Router-Shelf Redundancy for the Cisco AS5800

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

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

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

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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.

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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.

Prerequisites

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

Configuration Examples

Configuring the Cisco AS5800 for Shelf Redundancy

SUMMARY STEPS

1. Router(config)# **redundancy**
2. Router(config-red)# **failover group-number** *group-code*

DETAILED STEPS

	Command or Action	Purpose
Step 1	Router(config)# **redundancy**	Enters configuration-redundancy mode.

Command or Action	Purpose
Step 2 Router(config-red)# **failover group-number** *group-code*	Configures router-shelf failover.
	Note Use the same *group-code* 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

SUMMARY STEPS

1. Router(config)# **redundancy**
2. Router(config-red)# **failover group-number** *group-number*

DETAILED STEPS

Command or Action	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
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	Cisco IOS Master Commands List, All Releases
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/

Standards

Standard	Title
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MIBs

MIB	MIBs Link
• CISCO-C8500-REDUNDANCY-MIB	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
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Feature Information for Router-Shelf Redundancy for the Cisco AS5800

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Table 1   *Feature Information for AToM NSF Any Transport over MPLS and AToM Graceful Restart*

Feature Name	Releases	Feature Information
Router-Shelf Redundancy for the Cisco AS5800	12.1(5) XV1	This feature was introduced.
Router-Shelf Redundancy for the Cisco AS5800	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.

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.