network Management

Minimal Simple Network Management Protocol (SNMP) support is provided—a trap is issued when failover occurs, and SNMP variables indicate whether a router shelf is active or on standby. An existing MIB—CISCO-C8500-REDUNDANCY-MIB—defines a suitable trap for issuing on failover.

Benefits

When an active router shelf in a Cisco AS5800 loses communication with its DSC, a backup router shelf can be invoked to automatically take over DSCs controlled by the lost router shelf. This backup method, called redundancy, is provided on the Cisco AS5800 to prevent a single point of failure, subsequent downtime, and user intervention to resolve unrecoverable hardware faults.

Restrictions

Router Shelves

Two router shelves of the same model and configuration must be available for this feature to operate.

External Servers

Although some of the failover functionality exists in the existing code base, ensure that the various external servers that can run with the Cisco AS5800 still function when redundant router shelves are used. The servers of concern at the moment are RPMS, SS7, and System Controller; the first two are discussed below:

- Resource pool management server (RPMS). For Resource Pool Management (RPM) to work, the resource pool manager server (RPMS) must be configured with the same information for both router shelves.
- Signaling System 7 (SS7). In an SS7 setup, the call signaling comes through an external Cisco SC2200 unit rather than directly from the switch over the trunk line (as for CAS and ISDN). For call signaling to work after failover, both router shelves must be connected to the Cisco SC2200 using the SS7 Redundant Link Manager (RLM) feature, which was intended to provide redundant links between a single router shelf and the signaling controller. RLM links must be configured from both the active and standby router shelves—the change of router shelves will look like a change from one redundant link to another.

Related Features and Technologies

RSC Handover Redundancy

The Router Shelf Controller Handover Redundancy feature that is available on the Cisco AS5850 is similar to Router Shelf Redundancy on the Cisco AS5800.

Related Documents

- *AS5800 Operations, Administration, Maintenance, and Provisioning (OAM&P) Guide*
http://www.cisco.com/univercd/cc/td/doc/product/access/acs_serv/as5800/sw_conf/58_oamp/index.htm
- *Cisco IOS Dial Technologies Configuration Guide*
http://www.cisco.com/univercd/cc/cc/td/doc/product/software/ios122/122cgcr/fdial_c/index.htm
- *Cisco IOS Dial Technologies Command Reference*
http://www.cisco.com/univercd/cc/cc/td/doc/product/software/ios122/122cgcr/fdial_r/index.htm
- *Cisco SS7 Interconnect for Access Servers Solution*
<http://www.cisco.com/univercd/cc/td/doc/product/access/sc/rel7/soln/das22/index.htm>
- *Cisco SS7 Dial Access Solution System Integration*
<http://www.cisco.com/univercd/cc/td/doc/product/access/sc/r1/>
- *Cisco SC2200 Signaling Controller documentation*
<http://www.cisco.com/univercd/cc/td/doc/product/access/sc/r2/>

Supported Platforms

- Cisco AS5800

Table 1 Cisco IOS Release and Platform Support for this Feature

Platform	12.1(5)XV1	12.2(11)T
Cisco AS5800	X	X

Determining Platform Support Through Cisco Feature Navigator

Cisco IOS software is packaged in feature sets that support specific platforms. To get updated information regarding platform support for this feature, access Cisco Feature Navigator. Cisco Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Cisco Feature Navigator is a web-based tool that enables you to quickly determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or release. Under the release section, you can compare releases side by side to display both the features unique to each software release and the features in common.

To access Cisco Feature Navigator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to cco-locksmith@cisco.com. An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions at <http://www.cisco.com/register>.

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

<http://www.cisco.com/go/fn>

Availability of Cisco IOS Software Images

Platform support for particular Cisco IOS software releases is dependent on the availability of the software images for those platforms. Software images for some platforms may be deferred, delayed, or changed without prior notice. For updated information about platform support and availability of software images for each Cisco IOS software release, refer to the online release notes or, if supported, Cisco Feature Navigator.

Supported Standards, MIBs, and RFCs

Standards

No new or modified standards are supported by this feature.

MIBs

- CISCO-C8500-REDUNDANCY-MIB

To obtain lists of supported MIBs by platform and Cisco IOS release, and to download MIB modules, go to the Cisco MIB website on Cisco.com at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

RFCs

No new or modified RFCs are supported by this feature.

Prerequisites

Before configuring the router for shelf redundancy, do the following:

- Ensure that your network is up and running.
- Test each router shelf to verify connectivity.

Configuration Tasks

See the following sections for configuration tasks for the Router-Shelf Redundancy feature. Each task in the list is identified as either required or optional:

- [Configuring the Cisco AS5800 for Shelf Redundancy](#) (required)
- [Configuring the Shelf Redundancy Feature](#) (required)

- [Verifying Shelf Redundancy](#) (required)

Configuring the Cisco AS5800 for Shelf Redundancy

	Command	Purpose
Step 1	Router(config)# redundancy	Enters configuration-redundancy mode.
Step 2	Router(config-red)# failover group-number group-code	Configures router-shelf failover. Note Use the same <i>group-code</i> argument for both routers. This code is used when the system controller is used and it identifies the two routers as effectively representing the same set of dial-shelf resources.

Connect to each router shelf in turn and enter these commands. Treat router shelves as if they are connected as a split dial-shelf configuration.



Note

This configuration by itself is not enough for successful failover to occur. Because there is no automatic synchronization of configuration between router shelves, you must configure each router shelf separately. Typically the two router shelves, active and backup, must have the same configuration except for the IP address on egress interfaces.



Note

Since configuration is error prone, test the backup router shelf's configuration to ensure that errors are not discovered only when the active router shelf fails in a production environment.

Configuring the Shelf Redundancy Feature

	Command	Purpose
Step 1	Router(config)# redundancy	Enters configuration-redundancy mode.
Step 2	Router(config-red)# failover group-number group-number	Sets the router shelf to failover mode. You must enter this command on both router shelves.

Verifying Shelf Redundancy

Use the **show redundancy** command to verify whether the “Shelf is redundant” string is displayed on a redundancy-enabled access server, as illustrated below:

```
Router# show redundancy
T1 1/0 is up.
  Applique type is Channelized T1
  Cablelength is long gain36 0db
  No alarms detected.
  alarm-trigger is not set
  Version info of slot 3: HW: 256, PLD Rev: 1
```

```

Framer Version: 0x8

Manufacture Cookie Info:
EEPROM Type 0x0001, EEPROM Version 0x01, Board ID 0x02,
Board Hardware Version 1.0, Item Number 32-0-00,
Board Revision 00, Serial Number 12059498,
PLD/ISP Version <unset>, Manufacture Date 19-Jun-1999.

Framing is ESF, Line Code is AMI, Clock Source is Line.
Trunk setting is rbs-zero.
Data in current interval (619 seconds elapsed):
  380 Line Code Violations, 171 Path Code Violations
  0 Slip Secs, 0 Fr Loss Secs, 137 Line Err Secs, 10 Degraded Mins
  137 Errored Secs, 21 Bursty Err Secs, 0 Severely Err Secs, 0 Unavail Secs
Total Data (last 24 hours)
  203903 Line Code Violations, 27284 Path Code Violations,
  7 Slip Secs, 531 Fr Loss Secs, 18414 Line Err Secs, 1431 Degraded Mins

```

The following example shows output from two router shelves configured as a failover pair. The active router shelf is initially RouterA. The commands **show redundancy history** and **show redundancy** have been issued. The **show redundancy** command shows that failover is enabled and shows the configured group number. The **show redundancy** command also shows that this router shelf is the active one of the pair. Compare this output with that from the backup router shelf (RouterB) further below.

**Note**

When RouterA is reloaded, thereby forcing a failover, new entries are shown on RouterB when a **show redundancy history** command is issued after failover has occurred.

Log from the First Router Shelf (RouterA):

```

RouterA#
RouterA# show redundancy history
DSC Redundancy Status Change History:

010215 18:17 Slot -1 DSC:Failover configured -> ACTIVE role by default.
010215 18:18 Slot -1 DSC:Failover -> BACKUP role.
010215 18:18 Slot 12 DSC:Failover -> ACTIVE role.
010215 18:18 Slot 12 DSC:Hub, becoming active - arb timeout

RouterA#
RouterA# show redundancy
failover mode enabled, failover group = 32

Currently ACTIVE role.

DSC in slot 12:

Hub is in 'active' state.
Clock is in 'active' state.

No connection to slot 13

RouterA#
RouterA# reload
Proceed with reload? [confirm]

*Feb 15 20:19:11.059:%SYS-5-RELOAD:Reload requested
System Bootstrap, Version 11.1(13)CA, EARLY DEPLOYMENT RELEASE SOFTWARE (fc1)
Copyright (c) 1997 by cisco Systems, Inc.
C7200 processor with 131072 Kbytes of main memory

rommon 1 >

```

Log from the Second Router Shelf (RouterB):

```

RouterB#
RouterB# show redundancy
failover mode enabled, failover group = 32

Currently BACKUP role.

No connection to slot 12

DSC in slot 13:

Hub is in 'backup' state.
Clock is in 'backup' state.

RouterB#
*Feb 16 03:24:53.931:%DSC_REDUNDANCY-3-BICLINK:Switching to DSC 13
*Feb 16 03:24:53.931:%DSC_REDUNDANCY-3-BICLINK:Failover:changing to active mode
*Feb 16 03:24:54.931:%DIAL13-3-MSG:
02:32:06:%DSC_REDUNDANCY-3-EVENT:Redundancy event:LINK_FAIL from other DSC
*Feb 16 03:24:55.491:%OIR-6-INSCARD:Card inserted in slot 12, interfaces administratively
shut down
*Feb 16 03:24:58.455:%DIAL13-3-MSG:
02:32:09:%DSC_REDUNDANCY-3-EVENT:Redundancy event:LINK_FAIL from other DSC
*Feb 16 03:25:04.939:%DIAL13-0-MSG:

RouterB# show redundancy
failover mode enabled, failover group = 32

Currently ACTIVE role.

No connection to slot 12

DSC in slot 13:

Hub is in 'active' state.
Clock is in 'backup' state.

RouterB# show redundancy history
DSC Redundancy Status Change History:

010216 03:09 Slot -1 DSC:Failover configured -> BACKUP role.
010216 03:24 Slot 13 DSC:Failover -> ACTIVE role.
010216 03:24 Slot 13 DSC:Hub, becoming active - D12 linkfail
010216 03:24 Slot 13 DSC:Hub, becoming active - D12 linkfail
RouterB#
*Feb 16 03:26:14.079:%DSIPPF-5-DS_HELLO:DSIP Hello from shelf 47 slot 1 Succeeded
*Feb 16 03:26:14.255:%DSIPPF-5-DS_HELLO:DSIP Hello from shelf 47 slot 3 Succeeded
*Feb 16 03:26:14.979:%DSIPPF-5-DS_HELLO:DSIP Hello from shelf 47 slot 10 Succeeded

```

Command Reference

This section documents new or modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.2 command reference publications.

- [redundancy](#)
- [failover group-number](#)
- [show redundancy](#)

redundancy

To configure shelf redundancy for Cisco AS5800 universal access servers, use the **redundancy** command in global configuration mode. To disable, use the **no** form of this command.

redundancy

no redundancy

Syntax Description There is no syntax for this command.

Defaults Redundancy is disabled.

Command Modes Global configuration mode

Command History	Release	Modification
	12.2(2)T	This command was introduced.
	12.2(11)T	This command was integrated into Cisco IOS Release 12.2(11)T.

Usage Guidelines Use the **redundancy** global configuration command to enter redundancy-configuration mode.

Examples The following example assigns the configured router shelf to the redundancy pair designated as 25. This command must be issued on both router shelves in the redundant router-shelf pair:

```
Router(config)# redundancy
Router(config-red)# failover group-number 25
```

Related Commands	Command	Description
	failover group-number	Assigns a router-shelf pair to a redundancy router-shelf pair code.
	show redundancy	Displays current or historical status and related information and shows the router-shelf redundancy status.

failover group-number

To configure shelf redundancy for Cisco AS5800 universal access servers, use the **failover group-number** command in redundancy-configuration mode. To disable, use the **no** form of this command.

failover group-number *group-code*

no failover group-number *group-code*

Syntax Description	<i>group-code</i>	Enter the failover group code—an integer that identifies a redundant pair of router shelves. Each member of the pair must be configured with the same group code. When failover mode is enabled, this group code is sent in place of the router MAC address.
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Defaults	Redundancy is not enabled.
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Command Modes	Redundancy configuration
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Command History	Release	Modification
	12.1(5)XV1	This command was introduced.
12.2(11)T	This command was integrated into Cisco IOS Release 12.2(11)T.	

Usage Guidelines	<p>This command must be configured on both router shelves. The parameter <i>group-code</i> is used by the system controller and must be the same for both router shelves forming the redundant pair.</p> <p>For successful failover to occur, both router-shelf configurations must be synchronized. Configure each router shelf separately, as active and backup respectively, with the same configuration except for the IP address on egress interfaces.</p>
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Note Test the backup router shelf's configuration before deployment in a production environment.

Examples	<p>The following example assigns the configured router shelf to the redundancy pair designated as 25. This command must be issued on both router shelves in the redundant router-shelf pair:</p>
-----------------	--

```
Router(config)# redundancy
Router(config-red)# failover group-number 25
```

Related Commands	Command	Purpose
	redundancy	Enters redundancy mode for further configuration.
	show redundancy	Displays current or historical status and related information and shows shelf-redundancy status.

show redundancy

To display current or historical status and related information on the redundant router shelf and to show shelf-redundancy status for Cisco AS5800 universal access servers, use the **show redundancy** command in privileged EXEC mode.

show redundancy [history]

Syntax Description

history	(Optional) Displays a log of past status and related information on the redundant router shelf.
----------------	---

Defaults

This command is issued on a per-use basis.

Command Modes

Privileged EXEC

Command History

Release	Modification
11.3(6)AA	This command was introduced.
12.2(2)T	This command was modified to display Cisco AS5800 information.
12.2(11)T	This command was integrated into Cisco IOS Release 12.2(11)T.

Usage Guidelines

Use this command from the router-shelf console to determine when failover is enabled. Use with the **history** keyword to log failover events. The command is issued on a once-each-time basis and therefore does not have to be turned off.

Examples

The following is sample output from the **show redundancy** command:

```
Router# show redundancy

DSC in slot 12:

Hub is in 'active' state.
Clock is in 'active' state.

DSC in slot 13:

Hub is in 'backup' state.
Clock is in 'backup' state.

Router#
```

The following is sample output from the **show redundancy history** command:

```
Router# show redundancy history
DSC Redundancy Status Change History:

981130 18:56 Slot 12 DSC: Hub, becoming active - RS instruction
981130 19:03 Slot 12 DSC: Hub, becoming active - D13 order
```

The following is sample output from two router shelves configured as a failover pair. The active router shelf is initially RouterA. The commands **show redundancy history** and **show redundancy** have been issued. The **show redundancy** command shows that failover is enabled, shows the configured group number, and shows that this router shelf is the active one of the pair. Compare this output with that from the backup router shelf (RouterB) further below.



Note

When RouterA is reloaded, thereby forcing a failover, new entries are shown on RouterB when a **show redundancy history** command is issued after failover has occurred.

Log from the First Router (RouterA):

```
RouterA#
RouterA# show redundancy history
DSC Redundancy Status Change History:

010215 18:17 Slot -1 DSC:Failover configured -> ACTIVE role by default.
010215 18:18 Slot -1 DSC:Failover -> BACKUP role.
010215 18:18 Slot 12 DSC:Failover -> ACTIVE role.
010215 18:18 Slot 12 DSC:Hub, becoming active - arb timeout

RouterA#
RouterA# show redundancy
failover mode enabled, failover group = 32

Currently ACTIVE role.

DSC in slot 12:

Hub is in 'active' state.
Clock is in 'active' state.

No connection to slot 13

RouterA#
RouterA# reload
Proceed with reload? [confirm]

*Feb 15 20:19:11.059:%SYS-5-RELOAD:Reload requested
System Bootstrap, Version 11.1(13)CA, EARLY DEPLOYMENT RELEASE SOFTWARE (fc1)
Copyright (c) 1997 by cisco Systems, Inc.
C7200 processor with 131072 Kbytes of main memory

rommon 1 >
```

Log from the Second Router (RouterB):

```

RouterB#
RouterB# show redundancy
failover mode enabled, failover group = 32

Currently BACKUP role.

No connection to slot 12

DSC in slot 13:

Hub is in 'backup' state.
Clock is in 'backup' state.

RouterB#
*Feb 16 03:24:53.931:%DSC_REDUNDANCY-3-BICLINK:Switching to DSC 13
*Feb 16 03:24:53.931:%DSC_REDUNDANCY-3-BICLINK:Failover:changing to active mode
*Feb 16 03:24:54.931:%DIAL13-3-MSG:
02:32:06:%DSC_REDUNDANCY-3-EVENT:Redundancy event:LINK_FAIL from other DSC
*Feb 16 03:24:55.491:%OIR-6-INSCARD:Card inserted in slot 12, interfaces administratively
shut down
*Feb 16 03:24:58.455:%DIAL13-3-MSG:
02:32:09:%DSC_REDUNDANCY-3-EVENT:Redundancy event:LINK_FAIL from other DSC
*Feb 16 03:25:04.939:%DIAL13-0-MSG:

RouterB# show redundancy
failover mode enabled, failover group = 32

Currently ACTIVE role.

No connection to slot 12

DSC in slot 13:

Hub is in 'active' state.
Clock is in 'backup' state.

RouterB# show redundancy history
DSC Redundancy Status Change History:

010216 03:09 Slot -1 DSC:Failover configured -> BACKUP role.
010216 03:24 Slot 13 DSC:Failover -> ACTIVE role.
010216 03:24 Slot 13 DSC:Hub, becoming active - D12 linkfail
010216 03:24 Slot 13 DSC:Hub, becoming active - D12 linkfail
RouterB#
*Feb 16 03:26:14.079:%DSIPPF-5-DS_HELLO:DSIP Hello from shelf 47 slot 1 Succeeded
*Feb 16 03:26:14.255:%DSIPPF-5-DS_HELLO:DSIP Hello from shelf 47 slot 3 Succeeded
*Feb 16 03:26:14.979:%DSIPPF-5-DS_HELLO:DSIP Hello from shelf 47 slot 10 Succeeded

```

Related Commands

Command	Description
hw-module	Enables the router shelf to stop a DSC or to restart a stopped DSC.
debug redundancy	Displays information used for troubleshooting dual (redundant) router shelves.

Glossary

DSC—dial-shelf controller.

DSIP—Dial Shelf Interconnection Protocol.

RLM—redundant link manager.

RPM—resource pool management.

RPMS—resource pool manager server.

SDP—Session Definition Protocol.

SNMP—Simple Network Management Protocol.

SS7—Signaling System 7.