

Redundant Link Manager (RLM)

The following sections are provided:

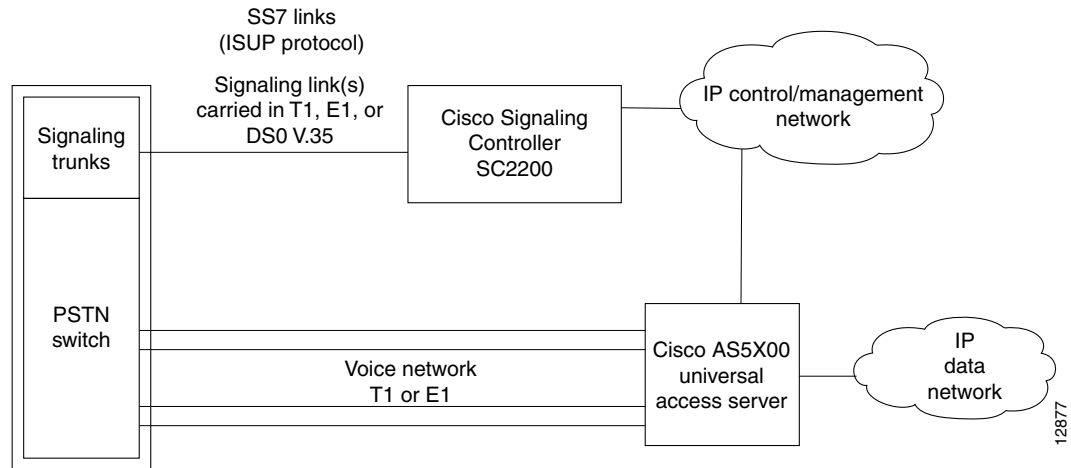
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Feature Summary

The goal of Redundant Link Manager (RLM) is to primarily provide a virtual link management over multiple IP networks so that the Q.931 signaling protocol and other proprietary protocols can be transported on top of multiple redundant links between the Cisco Signaling Controller (CSC) and the Network Access Server (NAS). In addition to this, RLM opens, maintains, and closes multiple links, manages buffers of queued signaling messages, and monitors whether links are active for link failover and Signaling Controller failover. The user can create more than one IP connection between the CSC and the NAS.

The RLM goes beyond Q.921, because it allows for future use of different upper layers, and more importantly, allows for multiple, redundant paths to be treated as one path by upper layers.

Figure 1 Release 2 Architecture



The protocol stack is illustrated in the following figure.

Table 1 Protocol Stack

Extended Q.931
Q.921
UDP
IP

Extended Q.931 provides call control and maintenance functions. The Q.931 implementation is based on Cisco’s National ISDN-2 (NI2), with custom enhancements. The Signaling Controller appears as one or more signaling points in an SS7 network, and performs interworking between the various SS7 protocols in use worldwide to the extended NI2 protocol used between the Cisco SC2200 and NAS.

Q.921 is used to encapsulate the Q.931 messages. It guarantees the in-sequence transmission of Extended Q.931 messages and provides for retransmission. UDP provides for the connectionless transfer of signaling messages across the subnetworks (LAN or WAN), connecting the access servers to the signaling controller.

Benefits

The Cisco SS7/C7 Dial Access Solution System runs on the Cisco AS5200, AS5300, and AS5800 Access Servers in conjunction with Cisco Signaling Controller (CSC) on the Network Access Servers (NAS) to enhance features previously introduced in Cisco IOS release 11.3(5)AA. These features include:

- Redundant Link Management (RLM)
- Continuity Testing (COT)
- ISDN Module

Provided is support for IP connection to SS7/C7 Signaling Controller and associated continuity testing. This support allows carrier customers to connect their access servers to the Public Switch Telephone Network (PSTN) directly, by using Signaling System #7 (SS7/C7) signaling protocols.

The SS7/C7 signaling links terminate on a separate UNIX system called the Signaling Controller (SC2200). The SC2200 maps incoming calls, which are signaled via SS7/C7, to bearers on the access servers. The access servers and SC2200 interact to set up and tear down calls using an extended Q.931 protocol over Q.921 and UDP. In this manner, the access servers and SC2200 form a system that emulates an end-office switch in the PSTN.

The Cisco SS7/C7 Dial Access Solution System uses the ISDN Q.931 and Q.921 protocols over a Redundant Link Manager (RLM) module. RLM makes use of the UDP protocol to transfer information from the NAS to the CSC and vice versa. The ISDN module works in conjunction with the RLM.

Restrictions

The client or server side must support the RLM protocol, which manages those redundant links between the server and client and handles the link and server failover mechanism.

Related Technologies

The Cisco SS7/C7 Dial Access Solution System runs on the Cisco AS5200, AS5300, and AS5800 Access Servers in conjunction with the following Cisco technologies:

- Cisco Signaling Controller (CSC) on the Network Access Servers (NAS)
- Continuity Testing (COT)
- ISDN Module

Supported Platforms

The following hardware platforms support this feature:

- Cisco AS5800
- Cisco AS5300
- Cisco AS5200
- Cisco AccessPath TS and TS3

Prerequisites

We recommend that all access servers use at least two IP interfaces to connect to the primary and alternative IP interfaces of the CSC. Otherwise, the control traffic will be impacted by the data traffic by sharing the same interface for both types of traffic.

Supported MIBs and RFCs

None.

List of Terms

CSC—Cisco Signaling Controller. A server which interfaces between the NAS and the SS7 signaling network.

COT—Continuity test. Used to test individual DS0 channels via either loopback or tone detection and generation.

DSP—Digital Signal Processor. Many firmware functions of a NAS are performed by DSPs which are generally provisioned as banks of shared resources among all the DS0s. Typical DSP functions include: data modems, voice CODECS, fax modems and CODECS, and low-level signaling (such as CAS/R2).

HDLC—High-Level Data Link Control.

ISP—Internet service provider.

NAS—Network access server. A Cisco platform (or collection of platforms such as an AccessPath system which interfaces between the packet world (for example, the Internet) and the circuit world (for example, the PSTN).

PSTN—Public Switched Telephone Network.

SS7—Signaling System Number 7.

SSP—Service switching point. An element of an SS7-based Intelligent Network which performs call origination, termination, or tandem switching. The combined NAS/CSC system looks like a single SSP to the SS7 network.

STP—Signal transfer point. An element of an SS7-based Intelligent Network which performs routing of the SS7 signaling.

T1—A digital carrier used to transmit a DS-1 formatted digital signal at 1.544 MHz.

TDM—Time-division multiplexing. The transmission scheme employed by all digital circuits in the PSTN.

RLM—Redundant link manager.

UDP—User Datagram Protocol.

VoIP—Voice over IP. The ability to carry normal telephony-style voice over an IP-based Internet with POTS-like functionality, reliability, and voice quality.

Configuration Tasks

Configure the access server interfaces for Redundant Link Manager.

Configure

Step	Command	Purpose
1	Router> enable Password: <password> Router#	Enter enable mode. Enter the password. You have entered enable mode when the prompt changes to Router#.
2	Router# configure terminal Enter configuration commands, one per line. End with CNTL/Z. Router(config)#	Enter global configuration mode. You have entered global configuration mode when the prompt changes to Router(config)#.
3	Router(config)# interface Loopback1 Router(config-if)# ip address 10.1.1.1 255.255.255.255	Specify the IP address of the first interface.
4	Router(config-if)# interface Loopback2 Router(config-if)# ip address 10.1.1.2 255.255.255.255	Specify the IP address of the second interface.
5	Router(config-if)# rlm group 1 Router(config-rlm-group)#	Specify the RLM group (network access server) that you want to configure using the rlm group global configuration command.
6	Router(config-rlm-group)# server r1-server Router(config-rlm-group-sc)# link address 10.1.4.1 source Loopback1 weight 4 Router(config-rlm-group-sc)# link address 10.1.4.2 source Loopback2 weight 3	Specify the device name. Specify the link addresses and their weighting preferences.
7	Router(config-rlm-group-sc)# server r2-server Router(config-rlm-group-sc)# link address 10.1.5.1 source Loopback1 weight 2 Router(config-rlm-group-sc)# link address 10.1.5.2 source Loopback2 weight 1	Specify the device name. Specify the link addresses and their weighting preferences.
8	Router(config-rlm-group-sc)# router eigrp 100 Router(config-router)#	

Verify

- Enter the **show rlm group status** command and specify the group number:

```
Router# show rlm group 1 status

RLM Group 1 Status
User/Port: RLM_MGR/3000
Link State: Up          Last Link Status Reported: Up
Next tx TID: 1          Last rx TID: 0
Server Link Group[r1-server]:
  link [10.1.1.1(Loopback1), 10.1.4.1] = socket[active]
  link [10.1.1.2(Loopback2), 10.1.4.2] = socket[standby]
Server Link Group[r2-server]:
  link [10.1.1.1(Loopback1), 10.1.5.1] = socket[opening]
  link [10.1.1.2(Loopback2), 10.1.5.2] = socket[opening]
```

Note the following:

- The link state must report being up.
- No errors should be reported.

Note For a description of the output display fields, see the **show rlm group status** command reference page.

- Enter the **show isdn status** command to view layer status information. If ISDN has not been configured, see the document *ISDN Module* for configuration information.

```
Router# show isdn status

Global ISDN Switchtype = primary-ni
ISDN Serial1:23 interface
  dsl 0, interface ISDN Switchtype = primary-ni :Primary D channel of nfas group 0
  Layer 1 Status:
    ACTIVE
  Layer 2 Status:
    TEI = 0, Ces = 1, SAPI = 0, State = MULTIPLE_FRAME_ESTABLISHED
Layer 3 Status:
  0 Active Layer 3 Call(s)
  Activated dsl 0 CCBs = 0
ISDN Serial2:23 interface
  dsl 1, interface ISDN Switchtype = primary-ni :Group member of nfas group 0
  Layer 1 & 2 Status Not Applicable
  Layer 3 Status:
    0 Active Layer 3 Call(s)
  Activated dsl 1 CCBs = 0
  Total Allocated ISDN CCBs = 0
```

Note the following information for Serial 0:23 (the first half of the messages):

- Layer 1 Status should be “ACTIVE.”
- Layer 2 Status should be “MULTIPLE_FRAME_ESTABLISHED.” (It might take several seconds for Layer 2 status to appear.)
- Layer 3 Status should be “0 Active Layer 3 Call(s).”

The second half of the messages display information for Serial 1:23.

Troubleshooting Tips

If you are having trouble:

- Make sure the cable connection is not loose or disconnected if the Layer 1 Status is “Deactivated.” This status message indicates a problem at the physical layer.
- There may be a problem with your telco or the framing and line code types you entered may not match your telco’s. A Layer 2 error indicates that the access server cannot communicate with the telco; there is a problem at the data link layer.

Command Reference

This section documents new or modified commands. All commands below are used under the top level command, **rlm group** *group-number*. All other commands used with this feature are documented in the Cisco IOS Release 11.3 command references.

- **clear interface**
- **clear rlm group**
- **interface**
- **link**
- **protocol rlm port**
- **retry keepalive**
- **server**
- **show rlm group statistics**
- **show rlm group status**
- **show rlm group timer**
- **shutdown**
- **timer**

clear interface

To reset the hardware logic on an interface, use the **clear interface** command.

clear interface *name-tag*

Syntax Description

name-tag The logic name to identify the server configuration so that multiple entries of server configuration can be entered.

Command Mode

Privileged EXEC

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Example

```
Router# clear interface loopback 1

Router#
02:48:52: rlm 1: [State_Up, rx ACTIVE_LINK_BROKEN] over link [10.1.1.1(Loopback1),
10.1.4.1]
02:48:52: rlm 1: link [10.1.1.2(Loopback2), 10.1.4.2] requests activation
02:48:52: rlm 1: link [10.1.1.1(Loopback1), 10.1.4.1] is deactivated
02:48:52: rlm 1: link [10.1.1.1(Loopback1), 10.1.4.1] = socket[10.1.1.1, 10.1.4.1]
02:48:52: rlm 1: [State_Recover, rx USER_SOCKET_OPENED] over link [10.1.1.1(Loopback1),
10.1.4.1] for user RLM_MGR
02:48:52: rlm 1: link [10.1.1.1(Loopback1), 10.1.4.1] is opened
02:48:52: rlm 1: link [10.1.1.1(Loopback1), 10.1.5.1] = socket[10.1.1.1, 10.1.5.1]
02:48:52: rlm 1: [State_Recover, rx USER_SOCKET_OPENED] over link [10.1.1.1(Loopback1),
10.1.5.1] for user RLM_MGR
02:48:52: rlm 1: link [10.1.1.1(Loopback1), 10.1.5.1] is opened
02:48:52: rlm 1: [State_Recover, rx START_ACK] over link [10.1.1.2(Loopback2),
10.1.4.2]
02:48:52: rlm 1: link [10.1.1.2(Loopback2), 10.1.4.2] is activated
02:48:52: rlm 1: [State_Up, rx LINK_OPENED] over link [10.1.1.1(Loopback1), 10.1.4.1]

Router# show rlm group 1 status
RLM Group 1 Status
  User/Port: RLM_MGR/3000
  Link State: Up          Last Link Status Reported: Up_Recovered
  Next tx TID: 4         Last rx TID: 0
  Server Link Group[r1-server]:
    link [10.1.1.1(Loopback1), 10.1.4.1] = socket[standby, 10.1.1.1, 10.1.4.1]
    link [10.1.1.2(Loopback2), 10.1.4.2] = socket[active, 10.1.1.2, 10.1.4.2]
  Server Link Group[r2-server]:
    link [10.1.1.1(Loopback1), 10.1.5.1] = socket[opening, 10.1.1.1, 10.1.5.1]
    link [10.1.1.2(Loopback2), 10.1.5.2] = socket[opening, 10.1.1.2, 10.1.5.2]
```

```
Router#  
Router#  
02:49:52: rlm 1: [State_Up, rx UP_RECOVERED_MIN_TIMEOUT]  
02:49:52: rlm 1: link [10.1.1.1(Loopback1), 10.1.4.1] requests activation  
02:49:52: rlm 1: [State_Switch, rx SWITCH_ACK] over link [10.1.1.1(Loopback1),  
10.1.4.1]  
02:49:52: rlm 1: link [10.1.1.2(Loopback2), 10.1.4.2] is deactivated  
02:49:52: rlm 1: link [10.1.1.1(Loopback1), 10.1.4.1] is activated
```

Related Commands

- clear rlm group statistics**
- debug rlm group**
- interface**
- link source weight**
- protocol rlm port**
- retry keepalive**
- server**
- show rlm group statistics**
- show rlm group status**
- show rlm group timer**
- shutdown**
- timer**

clear rlm group

To clear all time stamps to zero, use the **clear rlm group** command.

clear rlm group *group-number* **link**

Syntax Description

group-number RLM group number (0 to 255).

Command Mode

Privileged EXEC.

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Example

```
Router# clear rlm group 1 link

Router#
02:48:17: rlm 1: [State_Up, rx ACTIVE_LINK_BROKEN] over link [10.1.1.1(Loopback1),
10.1.4.1]
02:48:17: rlm 1: link [10.1.1.2(Loopback2), 10.1.4.2] requests activation
02:48:17: rlm 1: link [10.1.1.1(Loopback1), 10.1.4.1] is deactivated
02:48:17: rlm 1: [State_Recover, rx LINK_BROKEN] over link [10.1.1.2(Loopback2),
10.1.4.2]
02:48:17: rlm 1: link [10.1.1.1(Loopback1), 10.1.4.1] = socket[10.1.1.1, 10.1.4.1]
02:48:17: rlm 1: [State_Recover, rx USER_SOCKET_OPENED] over link [10.1.1.1(Loopback1),
10.1.4.1] for user RLM_MGR
02:48:17: rlm 1: link [10.1.1.1(Loopback1), 10.1.4.1] is opened
02:48:17: rlm 1: link [10.1.1.2(Loopback2), 10.1.4.2] = socket[10.1.1.2, 10.1.4.2]
02:48:17: rlm 1: [State_Recover, rx USER_SOCKET_OPENED] over link [10.1.1.2(Loopback2),
10.1.4.2] for user RLM_MGR
02:48:17: rlm 1: link [10.1.1.2(Loopback2), 10.1.4.2] is opened
02:48:17: rlm 1: link [10.1.1.1(Loopback1), 10.1.5.1] = socket[10.1.1.1, 10.1.5.1]
02:48:17: rlm 1: [State_Recover, rx USER_SOCKET_OPENED] over link [10.1.1.1(Loopback1),
10.1.5.1] for user RLM_MGR
02:48:17: rlm 1: link [10.1.1.1(Loopback1), 10.1.5.1] is opened
02:48:17: rlm 1: link [10.1.1.2(Loopback2), 10.1.5.2] = socket[10.1.1.2, 10.1.5.2]
02:48:17: rlm 1: [State_Recover, rx USER_SOCKET_OPENED] over link [10.1.1.2(Loopback2),
10.1.5.2] for user RLM_MGR
02:48:17: rlm 1: link [10.1.1.2(Loopback2), 10.1.5.2] is opened
02:48:17: rlm 1: [State_Recover, rx LINK_OPENED] over link [10.1.1.1(Loopback1),
10.1.4.1]
02:48:17: rlm 1: link [10.1.1.1(Loopback1), 10.1.4.1] requests activation
02:48:17: rlm 1: [State_Recover, rx LINK_OPENED] over link [10.1.1.2(Loopback2),
10.1.4.2]
02:48:17: rlm 1: [State_Recover, rx START_ACK] over link [10.1.1.1(Loopback1),
10.1.4.1]
02:48:17: rlm 1: link [10.1.1.1(Loopback1), 10.1.4.1] is activated
```

Related Commands

clear interface
debug rlm group
interface
link source weight
protocol rlm port
retry keepalive
server
show rlm group statistics
show rlm group status
show rlm group timer
shutdown
timer

link

This command is a preference weighted multiple entries command. Within the same server, the link preference is specified in weighting. Use the **no** form of this command to disable this function.

```
link { hostname name | address IP address } source interface weight number
no link { hostname name | address IP address } source interface weight number
```

Syntax Description

hostname <i>name</i>	If hostname is used, RLM will look up the DNS server periodically for the hostname configured until lookup is successful or the configuration is removed.
address <i>IP address</i>	IP address of the link.
source <i>interface</i>	We recommend you use the loopback interface as the source, so that it is independent of the hardware condition. Also, the source interface should be different in every link to avoid falling back to the same routing path. If you intend to use the same routing path for the failover, a single link is sufficient to implement it.
weight <i>number</i>	The higher the weighting number, the higher priority it gets to become the active link. If all entries have the same weighting, all links will be treated equally. There is no preference among servers according to the assumption that only one server will accept the connection requests at any given time. Otherwise, the preference will extend across all servers.

Default

Disabled

Command Mode

RLM configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Related Commands

```
clear rlm group statistics
clear interface
debug rlm group
interface
protocol rlm port
retry keepalive
server
show rlm group statistics
show rlm group status
```

**show rlm group timer
shutdown
timer**

protocol rlm port

The port number for the basic RLM connection can be reconfigured for the whole rlm-group. Use the **no** form of this command to disable this function.

protocol rlm port *port#*
no protocol rlm port *port#*

Syntax Description

port# Refer to Table 1 below for the default port numbers.

Table 1 Default Port Number

Protocol	Port Number
RLM	3000
ISDN	Port[RLM]+1

Default

3000

Command Mode

RLM configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Related Commands

clear rlm group statistics
clear interface
debug rlm group
interface
link source weight
retry keepalive
server
show rlm group statistics
show rlm group status
show rlm group timer
shutdown
timer

retry keepalive

RLM allows keepalive failures in consecutive certain amounts of time configured via CLI before it declares the link is down. Use the **no** form of this command to disable this function.

retry keepalive *number-of-times*
no retry keepalive *number-of-times*

Syntax Description

number of times Number of keepalive failures allowed before the link is declared down, from 1 to 100.

Default

3

Command Mode

RLM configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Related Commands

clear rlm group statistics
clear interface
debug rlm group
interface
link source weight
protocol rlm port
server
show rlm group statistics
show rlm group status
show rlm group timer
shutdown
timer

server

The IP addresses of the server will be defined under this context. Each server can have multiple entries of IP addresses or aliases. Use the **no** form of this command to disable this function.

```
server name-tag  
no server name-tag
```

Syntax Description

<i>name-tag</i>	The logic name to identify the server configuration so that multiple entries of server configuration can be entered.
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Default

Disabled

Command Mode

RLM configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Related Commands

```
clear rlm group statistics  
clear interface  
debug rlm group  
interface  
link source weight  
protocol rlm port  
retry keepalive  
show rlm group statistics  
show rlm group status  
show rlm group timer  
shutdown  
timer
```

show rlm group statistics

To display the network latency of the RLM group, use the **show rlm group statistics** command.

show rlm group *group-number* statistics

Syntax Description

group-number RLM group number (0 to 255).

Command Mode

Privileged EXEC.

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Sample Display

The following is a sample output from the **show rlm group *group-number* statistics** command.

```
Router# show rlm group 1 statistics
RLM Group 1 Statistics
Link_up:
  last time occurred at 02:45:48.724, total transition=1
  avg=00:00:00.000, max=00:00:00.000, min=00:00:00.000, latest=00:00:00.000
Link_down:
  last time occurred at 02:42:33.724, total transition=1
  avg=00:03:15.000, max=00:03:15.000, min=00:00:00.000, latest=00:03:15.000
Link_recovered:
  last time occurred at 00:00:00.000, success=0(0%), failure=0
  avg=0.000s, max=0.000s, min=0.000s, latest=0.000s
Link_switched:
  last time occurred at 00:00:00.000, success=0(0%), failure=0
  avg=0.000s, max=0.000s, min=0.000s, latest=0.000s
Server_changed:
  last time occurred at 00:00:00.000 for totally 0 times
Server Link Group[r1-server]:
Open the link [10.1.1.1(Loopback1), 10.1.4.1]:
  last time occurred at 02:43:03.724, success=1(100%), failure=0
  avg=162.000s, max=162.000s, min=0.000s, latest=162.000s
Echo over link [10.1.1.1(Loopback1), 10.1.4.1]:
  last time occurred at 02:47:15.724, success=91(62%), failure=54
  avg=0.000s, max=0.000s, min=0.000s, latest=0.000s
Open the link [10.1.1.2(Loopback2), 10.1.4.2]:
  last time occurred at 02:43:03.724, success=1(100%), failure=0
  avg=162.000s, max=162.000s, min=0.000s, latest=162.000s
Echo over link [10.1.1.2(Loopback2), 10.1.4.2]:
  last time occurred at 02:47:19.724, success=95(63%), failure=54
  avg=0.000s, max=0.000s, min=0.000s, latest=0.000s

Server Link Group[r2-server]:
Open the link [10.1.1.1(Loopback1), 10.1.5.1]:
  last time occurred at 02:46:06.724, success=0(0%), failure=1
  avg=0.000s, max=0.000s, min=0.000s, latest=0.000s
Echo over link [10.1.1.1(Loopback1), 10.1.5.1]:
  last time occurred at 02:47:18.724, success=0(0%), failure=85
  avg=0.000s, max=0.000s, min=0.000s, latest=0.000s
```

```

Open the link [10.1.1.2(Loopback2), 10.1.5.2]:
  last time occurred at 02:46:06.724, success=0(0%), failure=1
  avg=0.000s, max=0.000s, min=0.000s, latest=0.000s
Echo over link [10.1.1.2(Loopback2), 10.1.5.2]:
  last time occurred at 02:47:18.724, success=0(0%), failure=85
  avg=0.000s, max=0.000s, min=0.000s, latest=0.000s

Router#

```

Table 2 Show RLM Group Statistics Field Descriptions

Field	Description
Link_up	Statistics collected when RLM group is in link up state.
total transition	Total number of transitions into a particular RLM group state.
avg	How long the average time interval lasts.
max	How long the maximum time interval lasts.
min	How long the minimum time interval lasts.
latest	How long the most recent time interval lasts.
Link_down	Statistics collected when RLM group is in the link down state.
Link_recovered	Statistics collected when RLM group is in the link recovery state.
Link_switched	Statistics collected when RLM group is in the link switching state.
Server_changed	Statistics collected for when and how many times RLM server failover happens.
Server Link Group[r1-server]	Statistics collected for those signaling links defined under a particular server link group, for example, r1-server.
Open the link	Statistics collected when a particular signaling link connection is open (broken).
Echo over link	Statistics collected when a particular signaling link connection is established.

Related Commands

```

clear rlm group statistics
clear interface
debug rlm group
interface
link source weight
protocol rlm port
retry keepalive
server
show rlm group status
show rlm group timer
shutdown
timer

```

show rlm group status

To display the status of the RLM group, use the **show rlm group status** command.

show rlm group *group-number* status

Syntax Description

group-number RLM group number (0 to 255).

Command Mode

Privileged EXEC.

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Sample Display

The following is a sample output from the **show rlm group *group-number* status** command.

```
Router# show rlm group 1 status

RLM Group 1 Status
User/Port: RLM_MGR/3000
Link State: Up          Last Link Status Reported: Up
Next tx TID: 1         Last rx TID: 0
Server Link Group[r1-server]:
link [10.1.1.1(Loopback1), 10.1.4.1] = socket[active]
link [10.1.1.2(Loopback2), 10.1.4.2] = socket[standby]
Server Link Group[r2-server]:
link [10.1.1.1(Loopback1), 10.1.5.1] = socket[opening]
link [10.1.1.2(Loopback2), 10.1.5.2] = socket[opening]
```

Table 3 Show RLM Group Status Field Descriptions

Field	Description
User/Port	A list of registered RLM users and the corresponding port numbers associated with them.
RLM_MGR	RLM management module.
Link State	The current RLM group's link state for connecting to the remote end.
Last Link Status Reported	The most recent link status change is reported to RLM users.
Next tx TID	The next transaction ID for transmission.
Last rx TID	The most recent transaction ID has been received.
Server Link Group[r1-server]	The status of all signaling links configured under a particular RLM server link group r1-server.
socket	The status of the individual signaling link.
Server Link Group[r2-server]	The status of all signaling links configured under a particular RLM server link group (r2-server).

Related Commands

clear rlm group statistics
clear interface
debug rlm group
interface
link source weight
protocol rlm port
retry keepalive
server
show rlm group statistics
show rlm group timer
shutdown
timer

show rlm group timer

To display the current timer values, use the **show rlm group timer** command.

show rlm group *group-number* **timer**

Syntax Description

group-number RLM group number (0 to 255).

Command Mode

Privileged EXEC.

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Sample Display

The following is a sample output from the **show rlm group** *group-number* **timer** command.

```
Router# show rlm group 1 timer

RLM Group 1 Timer Values
  open_wait   = 3s           force-down   = 30s
  recovery    = 12s          switch-link  = 5s
  minimum-up  = 60s          retransmit   = 1s
  keepalive   = 1s

Router#
```

Table 4 Show RLM Group Timer Field Descriptions

Field	Description
open_wait	Wait for the connection request to be acked.
recovery	Time to allow the link to recover to backup link before declaring the link is down.
minimum-up	Minimum time to force RLM to stay in the down state to make sure the remote end detects the link state is down.
keepalive	A keepalive packet will be sent out from NAS to CSC periodically.
force-down	Minimum time to force RLM to stay in down state to make sure the remote end detects the link state is down
switch-link	The maximum transition period allows RLM to switch from a lower preference link to a higher preference link. If the switching link does not complete successfully before this timer expires, RLM will go into the recovery state.

Table 4 Show RLM Group Timer Field Descriptions

Field	Description
retransmit	Because RLM is operating under UDP, it needs to retransmit the control packet if the packet is not acknowledged within this retransmit interval.

Related Commands

clear rlm group statistics
clear interface
debug rlm group
interface
link source weight
protocol rlm port
retry keepalive
server
show rlm group statistics
show rlm group status
shutdown
timer

shutdown

To shut down all of the links under the RLM group, use the **shutdown** command. RLM will not try to reestablish those links until the command is negated. Use the **no** form of this command to disable this function.

shutdown
no shutdown

Syntax Description

This command has no keywords or arguments.

Default

Disabled

Command Mode

RLM configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Related Commands

clear rlm group statistics
clear interface
debug rlm group
interface
link source weight
protocol rlm port
retry keepalive
server
show rlm group statistics
show rlm group status
show rlm group timer
timer

timer

These options can overwrite the default setting of timeout values. The defaults are specified in Table 7 and Table 8. Use the **no** form of this command to disable this function.

timer {**force-down** | **keepalive** | **minimum-up** | **open-wait** | **recovery** | **retransmit** | **switch-link**} *time in seconds*

no timer {**force-down** | **keepalive** | **minimum-up** | **open-wait** | **recovery** | **retransmit** | **switch-link**} *time in seconds*

Syntax Description

force-down	After RLM enters the down state, RLM will stay in the down state for a certain amount of time to make sure that the remote end will also enter the down state. After this occurs, both can be forced to be in sync again. This timer can also prevent RLM links from going up and down rapidly in an unstable network environment.
keepalive	A keepalive packet will be sent out from NAS to CSC periodically.
minimum-up	After a link is recovered from the failure state and RLM is in the up state, RLM will wait for a minimum time to make sure the new recovered link is stabilized before doing any operation.
open-wait	To overcome the latency while opening several links at the same time, RLM will use this timer to wait before opening the new links, and then choose the link with the highest weighting to become the active signaling link.
recovery	When NAS loses the active connection to CSC, it will try to reestablish the connection within the interval specified by this command. If it fails to reestablish the connection, RLM will declare that the RLM signaling link is down.
retransmit	Because RLM is operating under UDP, it needs to retransmit the control packet if the packet is not acknowledged within this retransmit interval.
switch-link	The maximum transition period allows RLM to switch from a lower preference link to a higher preference link. If the switching link does not complete successfully before this timer expires, RLM will go into the recovery state.

Default

Disabled

Command Mode

RLM configuration

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Related Commands

clear rlm group statistics
clear interface
debug rlm group
interface
link source weight
protocol rlm port
retry keepalive
server
show rlm group statistics
show rlm group status
show rlm group timer
shutdown

Debug Command

debug rlm group

Use the **debug rlm group** *group-number* command to display RLM errors. Use the **no** form of this command to disable debugging output.

```
debug rlm group group-number { packet echo | event }
no debug rlm group group-number { packet echo | event }
```

Syntax Description

group-number RLM group number (0 to 255)

packet echo Monitors the RLM keepalive on a link.

event Monitors RLM state changes.

Usage Guidelines

This command first appeared in Cisco IOS Release 11.3(7).

Sample Display

Figure 2 shows sample **debug rlm group 1 packet echo** output.

Figure 2 Sample Debug RLM Group Packet Echo Output

```
Router# debug rlm group 1 packet echo

10:07:44: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] rx ECHO_ACK(tid=35167)
10:07:45: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] tx ECHO_REQ(tid=35168)
10:07:45: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] rx ECHO_ACK(tid=35168)
10:07:46: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] tx ECHO_REQ(tid=35169)
10:07:46: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] rx ECHO_ACK(tid=35169)
10:07:47: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] tx ECHO_REQ(tid=35170)
10:07:47: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] rx ECHO_ACK(tid=35170)
10:07:48: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] tx ECHO_REQ(tid=35171)
10:07:48: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] rx ECHO_ACK(tid=35171)
10:07:49: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] tx ECHO_REQ(tid=35172)
10:07:49: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] rx ECHO_ACK(tid=35172)
```

Table 5 describes the significant fields in Figure 2.

Table 5 Debug RLM Group Packet Echo Field Descriptions

Field	Description
10:07:44	Enabled debug time stamp in hours:minutes:seconds.
rlm 1	RLM group number.
rx	Receive an RLM control packet.
ECHO_ACK	The RLM ECHO_ACK packet.
tx	Transmit an RLM control packet.
ECHO_REQ	The RLM ECHO_REQ packet.

Figure 3 shows sample **debug rlm event** output.

Figure 3 Sample Debug RLM Event Output

```
Router# debug rlm group 1 event

10:09:55: rlm 1: [State_Up, rx ACTIVE_LINK_BROKEN] over link [1.14.33.34(Ethernet0),
1.14.33.62]
10:09:58: rlm 1: [State_Recover, rx OPEN_WAIT_TIMEOUT]
10:10:01: rlm 1: [State_Recover, rx OPEN_WAIT_TIMEOUT]
10:10:04: rlm 1: [State_Recover, rx OPEN_WAIT_TIMEOUT]
10:10:07: rlm 1: [State_Recover, rx RECOVERY_TIMEOUT]
10:10:07: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] is deactivated
10:10:28: %ISDN-6-LAYER2DOWN: Layer 2 for Interface, TEI 0 changed to down
10:10:37: rlm 1: [State_Down, rx DOWN_MIN_TIMEOUT]
10:10:37: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] = socket[1.14.33.34,
1.14.33.62]
10:10:37: rlm 1: [State_Down, rx USER_SOCKET_OPENED] over link [1.14.33.34(Ethernet0),
1.14.33.62] for user RLM_MGR
10:10:37: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] is opened
10:10:37: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] = socket[1.14.33.34,
1.14.33.62]
10:10:37: rlm 1: [State_Down, rx USER_SOCKET_OPENED] over link [1.14.33.34(Ethernet0),
1.14.33.62] for user ISDN
10:10:37: rlm 1: [State_Down, rx LINK_OPENED] over link [1.14.33.34(Ethernet0),
1.14.33.62]
10:10:40: rlm 1: [State_Down, rx OPEN_WAIT_TIMEOUT]
10:10:40: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] requests activation
10:10:40: rlm 1: [State_Down, rx START_ACK] over link [1.14.33.34(Ethernet0),
1.14.33.62]
10:10:40: rlm 1: link [1.14.33.34(Ethernet0), 1.14.33.62] is activated
10:10:43: %ISDN-6-LAYER2UP: Layer 2 for Interface, TEI 0 changed to up
Router-1#
```

Table 6 describes the significant fields in Figure 3.

Table 6 Debug RLM Group Event Field Descriptions

Field	Description
10:09:55	Current time in hours:minutes:seconds.
rlm 1	RLM group number.
1.14.33.34 (Ethernet 0), 1.14.33.62	A source/destination IP address pair assigned for a signaling link.
%ISDN-6-LAYER2DOWN	System warning message to show that ISDN layer 2 is down.

What to Do Next

For additional software configuration information, see the following publications:

- *Cisco SS7/CCS7 Dial Access Solution System Integration Guidelines*
- *Cisco AS5300 Universal Access Server Software Configuration Guide*
- *Cisco AS5800 Universal Access Server Installation and Configuration Guide*
- *Dial Solutions Configuration Guide* (Cisco IOS Release 12.0)

Table 7 RLM Default Timing Values

Timer	Timer's Default Value in Seconds	Usage
rlm_timer_link_echo	1	Keepalive timeout for checking link integrity.
rlm_timer_link_latency_test	60	This periodical timer will be reset whenever an echo is sent.
rlm_timer_link_open_wait	3	Wait for the connection request to be acked.
rlm_timer_link_recovery	12	Time to allow the link to recover to backup link before declaring the link is down.
rlm_timer_link_switch	5	Time to detect the link switch failure.
rlm_timer_link_down_min	30	Minimum time to force RLM to stay in the down state to make sure the remote end detects the link state is down.
rlm_timer_link_up_recovered_min	60	Minimum time to stabilize the newly recovered higher preference link before switching over.
rlm_timer_cmd_ack	1	UDP retransmission timer for each RLM request message before the request is acked.

Table 8 RLM Default Countdown Values

Counter	Default Countdown Value	Usage
rlm_link_echo_retry	3	Allow certain number of consecutive echo failures before failover.

