C H A P T E R **2**

Diameter Interface Support

Overview

The diameter layer is responsible for maintaining connections to other diameter peers. This includes connecting to the peers, sending watch dogs (keep alive), and disconnecting from the peers.

The SCA BB diameter infrastructure includes several components: the standard diameter stack, the peer table, the routing table, and the forwarding scheme table, which defines the forwarding method for each realm. The supported forwarding methods are high availability (HA) and load balancing (LB).

The main entity in the diameter infrastructure is the peer table. The peer table includes all the peers that the SCE should connect to at the transport level. A Uniform Resource Identifier (URI) (usually ip:port) identifies each peer.

The routing table and the peer table support online configuration, that is, add and remove commands are supported while the diameter stack is up. The peer table and the routing table configurations are saved to the running configuration.

Peer State Machine

As shown in Figure A-2, after the establishment of a connection and successful exchange of Capability Exchange Request (CER) and Capability Exchange Answer (CEA) messages, the peers send watch dog messages. Even if a single watch dog message is not answered, the connection is disconnected and is considered down. The SCE tries to reestablish TCP connection once in every Tx timer time interval. When TCP connection is reestablished, the peer connection is still considered to be down until a Watch Dog Request (WDR) and a Watch Dog Answer (WDA) messages are exchanged.

Standard Diameter Stack

The standard diameter stack is used for sending and receiving diameter messages. The diameter stack supports both the Gx and Gy interfaces. There is only one diameter stack instance.

The diameter stack includes the following general configurations:

- Tx timeout
- Logging level
- Port
- Realm

The diameter stack holds general message statistics for non-application-specific messages.

The diameter stack includes start and stop operations. To prevent state loss, you cannot stop the stack while one of the interfaces is up.

Managing the Peer Table

The peer table lists all the peers with which the SCE has a direct connection. The information for each entry includes:

- Peer host—The host IP
- Peer port
- State—Nonconfigurable (Reflects the connection state (open or closed))

Table 2-1 lists the CLI commands used to configure and monitor the peer table.

Table 2-1   Peer Table CLI Commands

CLI Commands	Description
diameter peer *<name>* **peer-host** *<ip>* **port** *<port>*	Add entry to the peer table.
no diameter peer *<name>*	Remove entry from the peer table.
no diameter peer all	Clear the peer table.
show diameter peer-table	Show the peer table.
show diameter peer *<name>*	Show the specified peer table entry.

Example for adding a peer:

```
SCE8000(config)# diameter peer test_peer peer-host 1.1.1.1
```

Note Removing a peer from the peer table removes all the peer-related configuration information from the routing table and from the forwarding scheme table.

Example for executing a **show** command:

```
SCE8000> show diameter peer-table

Peer Table:
-------------------------------------------------------------
| Name          | Host             | Port      | State |
-------------------------------------------------------------
| SER_GX        | 10.121.64.38     | 3869      | Up    |
| SER_GY        | 10.121.64.46     | 3870      | Up    |
-------------------------------------------------------------
```

The Peer table lists the peers and their state. The state can be Up, Down, or N/A. N/A means the stack is not currently activated.

Note A peer is defined by a URI. Therefore, the same IP cannot be used on different ports to distinguish between two servers except when a domain name server (DNS) is used.

Managing the Routing Table

The routing table contains the peer application support and the forwarding scheme priority information. Each entry in the routing table includes the peer name, supported application, realm, and priority.

When the SCE sends an application message, it is sent to a realm and not to a specific server. In the Gx interface, there is one realm with many peers that support that realm. In the Gy interface, there can be several realms. Each peer can support both interfaces.

Table 2-2 lists the CLI commands used to configure and monitor the routing table.

Table 2-2   Routing Table CLI Commands

CLI Commands	Command Description
diameter realm <*realm name*> (Gx | Gy) peer <*name*> priority <*0-99*>	Add entry to the routing table.
no diameter realm <*realm name*> (Gx | Gy) peer <*name*>	Remove entry from the routing table.
no diameter realm <*realm name*> peer <*name*>	Remove all entries for the peer from the routing table.
no diameter realm all	Clear the routing table.
show diameter routing-table	Show the routing table.
show diameter realm <*realm name*>	Show all routing table entries that match the realm host.

Example for adding a route:

```
SCE8000(config)# diameter realm test_realm.cisco.com Gy peer test_peer priority 95
```

Example for showing the route table:

```
SCE8000> show diameter routing-table
 ---------------------------------------------------------
| Name         | Realm           | Application | Priority |
 ---------------------------------------------------------
| SER_GY       | cisco.com       | Gy          | 0        |
| SER_GX       | cisco.com       | Gx          | 0        |
 ---------------------------------------------------------
SCE8000>
```

In the example, the peer named SER_GY supports the Gy application on the cisco.com realm.

Diameter Load Balancing and High Availability Schemes

Diameter networks support load balancing (LB) and high availability (HA) schemes.

The diameter protocol sends messages to a realm and not to a specific server, letting other nodes in the diameter network take care of HA and LB schemes. Some diameter networks require that a network client handles the LB and HA. This is achieved by sending messages to a specific server that acts as the network client.

For information about load balancing and failover troubleshooting for the Gx interface, see the "High Availability for the Gx Interface" section on page 3-10. For information about load balancing and failover troubleshooting for the Gy interface, see the "Gy Interface Failover Support" section on page 4-22.

Forwarding Scheme Table

The Forwarding Scheme table defines the HA and LB scheme per each realm and application (one scheme per each combination of realm and application).

The following options are supported:

- LB with default HA
- HA with no LB

Table 2-3 lists the forwarding scheme examples for load balancing and high availability. For information on configuring the diameter forwarding scheme, see the "Diameter Forwarding Mode CLI Commands" section on page 2-8.

Table 2-3   Forwarding Scheme Examples

Model	Server	Load Balancing	High Availability
Load Balancing	A, B, C	Round Robin	When server A fails, the traffic is shared between server B and server C.
High Availability	A, B	None	Server A is primary. Server B is secondary.

Load Balancing

Load balancing is completed by round robin, using the available servers. The available servers are round robin cycled per session and not per message, that is, the messages for a specific session are all sent to the same server.

When a server fails, it is removed from the round robin.

If a server is removed from the round robin and a session has already initiated, an alternative server completes the session. The application can either start a new session or continue with the alternate server. For information on configuring the load balancing scheme, see the "Diameter Forwarding Mode CLI Commands" section on page 2-8.

High Availability (Failover)

When the high availability scheme is used, there is no load balancing between servers. The high availability scheme is strictly an active/standby scheme.

Each server is assigned a priority. Only the server with the highest priority handles the session. When the active server fails, all the new sessions are started on the next server in the priority list order. This mode supports stickiness, that is, when a failed server is back up, new sessions are forwarded to it, but already existing sessions remain forwarded to the secondary server unless transferred by an application decision. For information on configuring the high availability (failover) scheme, see the "Diameter Forwarding Mode CLI Commands" section on page 2-8.

Diameter Support Configuration

This section contains the information and instructions to configure and monitor the diameter forwarding, load balancing, and high availability schemes. This section contains the following subsections:

- Diameter Stack CLI Commands, page 2-7
- Diameter Forwarding Mode CLI Commands, page 2-8

Diameter Stack CLI Commands

Table 2-4 lists the CLI commands used to configure and monitor diameter stack support. All the commands, except **origin-realm** and **diameter port**, can be set while the stack is running.

Table 2-4   *Diameter Stack CLI Commands*

CLI Command	Command Description
[no] diameter	Start or stop the stack.
show diameter	Show the stack state.
show diameter counters	Show message statistics.
clear diameter counters	Reset all the statistics.
diameter origin-realm *<realm>*	Configure the stack realm. Run only when the stack is down.
diameter port *<port>*	Configure the stack host. Run only when the stack is down.
diameter logging-level *<level>*	Set the logging level of the stack.
diameter tx-timer *<timeout-in-seconds>*	Set the default timeout on the message.
default diameter origin-realm	Set origin-realm to default.
default diameter	Set stack state to default.
default diameter logging-level	Set stack logging level to default. Root-level command
default diameter tx-timer	Set tx timer to default.

Example for showing the diameter counters:

```
SCE8000> show diameter counters
WDR Sent     : 150
WDR Received : 182
WDA Sent     : 182
WDA Received : 150
CER Sent     : 3
CER Received : 0
CEA Sent     : 0
CEA Received : 3
DPR Sent     : 0
DPA Sent     : 1
```

Diameter Forwarding Mode CLI Commands

Table 2-5 lists the CLI commands used to configure and monitor the diameter forwarding mode.

Table 2-5   Diameter Forwarding Mode CLI Commands

CLI Command	Command Description

diameter realm *<realm>* (Gx | Gy) forwarding-mode (load-balancing | high-availability [shared-session-on [stickiness-on | stickiness-off] | shared-session-off])	Configure the forwarding mode. High availability mode has additional options:
	
	• shared-session-on
	  – stickiness-on
	  – stickiness-off
	• shared-session-off

show diameter forwarding-mode	Show load balancing and high availability configuration.

Example for configuring load balancing:

```
SCE8000(config)# diameter realm test_realm.cisco.com Gx forwarding-mode load-balancing
```

Example for configuring high availability:

```
SCE8000(config)# diameter realm realm test_realm.cisco.com Gy forwarding-mode
high-availability shared-session-on stickiness-off
```