Oracle® Communications Subscriber-Aware Load Balancer

Essentials Guide
Release L-CX1.5.0M1

February 2017

ORACLE

Notices

Contents

About this Guide

Version L-CX1.5.0M1 provides an updated release of the Oracle Communications Subscriber-Aware Load Balancer (SLB). This guide describes that release.

This guide is written for network administrators and architects, and provides information about the SBC and SLB configuration for the load balancing on IP address and port feature. For information on overall configuration and operation of SLB cluster members, refer to the S-CZ7.2.0M6 documentation set. This SBC release is the only Session Border Control (SBC) release that supports the SLB load balancing on IP address and port feature on SBCs, in addition to the full complement of other SBC functionality.

Related Documentation

The following table describes the documentation set for this release.

Document Name and Part Number	Document Description
4500 System Hardware Installation Guide (400-0101-00)	Contains information about the components and installation of the 4500 system.
3800 Hardware Installation Guide (400-0118-00)	Contains information about the components and installation of the 3800 system.
3000 & 4000 Release Notes (400-0066-00)	Contains information about the current documentation set release, including new features and management changes.
4000 ACLI Configuration Guide (400-0061-00)	Contains information about the administration and software configuration of the SBC.
4000 ACLI Reference Guide (400-0062-00)	Contains explanations of how to use the ACLI, as an alphabetical listings and descriptions of all ACLI commands and configuration parameters.
4000 Maintenance and Troubleshooting Guide (400-0063-00)	Contains information about SBC logs, performance announcements, system management, inventory management, upgrades, working with configurations, and managing backups and archives.
4000 MIB Reference Guide (400-0010-00)	Contains information about Management Information Base (MIBs), Acme Packet's enterprise MIBs, general trap information, including specific details about standard traps and enterprise traps, Simple Network Management Protocol (SNMP) GET query information (including standard and enterprise SNMP GET query names, object identifier names and numbers, and descriptions), examples of scalar and table objects.
4000 Accounting Guide (400-0015-00)	Contains information about the SBC's accounting support, including details about RADIUS accounting.
4000 HDR Resource Guide (400-0141-00)	Contains information about the SBC's Historical Data Recording (HDR) feature. This guide includes HDR configuration and system-wide statistical information.
4000 Administrative Security Essentials (400-0132-00)	Contains information about the SBC's support for its Administrative Security license.

Revision History

Date	Revision Number	Description
November 19, 2013	Revision 1.00	Initial release of software version L-CX1.5.0
November 30, 2015	Revision 2.00	Release of software version L-CX1.5.0 M1, which includes changes to support the SLB - load balancing on IP address and port feature.
January 21, 2016	Revision 2.01	Reinserted the Online Offline Configuration topic accidentally omitted from Revision 2.00.
August 23, 2016	Revision 2.02	Added information about cluster assignment and membership
February 2, 2017	Revision 2.03	Added AP4600 to the list of supported hardware.

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New for L-CX1.5.0M1

This section discusses new Subscriber-Aware Load Balancer (SLB) system capacities included in this release, as well as new and modified commands.

The new feature included in this release is **load balancing on IP address and port**.

The purpose of this feature is to enhance the endpoint (EPT) hashed key lookup to include source port data. The feature achieves better balancing of endpoints which reside behind a Network Address Translation (NAT) IP address. This feature accounts for having numerous endpoints coming into the SLB with a single (or a few) IP address(es), therefore the making the dispersion within an SBC cluster optimal.

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Caveats for Release L-CX1.5.0

Note: For Caveats for Session Boarder Controllers (SBCs) when they are Subscriber-Aware Load Balancer (SLB) cluster members, refer to the appropriate documentation for the SBC.

These limitations apply to release L-CX1.5.0M1 of the Subscriber-Aware Load Balancer:

General

- Two million endpoints are supported for this release.
- This release supports only the SLB product type, on the Acme Packet 4500 platform. You will not be able to configure the platform to run as the SBC product type using this release.

Supported Cluster Hardware and Software

- This release of software supports cluster members on the following hardware, using release the S-CZ7.2.0M6:
- Acme Packet 6300
- Acme Packet 4500
- Acme Packet 4600

Cluster Membership

- Each SBC may be a member of only one cluster, and a cluster may be associated with only one Subscriber-Aware Load Balancer.

Load Balancer

- All SBCs in a cluster employing the load balancing on IP address and port feature must use release S-CZ7.2.0M6.

Protocol Support

- The source-port-aware feature does not function as desired with any traffic that has encrypted Layer 4 header information, such as IPSEC and IMS-AKA.
- The Oracle Communications Session Border Controller's FTP Server is deprecated. Only SFTP server services are supported.
    - FTP Client access for features such as HDR/CDR push remains.

Physical Interface RTC Support

- After changing any Physical Interface configuration, a system reboot is required.

High Availability Pairing (HA)

- When upgrading an HA pair, you must perform a double reboot on both of the HA pair.

- General Procedure: On the Standby SLB, upgrade to L-CX1.5.0M1 and reboot it. Upgrade the Active SLB and reboot. (It now becomes the Standby) Make the required configuration changes (enable **port-aware-balancing** in the **lbp-config** section), and save the configuration. (The standby will learn of the new setting.) Reboot both Active & Standby (with preference for Active being done first) to activate the feature.

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Subscriber-Aware Load Balancer Configuration

SLB Configuration

This section explains how to configure functionality specific to the SLB; it does not include configuration steps for functions that it shares in common with its corresponding SBCs (for example, system-config, phy-interface, network-interface, and so on). For information about general SBC configuration, refer to the appropriate documentation as listed in About This Guide.

SLB configuration is quite simple; aside from basic network connectivity, the service interfaces, and the distribution policy, much of the configuration is learned dynamically from the SBCs that comprise the cluster.

SLB Tunnel Configuration

The SLB sends and receives signaling messages to and from clustered SBCs through an IP-in-IP tunnel. The SLB requires one tunnel per interface.

Use the following procedure to perform required SLB-side tunnel configuration. Completion of tunnel configuration is accomplished on the clustered SBCs as described in SBC Tunnel Configuration.

1. From superuser mode, use the following ACLI command sequence to access tunnel-config configuration mode. While in this mode, you partially configure the tunnel-config configuration element.

```
ACMEPACKET# configure terminal
ACMEPACKET(configure)# system
ACMEPACKET(system)# network-interface
ACMEPACKET(network-interface)# tunnel-config
ACMEPACKET(tunnel-config)# ?
local-ip-address    tunnel local IP address
port    tunnel local & remote control ports
protocol    tunnel control transport protocol
tls-profile    tunnel control TLS profile
select    select tunnel to edit
no    delete tunnel
show    show tunnel
done    write tunnel information
exit    return to previous menu
ACMEPACKET(tunnel-config)#
```

2. Use the **local-ip-address** parameter to specify the IP address at the SLB end of the tunnel.

   As the terminus for all tunnels from the clustered SBCs — and never the tunnel originator — only the local address is configured on the SLB.

Note: This address also supports the exchange of CCP messages.

```
ACMEPACKET(tunnel-config)# local-address 182.16.204.210
ACMEPACKET(tunnel-config)#
```

3. Use the **port** parameter to specify the port used to send and receive CCP messages.

```
ACMEPACKET(tunnel-config)# port 4444
ACMEPACKET(tunnel-config)#
```

4. Use the **protocol** parameter to specify the transport protocol used in support of cluster control messages.

   Supported protocols are UDP (the recommended default), TCP, or TLS.

   Note: CCP messages are exchanged quite frequently, and the overhead associated with encrypting and decrypting these messages is significant. Selection of TLS as the Transport Layer protocol degrades system performance.

```
ACMEPACKET(tunnel-config)# protocol UDP
ACMEPACKET(tunnel-config)#
```

5. If TLS is the selected transport protocol, use the **tls-profile** parameter to select the existing TLS profile that identifies the cryptographic resources used to secure the TLS connection.

```
ACMEPACKET(tunnel-config)# tls-profile TLS-LB
ACMEPACKET(tunnel-config)#
```

6. Use **done**, **exit**, and **verify-config** to complete configuration of this tunnel-config configuration element.
7. Repeat Steps 1 through 6 to configure additional tunnel-config configuration elements.

Sample SLB Tunnel Configuration

The following formatted extract from **show running-config** ACLI output shows a sample tunnel configuration.

```
tunnel-config
local-ip-address     182.16.204.210
port                 4444
protocol             UDP
tls-profile                                      TLS-LB
last-modified-by     admin@console
last-modified-date   2013-11-07 18:49:04
```

Cluster Configuration

The cluster-config configuration element manages basic SLB interaction with clustered SBCs — it contains a set of global parameters that define the management of the RFC 2003 IP-in-IP tunnels that connect the SLB to clustered SBCs, and the details of rebalance operations. In addition, cluster-config provides for the creation of a list of service interfaces (signaling addresses) that are advertised to endpoints comprising the user access population.

Use the following procedure to perform required cluster-config configuration.

1. From superuser mode, use the following ACLI command sequence to access cluster-config configuration mode. While in this mode, you configure the cluster-config configuration element.

```
ACMEPACKET# configure terminal
ACMEPACKET(configure)# session-router
ACMEPACKET(session-router)# cluster-config
ACMEPACKET(cluster-config)# ?

state                          cluster control state
log-level                      configure log level
auto-rebalance                 Auto-rebalance cluster on new SD availability
source-rebalance-threshold     Percentage of advertised registration capacity
dest-rebalance-threshold       Percentage of advertised registration capacity
dest-rebalance-max             Percentage of advertised registration capacity
tunnel-check-interval          How often an SD's tunnels are checked
tunnel-fail-interval           Time for which no messages have been received
```

```
rebalance-request-delay        Delay between subsequent rebalance requests
session-multiplier             ratio of users (endpoints to sessions)
atom-limit-divisor             ratio of atoms (e.g. contacts to endpoints)
rebalance-skip-ahead           Skip endpoints refreshing sooner than
rebalance-max-refresh          Skip endpoints refreshing later than
ignore-tgt-svcs-on-rebalance   When selecting source SDs during rebalancing
rebalance-del-app-entries      Delete Application endpoint Data
inactive-sd-limit              Duration no SD control messages received
                               (seconds)
red-port                       redundant mgcp sync port
red-max-trans                  max redundant transactions to keep
red-sync-start-time            redundant sync start timeout
red-sync-comp-time             redundant sync complete timeout
service-ports                  configure service ports
select                         select cluster config
no                             delete cluster config
show                           show cluster config
done                           save cluster config information
exit                           return to previous menu
```

2. Use the **state** parameter to enable or disable the SLB software.

   The default setting, enabled, enables SLB functionality; disabled renders the SLB inoperable.

   ```
   ACMEPACKET(cluster-config)# state enabled
   ACMEPACKET(cluster-config)#
   ```

3. Use the **log-level** parameter to specify the contents of the SLB log.

   Log messages are listed below in descending order of severity.

   - emergency — the most severe
   - critical
   - major (error)
   - minor (error)
   - warning
   - notice
   - info — (default) the least severe
   - trace — (test/debug, not used in production environments)
   - debug — (test/debug, not used in production environments)
   - detail — (test/debug, not used in production environments)

   In the absence of an explicitly configured value, **log-level** defaults to critical, meaning that log messages with a severity of critical or greater (emergency) are written to the SLB log.

   ```
   ACMEPACKET(cluster-config)# log-level critical
   ACMEPACKET(cluster-config)#
   ```

4. Use the **auto-rebalance** parameter to specify SLB behavior when a new SBC joins an existing cluster.

   With this parameter enabled, the default setting, the SLB redistributes endpoints among cluster members when a new member joins the cluster. Refer to the Rebalancing section for operational details.

   With this parameter disabled, the alternate setting, pre-existing SBCs retain their endpoint populations, and the SLB directs all new endpoints to the newly active SBC until that SBC reaches maximum occupancy.

   ```
   ACMEPACKET(cluster-config)# auto-rebalance enabled
   ACMEPACKET(cluster-config)#
   ```

5. If **auto-rebalance** is set to enabled, use the **source-rebalance-threshold** and **dest-rebalance-threshold** parameters to specify threshold settings that identify existing cluster SBCs as either endpoint sources or endpoint destinations during the rebalance operation. Use the **dest-rebalance-max** parameter to specify the occupancy for the new cluster member. Refer to the Balancing section for details on occupancy and its calculation.

   If **auto-rebalance** is set to disabled, these three parameters can be ignored.

Parameter values are numeric percentages within the range 0 through 100.

source-rebalance-threshold specifies the minimum occupancy percent that identifies a clustered SBC as a source of endpoints during a rebalance operation. For example, using the default value of 50 (percent), any clustered SBC with an occupancy rate of 50% or more sheds endpoints during a rebalance. The SLB assigns these endpoints to the new cluster member.

dest-rebalance-threshold specifies the maximum occupancy percent that identifies a clustered SBC as a destination for endpoints during a rebalance operation. Note that the default setting of 0 (percent), ensures that no pre-existing SBC gains endpoints during a rebalance.

dest-rebalance-max specifies the maximum occupancy percent that the SLB transfers to the new cluster member during a rebalance operation. The default setting is 80 (percent). Should this threshold value be attained, the SLB distributes remaining endpoints to those SBCs identified as endpoint destinations by their **dest-rebalance-threshold** settings.

```
ACMEPACKET(cluster-config)# source-rebalance-threshold 50
ACMEPACKET(cluster-config)# dest-rebalance-threshold 40
ACMEPACKET(cluster-config)# dest-rebalance-max 75
```

6. If **auto-rebalance** is set to enabled, you can optionally use four additional parameters to fine-tune rebalance operational details.

   If **auto-rebalance** is set to disabled, these four parameters can be ignored.

   rebalance-request-delay specifies the interval (in milliseconds) between endpoint request messages sent from the SLB to a clustered SBC. As explained in the Rebalancing section, these messages request a list of endpoints that will be redistributed from the SBC to a new cluster member.

   By default, this parameter is set to 500 milliseconds.

   Setting this parameter to a higher value results in longer times for the completion of rebalancing; however longer durations provide more time for cluster member processsing of SIP traffic.

   rebalance-skip-ahead restricts the target set of SBC endpoints registration eligible for rebalancing to those whose re-registration is not imminent — that is, the registration is not scheduled within the number of milliseconds specified by the parameter setting. Setting this parameter to a non-zero value mitigates against the possibility of a race condition precipitated by a simultaneous endpoint removal generated by the SBC and the arrival of endpoint signalling on an SLB service port. The default setting (0 milliseconds) effectively makes the entire SBC endpoint set eligible for rebalancing.

   rebalance-max-refresh restricts the target set of SBC endpoints eligible for rebalancing to those whose re-registration is no further in the future than the time period (milliseconds) specified by this parameter— for example, assuming a parameter value of 6000, the target endpoint set is restricted to those whose re-registration is scheduled within the next 6 seconds.

   Because a re-balancing operation necessarily introduces a small window of unreachability for re-balanced endpoints, this parameter provides users with some degree of control over the period of time that a re-balanced endpoint may be unreachable.

   The default setting (0 milliseconds) effectively makes the entire SBC endpoint set eligible for rebalancing.

   rebalance-del-app-entries specifies when cached SIP entries for rebalanced endpoints are removed from the clustered SBC. The default setting (disabled) specifies that cached entries are retained after a rebalance operation, and subsequently removed from the cache by standard time-out procedures. When set to enabled, this parameter specifies that the SBC removes cached registration entries at the completion of the rebalance operation.

   ```
   ACMEPACKET(cluster-config)# rebalance-request-delay 750
   ACMEPACKET(cluster-config)# rebalance-skip-ahead 100
   ACMEPACKET(cluster-config)# rebalance-max-refresh 1000
   ACMEPACKET(cluster-config)# rebalance-del-app-entries enabled
   ```

7. Three parameters, **tunnel-fail-interval**, **tunnel-check-interval,** and **inactive-sd-limit** maintain and monitor the IP-in-IP tunnels established between the SLB and clustered SBCs.

tunnel-fail-interval specifies the interval (in milliseconds) between periodic keepalive messages sent from a clustered SBC to the SLB. If the SLB fails to receive a keepalive message within the specified period, it flags the tunnel as dead. By default, this parameter is set to 10000 milliseconds.

tunnel-check-interval specifies the interval (in milliseconds) between SLB tunnel audits. During a tunnel audit, the SLB checks the status of each tunnel and removes all tunnels flagged as dead. If all of a cluster member's tunnels are removed. the SLB places that cluster member in an out-of-service state. By default, this parameter is set to 15000 milliseconds.

If you change default settings for either parameter, ensure that the setting for **tunnel-check-interval** is greater than the **tunnel-fail-interval** setting.

inactive-sd-limit specifies the maximum silent interval (defined as the absence of heartbeat traffic from any tunnel) seconds) before the SLB flags a cluster member as dead, and removes that SBC from the cluster. By default, this parameter is set to 1800 seconds (30 minutes). supported values are integers within the range 0 through 31556926 (365 days).

```
ACMEPACKET(cluster-config)# tunnel-fail-interval 10000
ACMEPACKET(cluster-config)# tunnel-check-interval 15000
ACMEPACKET(cluster-config)# inactive-sd-limit 900
```

8. Use the **session-multiplier** and **atom-limit-divisor** parameters to specify optional, user-configurable numeric factors used in occupancy and occupancy rate calculations.

   session-multiplier provides a factor that when multiplied by an SBC's licensed session limit, determines the maximum number of endpoints that the SBC can support (that is, its maximum occupancy).

   The default setting is 10; valid settings include any integer values within the range 1 through 100.

   Using the default setting, an SBC licensed for 32,000 concurrent sessions has a maximum theoretical occupancy of 320,000 endpoints.

   atom-limit-divisor provides another factor that can be used in occupancy and occupancy percent calculations. By default, occupancy calculations are based on endpoints (IP addresses), and do not take into account the fact that the same IP address can represent multiple users.

   The default setting is 1, which assumes a conservative 1-to-1 correlation between endpoints and users; valid settings include any integer values within the range 1 through 1000.

   

   Note: The SLB initially calculates a tentative maximum occupancy value, expressed as a number of endpoint addresses, for each clustered SBC. SLB calculations are based upon the licensed capacity of each cluster member, and the values assigned to the session-multiplier and atom-limit-divisor parameters. After calculating the tentative maximum occupancy value, the SLB compares this value to the value of the registration-cache-limit parameter as defined on the clustered SBC. If the value of registration-cache-limit is either 0, or greater than the tentative maximum occupancy value, the calculated value is retained as the occupancy ceiling. However, if the registration-cache-limit value is greater than 0, but less than the tentative calculation, the value of registration-cache-limit is used as the occupancy ceiling.

   Once an SBC has reached its maximum number of endpoints, the SLB removes it from the load balancing algorithm. These parameter settings should be changed only after careful examination of network conditions and behavior.

```
ACMEPACKET(cluster-config)# session-multiplier 10
ACMEPACKET(cluster-config)# atom-limit-divisor 1
```

9. The **ignore-tgt-svc-on-rebalance** parameter is not currently supported, and can be safely ignored.
10. Retain default settings for the **red-port**, **red-max-trans**, **red-sync-start-time**, and **red-sync-comp-time** parameters.
11. Use **done**, **exit**, and **verify-config** to complete cluster configuration.

Sample Cluster Configuration

The following formatted extract from **show running-config** ACLI output shows a sample cluster configuration.

```
cluster-config
state                          enabled
log-level                      CRITICAL
auto-rebalance                 enabled
source-rebalance-threshold     50
dest-rebalance-threshold       40
dest-rebalance-max             75
tunnel-check-interval          750
tunnel-fail-interval           10000
rebalance-request-delay        500
session-multiplier             4
rebalance-skip-ahead           0
rebalance-max-refresh          0
ignore-tgt-svcs-on-rebalance   disabled
atom-limit-divisor             1000
rebalance-del-app-entries      disabled
inactive-sd-limit              1800
red-port                       2001
red-max-trans                  10000
red-sync-start-time            5000
red-sync-comp-time             1000
service-port
last-modified-by               admin@console
last-modified-date             2013-11-07 18:49:04
```

Service Ports Configuration

A service port is essentially a SIP port monitored by the SLB for incoming signaling from the user population. For virtually all network topologies, multiple service ports are expected on a typical SLB configuration. A service-port is a multiple instance configuration element; for each service port advertised to the access network(s), at least one service-port configuration element must be configured.

Use the following procedure to perform required service-ports configuration.

1. From superuser mode, use the following ACLI command sequence to access service-port configuration mode. While in this mode, you configure one or more service-port configuration elements.

```
ACMEPACKET# configure terminal
ACMEPACKET(configure)# session-router
ACMEPACKET(session-router)# cluster-config
ACMEPACKET(cluster-config)# service-ports
ACMEPACKET(service-port)# ?
address                    IP address
port                       port (default: 5060)
protocol                   transport protocol
network-interface          network interface for service port
select                     select cluster config
no                         delete cluster config
show                       show cluster config
done                       save cluster config information
exit                       return to previous menu
ACMEPACKET(service-port)#
```

2. Use the required **address** parameter to specify the IPv4 or IPv6 address of this service port.

```
ACMEPACKET(service-port)# address 10.0.0.1
ACMEPACKET(service-port)#
```

3. Use the **port** parameter to specify the port monitored by the SLB for incoming signaling messages.

   In the absence of an explicitly configured port, the SLB provides a default value of 5060 (the registered SIP port).

   Allowable values are integers within the range 0 through 65535.

```
ACMEPACKET(service-port)# port 5060
ACMEPACKET(service-port)#
```

4. Use the **protocol** parameter to choose the transport protocol.

   The supported setting is UDP (the recommended default).

   ```
   ACMEPACKET(service-port)# protocol udp
   ACMEPACKET(service-port)#
   ```

5. Use the required **network-interface** parameter to identify the SLB network interface that supports this service port. With this parameter, you have the option of specifying IPv4 or IPv6 (.4 or .6).

   ```
   ACMEPACKET(service-port)# network-interface M00:0.4
   ACMEPACKET(service-port)#
   ```

6. Use **done**, **exit**, and **verify-config** to complete configuration of this service-port configuration element.
7. Repeat Steps 1 through 6 to configure additional service-port configuration elements.

Sample Service Port Configuration

The following formatted extract from **show running-config** ACLI output shows a sample service port configuration.

```
service-port
address                       192.169.203.83
port                          5060
protocol                      UDP
network-interface             M00:0.4
last-modified-by              admin@console
last-modified-date            2013-11-07 18:49:04
```

Load Balancer Policy Configuration

The lbp-config configuration element manages the SLB endpoint table. It also creates and manages a list of service interfaces (signaling addresses) that are advertised to endpoints comprising the user access population.

Use the following procedure to perform required lbp-config configuration.

1. From superuser mode, use the following ACLI command sequence to access lbp-config configuration mode. While in this mode, you configure the lbp-config configuration element.

   ```
   ACMEPACKET# configure terminal
   ACMEPACKET(configure)# session-router
   ACMEPACKET(session-router)# lbp-config
   ACMEPACKET(lbp-config)#?
   state                                lbp state
   log-level                            configure log level
   untrusted-grace-period               Untrusted grace period
   max-untrusted-percentage             Maximum untrusted endpoints percentage
   max-untrusted-upper-threshold        Maximum untrusted endpoints upper
                                        threshold
   max-untrusted-lower-threshold        Maximum untrusted endpoints upper
                                        threshold
   endpoint-capacity-upper-threshold    endpoint capacity upper threshold
   endpoint-capacity-lower-threshold    endpoint capacity lower threshold
   red-port                             lbp redundant sync port: 0 to disable
                                        and 2000 to enable
   red-max-trans                        maximum redundancy transactions to keep
                                        on active
   red-sync-start-time                  timeout for transitioning from standby
                                        to active
   red-sync-comp-time                   sync request timeout after initial sync
                                        completion
   port-aware-balancing                 Include endpoint source port, in
   addition to the source IP address if NAT is used
   options                              optional features/parameters
   select                               select lbp config
   no                                   delete lbp config
   show                                 show lbp config
   ```

```
done                                    save lbp config information
exit                                    return to previous menu
ACMEPACKET(lbp-config)#
```

2. Use the **state** parameter to enable or disable the SLB software.

   The default setting, enabled, enables SLB functionality; disabled renders the SLB inoperable.

```
ACMEPACKET(lbp-config)# state enable
ACMEPACKET(lbp-config)#
```

3. Use the **log-level** parameter to specify the contents of the SLB log.

   Log messages are listed below in descending order of severity.

   - emergency — the most severe
   - critical
   - major (error)
   - minor (error)
   - warning
   - notice
   - info — (default) the least severe
   - trace — (test/debug, not used in production environments)
   - debug — (test/debug, not used in production environments)
   - detail — (test/debug, not used in production environments)

   In the absence of an explicitly configured value, **log-level** defaults to critical, meaning that log messages with a severity of critical or greater (emergency) are written to the LBP log.

```
ACMEPACKET(lbp-config)# log-level critical
ACMEPACKET(lbp-config)#
```

4. Use the **untrusted-grace-period**, **max-untrusted-percentage**, **max-untrusted-upper-threshold**, and **max-untrusted-lower-threshold** parameters to implement percentage-based management and monitoring of untrusted endpoints in the SLB endpoint database. Management and monitoring of untrusted endpoints is instrumental in detecting and responding to Denial-of-Service (DOS) attacks aimed at the SLB.

   untrusted-grace-period specifies the maximum time, in seconds, that a forwarding rule is retained by the SLB before it is confirmed with a promotion message from the SBC which received the untrusted endpoint. Refer to the Balancing section for message details.

   In the absence of an explicitly assigned value, the SLB provides a default setting of 30 (seconds).

   If this time period elapses without a promotion message arriving to confirm this user, the SLB deletes the entry.

   Setting this parameter to 0 allows untrusted/unconfirmed entries to exist indefinitely without aging out.

   max-untrusted-percentage specifies the percentage of the overall endpoint population that is reserved for untrusted users.

   The default setting is 20 (percent); supported values are integers within the range 1 through 100.

   This percentage is applied to the overall remaining occupancy of the SLB after trusted (confirmed) users are accounted for. For example, when empty, the SLB holds two million forwarding rules; assuming the default setting, at most 400,000 rules are reserved for untrusted rules. By the time one million users have been promoted, 20% of the remaining space means that up to 200,000 entries can be used for untrusted users.

   max-untrusted-upper-threshold specifies a threshold level at which the SLB (1) raises an alarm, and (2) issues an SNMP trap reporting an excessive number of untrusted endpoints within the entire endpoint population.

   This parameter, which has a default setting of 80 (percent), is calculated as a percent of **max-untrusted-percentage**. For example, assuming default settings for both parameters, the SLB raises an alarm and issues an SNMP trap when the percentage of untrusted endpoints attains 16%.

   max-untrusted-lower-threshold specifies a threshold level at which the SLB (1) clears the existing untrusted endpoint alarm, and (2) issues an SNMP trap reporting alarm clearance.

This parameter, which has a default setting of 70 (percent), is calculated as a percent of **max-untrusted-percentage**. For example, assuming default settings for both parameters, the SLB clears an alarm and issues an SNMP trap when the percentage of untrusted endpoints falls to 14%.

```
ACMEPACKET(lbp-config)# untrusted-grace-period 30
ACMEPACKET(lbp-config)# max-untrusted-percentage 20
ACMEPACKET(lbp-config)# max-untrusted-upper-threshold 80
ACMEPACKET(lbp-config)# max-untrusted-lower-threshold 70
ACMEPACKET(lbp-config)#
```

5. Use the **endpoint-capacity-upper-threshold** and **endpoint-capacity-lower-threshold** parameters to implement license-based management and monitoring of the SLB endpoint counts.

   endpoint-capacity-upper-threshold specifies a threshold level at which the SLB (1) raises an alarm, and (2) issues an SNMP trap reporting an excessive number of active endpoints.

   This parameter, which has a default setting of 80 (percent), is calculated as a percentage of the endpoints allowed by the installed SLB license.

   endpoint-capacity-lower-threshold specifies a threshold level at which the SLB (1) clears the existing endpoint alarm, and (2) issues an SNMP trap reporting alarm clearance.

   This parameter, which has a default setting of 70 (percent), is calculated as a percentage of the endpoints allowed by the installed SLB license.

   ```
   ACMEPACKET(lbp-config)# endpoint-capacity-upper-threshold 80
   ACMEPACKET(lbp-config)# endpoint-capacity-lower-threshold 70
   ACMEPACKET(lbp-config)#
   ```

6. Enable **port-aware-balancing** to include endpoint source port, in addition to the source IP and destination service representation when looking up a unique EPT prior to forwarding towards the SBC cluster. Choices are enabled and disabled. Default is disabled.

   ```
   ACMEPACKET(lbp-config)# port-aware-balancing enable
   ACMEPACKET(lbp-config)#
   ```

7. Use **done**, **exit**, and **verify-config** to complete configuration of this load-balancer-policy configuration element.

Sample Load Balancer Policy Configuration

The following formatted extract from **show running-config** ACLI output shows a sample load balancer policy configuration with port-aware-balancing enabled.

```
lbp-config
state                               enabled
log-level                           NOTICE
untrusted-grace-period              30
max-untrusted-percentage            20
max-untrusted-upper-threshold       80
max-untrusted-lower-threshold       70
end-point-capacity-upper-threshold  80
end-point-capacity-lower-threshold  70
red-port                            0
red-max-trans                       500000
red-sync-start-time                 5000
red-sync-comp-time                  1000
port-aware-balancing                enabled
last-modified-by                    admin@console
last-modified-date                  2015-11-07 18:49:04
```

Distribution Policy Configuration

Distributing endpoints equitably among the cluster members is the primary function of the SLB. The lp-config configuration element allows you to control the method of the SLB's distribution based on matching criteria. Using inbound packet matching criteria, you can control the assignment of users to SBCs. Matching is done by data

available up to and including the transport layer of the packet: source IP address and port, destination IP address and port, and transport protocol. The IP addresses and ports may or may not include bit masks as well.

Conceptually, the load balancer policy table, with sample data, looks akin to the following.

Source IP/Mask	Source Port/ Mask	Destination IP/ Mask	Destination Port/Mask	Transport Protocol Requirements (list)	Realm Identifiers (list)
192.168.7.22/32	0/0	10.0.0.1/32	5060/16		West
192.168.1.0/24	0/0	10.0.0.1/32	5060/16	UDP, TCP	North, South, West
192.168.0.0/16	0/0	10.0.0.1/32	5060/16	UDP, TCP	East, West
0.0.0.0/0	0/0	0.0.0.0/0	0/0		

Policies are matched using a longest prefix match algorithm; the most specific policy is selected when comparing policies to received packets. One and only one policy is chosen per packet; if the next hops in that route are all unavailable, the next best route is not consulted (instead, the default policy may be consulted – see below). This is different than the local-policy behavior on the SBC.

Within each policy you may configure multiple next hops, where each next hop is a named group of SBCs. In the sample policy table, this is indicated in the second policy with a source IP range of 192.168.1.0/24. The realm identifier list for this policy indicates North, South, West. Each of these realm identifiers represents a collection of zero or more SBCs, in SBC parlance these are roughly analogous to session-agent groups. Each of these realm identifiers is also assigned a priority (a value between 1 and 31, with 31 representing the highest priority) in the configuration, and the SLB sorts the possible destinations with the highest priority first. Upon receipt of a packet matching a policy with multiple configured realm identifiers, the SLB gives preference to SBCs from the realm identifier with the highest priority. Should no SBCs be available in that priority level (due to saturation, unavailability, and so on.) the SLB moves on to investigate the next priority level, and so on. Should no SBCs become available after traversing the entire list of all SBCs within each priority level, the SBC either drops the packet or attempt to use the default policy.

The bottom row of the sample table shows this implicit, last resort default policy. When enabled, the SLB reverts to the default policy when all of the potential next hop realms referenced in the endpoint's distribution rule are unavailable. In that event, the default policy attempts to locate a clustered SBC that advertises support for the service-interface that the packet arrived on. The realm is not considered when matching to the default policy. If such an SBC is found, the SLB forwards the packet to that SBC; if such an SBC is not found, the SLB drops the packet.

It is not necessary to configure the default policy — it is simply intended as a catchall policy, and may be used when all that is required is a simple round-robin balancing scheme based on simple metrics (for example, CPU utilization and number of registrations currently hosted by an SBC). If no policies are configured on the SLB, the default policy is used. The default realm is implied in the above table as * and is enabled by default for policy records.

Use the following procedure to perform required lb-config configuration.

1. From superuser mode, use the following ACLI command sequence to access lb-config configuration mode. While in this mode, you configure the distribution rules used to implement policy-based load balancing on the SLB.

```
ACMEPACKET# configure terminal
ACMEPACKET(configure)# session-router
ACMEPACKET(session-router)# lb-policy
ACMEPACKET(lb-policy)# ?
state                    lb policy state
default-realm            use default realm
description              load balancer policy description
protocols                list of protocols
lb-realms                list of realms
                               name
                               priority
```

```
source-addr             source ip address
destination-addr        destination ip address
select                  select lb policy
no                      delete lb policy
show                    show lb policy
done                    save lb policy information
exit                    return to previous menu
ACMEPACKET(lb-policy)#
```

2. Use the **state** parameter to enable or disable this distribution rule.

   The default setting, enabled, enables the distribution rule; disabled disables the rule.

```
ACMEPACKET(lb-policy)# state enabled
ACMEPACKET(lb-policy)#
```

3. Use the **default-realm** parameter to enable or disable the default distribution policy.

   The default setting, enabled, enables the default policy; disabled disables the policy.

   With **default-realm** enabled, the SLB provides a best-effort delivery model if the next-hop realms listed in this distribution rule are unavailable. With **default-realm** disabled, the orphaned packet is dropped.

```
ACMEPACKET(lb-policy)# default-realm enabled
ACMEPACKET(lb-policy)#
```

4. Optionally use the **description** parameter to provide a description of this distribution rule.

```
ACMEPACKET(lb-policy)# description Local traffic to Los Angeles site
ACMEPACKET(lb-policy)#
```

5. Use the **protocols** parameter to construct a list of protocols that must be supported by this distribution rule.

```
ACMEPACKET(lb-policy)# protocols udp
ACMEPACKET(lb-policy)#
```

6. Use either the **source-addr** parameter or the **destination-address** parameter to specify matching criteria for this distribution rule.

   Use the **source-addr** parameter to specify source-address-based matching criteria.

   Packets whose source IP addresses match the criteria specified by this parameter are subject to this distribution rule.

```
ACMEPACKET(lb-policy)# source-addr 10.0.0.1
ACMEPACKET(lb-policy)#
```

   matches any port on the specified IP source address

```
ACMEPACKET(lb-policy)# source-addr 10.0.0.1:5060
ACMEPACKET(lb-policy)#
```

   matches the specified IP source address:port pair

```
ACMEPACKET(lb-policy)# source-addr 10.0.0.1/24
ACMEPACKET(lb-policy)#
```

   matches any IP source address, any port on the 10.0.0.x subnet

```
ACMEPACKET(lb-policy)# source-addr 10.0.0.240/28:5060
ACMEPACKET(lb-policy)#
```

   matches IP source addresses 10.0.0.240:5060 through 10.0.0.255:5060

   Use the **destination-addr** parameter to specify destination-address-based matching criteria.

   Packets whose destination IP addresses match the criteria specified by this parameter are subject to this distribution rule.

```
ACMEPACKET(lb-policy)# destination-addr 10.0.0.1
ACMEPACKET(lb-policy)#
```

   matches any port on the specified IP destination address

```
ACMEPACKET(lb-policy)# destination-addr 10.0.0.1:5060
ACMEPACKET(lb-policy)#
```

matches the specified IP destination address:port pair

```
ACMEPACKET(lb-policy)# destination-addr 10.0.0.1/24
ACMEPACKET(lb-policy)#
```

matches any IP destination address, any port on the 10.0.0.x subnet

```
ACMEPACKET(lb-policy)# destination-addr 10.0.0.240/28:5060
ACMEPACKET(lb-policy)#
```

matches destination IP addresses 10.0.0.240:5060 through 10.0.0.255:5060

7. Use the **lb-realms** parameter to access lb-realm configuration mode.

   While in lb-realm configuration mode you identify one or more SBCs eligible to receive traffic that matches this distribution rule.

```
ACMEPACKET(lb-policy)# lb-realms
ACMEPACKET(lb-realm)#
name              realm name (string identifier)
priority          priority (range 1-31)
select            select a lb realm to edit
no                delete selected lb realm
show              show lb realm information
done              write lb realm information
exit              return to previous menu
ACMEPACKET(lb-realm)#
```

8. Use the **name** parameter to identify the realm.

   As previously discussed, the name field is roughly analogous to an SBC session-agent group. SBCs configured to communicate within a cluster hosted by an SLB advertise offered services to the SLB. These services (for example, SIP support) exist in realms, whose names are sent to the SLB as part of the SBC advertisement. The SLB, upon receipt of these advertisements, joins each SBC into one or more realm identifier groups based upon the realm name(s) the SBC has offered up. The **name** command of the lb-realm configuration element matches this distribution rule to a supporting SBC that has offered that realm name for cluster membership.

```
ACMEPACKET(lb-realm)# name LosAngeles
ACMEPACKET(lb-realm)#
```

9. Use the **priority** parameter to specify the realm priority.

   Priority is expressed as an integer value within the range 0 to 31 — the higher the integer, the greater the priority.

   The default value, 0, specifies use of the default routing policy, and should not be used when policy-based distribution is enabled.

   Priority values are considered when multiple SBCs offer the same service to matched packets.

```
ACMEPACKET(lb-realm)# priority 31
ACMEPACKET(lb-realm)#
```

10. Use **done**, **exit**, and **verify-config** to complete configuration of this lb-realm configuration element.
11. To specify other eligible SBCs, repeat Steps 7 through 10. For example,

```
ACMEPACKET(lb-config)# lb-realms
ACMEPACKET(lb-realm)# name LasVegas
ACMEPACKET(lb-realm)# priority 25
ACMEPACKET(lb-realm)# done
ACMEPACKET(lb-realm)# exit
ACMEPACKET(lb-realm)# verify-config
```

12. Use **done**, **exit**, and **verify-config** to complete configuration of this distribution rule.
13. To specify additional distribution rules, repeat Steps 1 through 12 as often as necessary.

Sample Distribution Rule Configurations

The following formatted extract from **show running-config** ACLI output shows sample distribution rule configurations.

```
lb-policy
state                enabled
default-realm        enabled
description
protocols            TCP
       lb-realm
       name          Realm192p1
       priority      10
source-addr          1.1.0.0/16
destination-addr     0.0.0.0/0
last-modified-by     admin@console
last-modified-date   2013-11-07 18:58:10
lb-policy
state                enabled
default-realm        enabled
description
protocols            TCP
       lb-realm
       name          Realm192p1
       priority      7
source-addr          1.20.0.0/16
destination-addr     0.0.0.0/0
last-modified-by     admin@console
last-modified-date   2013-11-07 19:01:01
lb-policy
state                enabled
default-realm        enabled
description
protocols            TCP
       lb-realm
       name          Realm192p1
       priority      5
source-addr          1.120.0.0/16
destination-addr     0.0.0.0/0
last-modified-by     admin@console
last-modified-date   2013-11-07 19:00:49
lb-policy
state                enabled
default-realm        enabled
description
protocols            TCP
       lb-realm
       name          Realm192p1
       priority      3
```

Forced Rebalance

The **notify ccd rebalance** ACLI command initiates an immediate forced rebalance operation. A forced rebalance operation is identical to the one described in the Rebalancing section.

notify ccd rebalance [cancel [sd-name]]

```
ACMEPACKET# notify ccd rebalance
```

initiates the forced rebalance by calculating drop counts for each eligible cluster member, and then requesting drops from the first cluster member in the rebalance queue.

```
ACMEPACKET# notify ccd rebalance cancel
```

terminates the forced rebalance.

```
ACMEPACKET# notify ccd rebalance cancel ~sam
```

terminates the forced rebalance for a specified cluster member. Note the use of tilde special character, which forces the SLB to do a substring match of the following string against all cluster member names. Assuming a cluster member samadams@172.30.68.31 — that cluster member removes itself from the rebalance queue, if it has not yet removed endpoints, or ceases endpoint removal and exits the queue if it is currently doing so.

The **notify ccd drop** ACLI command instructs the target cluster member to drop a specific number of endpoints from a specific realm, from all realms, or without regard for realm.

notify ccd drop <sd-name> (<realm> <number> | <number>)

```
ACMEPACKET# notify ccd drop ~sam boston 100
```

instructs the target cluster member to drop 100 endpoints from the boston realm

```
ACMEPACKET# notify ccd drop ~sam * 100
```

using the * special character instructs the target cluster member to drop 100 endpoints from all realms

```
ACMEPACKET# notify ccd drop ~sam 100
```

instructs the target cluster member to drop 100 endpoints without regard for realm

SBC Configuration

This section describes the configuration necessary to allow an SBC to join a cluster. Configuration is simplified to allow for an easy and seamless migration from a deployed standalone SBC to a deployed clustered SBC. There are only two places where new configuration is required: in the network-interface configuration element, where tunnel information is defined; and in the signaling application's interface, (the sip-interface configuration element).

SBC Tunnel Configuration

Configuring the properties of the IP-in-IP tunnel on the SBC is a matter of configuring the local IP address, remote IP address, and specifying transport layer and application layer protocol support.

The following example uses a tunnel named sipSignaling, which was initially and partially configured on the SLB. Note in the following configuration that the value of **remote-ip-address** parameter must agree with the value which was previously set with the **local-ip-address** parameter on the SLB. The complementary configuration performed on the SBC enables tunnel establishment between the SBC and the SLB.

1. From superuser mode, use the following ACLI command sequence to access tunnel-config configuration mode. While in this mode, you perform required SBC tunnel configuration.

```
ACMEPACKET# configure terminal
ACMEPACKET(configure)# system
ACMEPACKET(system)# network-interface
ACMEPACKET(network-interface)# tunnel-config
ACMEPACKET(tunnel-config)# ?
name                  tunnel name
local-ip-address      tunnel local IP address
remote-mac-address    tunnel remote mac address
remote-ip-address     tunnel remote IP address
application           application protocol for this tunnel
port                  tunnel local & remote control ports
protocol              tunnel control transport protocol
tls-profile           tunnel control TLS profile
traffic-policy                              Name of traffic policy that

            applies to this tunnel
select                select tunnel to edit
no                    delete tunnel
show                  show tunnel
done                  write tunnel information
```

```
exit                    return to previous menu
ACMEPACKET(tunnel-config)#
```

2. Use the **name** command to provide a unique identifier for this tunnel instance.

```
ACMEPACKET(tunnel-config)# name sipSignaling
ACMEPACKET(tunnel-config)#
```

3. Use the **local-ip-address** parameter to specify the IP address at the SBC end of the tunnel.

Note: This address also supports the exchange of CCP messages.

```
ACMEPACKET(tunnel-config)# local-ip-address 1.1.1.100
ACMEPACKET(tunnel-config)#
```

4. Ignore the **remote-mac-address** parameter which is not required for tunnel configuration.
5. Use the **remote-ip-address** parameter to specify the IP address at the SBC end of the tunnel.

Note: This address also supports the exchange of CCP messages.

```
ACMEPACKET(tunnel-config)# remote-ip-address 182.16.204.210
ACMEPACKET(tunnel-config)#
```

6. Use the **port** parameter to specify the port used to send and receive cluster control messages.

```
ACMEPACKET(tunnel-config)# port 4444
ACMEPACKET(tunnel-config)#
```

7. Use the **protocol** parameter to specify the transport protocol used in support of cluster control messages.

   Supported transport protocol is UDP (the recommended default).

```
ACMEPACKET(tunnel-config)# protocol UDP
ACMEPACKET(tunnel-config)#
```

8. Use the **application** parameter to specify the application protocol supported by this tunnel.

   Specify the SIP protocol.

```
ACMEPACKET(tunnel-config)# application SIP
ACMEPACKET(tunnel-config)#
```

9. Use **traffic-policy** to enter the name of the traffic policy that applies to this tunnel (1-128 characters long) as configured on the SLB

   This configuration is a per-tunnel configuration. Once configured, it will be passed on via the CCP protocol to SLB in Heartbeat messages.

   The CCD task running on the SLB will extract the traffic policy name and will find the matching traffic-policy configuration on the SLB.

```
ACMEPACKET(tunnel-config)# traffic-policy <pattern>
ACMEPACKET(tunnel-config)#
```

10. Use **done**, **exit**, and **verify-config** to complete configuration of this tunnel-config configuration element.
11. Repeat Steps 1 through 9 to complete tunnel configuration on other SIP interfaces as required.

Sample SBC Tunnel Configuration

The following formatted extract from **show running-config** ACLI output shows a sample SBC (cluster member) configuration.

```
tunnel-config
name                          one
local-ip-address              1.1.1.100
remote-mac-address
remote-ip-address
port                          4444
protocol                      UDP
tls-profile
```

```
application                     SIP
last-modified-by                admin@console
last-modified-date              2013-11-10 23:24:15
```

Note: This configuration is a per-tunnel configuration. Once configured, it will be passed on via the CCP protocol to SLB in Heartbeat messages.

SIP Configuration

In a traditional SBC configuration the IP address assigned to a sip-port configuration element is contained within the address space defined by the network interface netmask. This is not be the case for clustered SBCs. Rather, the IP address assigned to the sip-port is identical to the address of an SLB service-port advertised on the access network. The process of encapsulating the packets between the SLB and SBC masks the fact that the IP address the SBC expects to receive IP packets on is different than the Layer 5 address the SBC expects the SIP address on.

Consistency of realm identification is vital to successful and predictable policy-based load balancing. Take particular care to ensure that the **realm-id** of the sip-interface configuration element mirrors the **lb-realm** assignments made while configuring distribution rules. See the Distribution Policy Configuration section.

In the following configuration example, the **realm-id** is LosAngeles. This SBC, when booted, will detect that it is a member of an SLB cluster and register the service port 10.0.0.1:5060/UDP as the realm LosAngeles with the SLB. The SLB will automatically create the SBC group LosAngeles (if it doesn't exist) or join the SBC to the group LosAngeles (if it is not the first to advertise LosAngeles). Policy statements that direct packets to LosAngeles now consider this SBC as a potential destination, assuming the address:port/protocol also are consistent with the policy's matching criteria.

This technique allows you to configure the same IP:port/protocol on multiple SBCs, with different realm-id labels, to indicate priority of one SBC or group of SBCs over another. As an example, consider several SBCs geographically situated together with the label LosAngeles, and several other SBCs geographically situated elsewhere with the label NewYork, all with the identical SIP interface and SIP port configuration. A policy can be easily defined to give preference to a source subnet of users in California to the LosAngeles member SBCs, with NewYork as a second priority. This provides flexibility in network design without undue burden in the configuration: SBCs' tagged with the same realm name are joined in dynamically created SBC groups by the SLB, with no explicit configuration required on the SLB whatsoever.

1. From superuser mode, use the following ACLI command sequence to access sip-interface configuration mode. While in this mode, you verify the **realm-id** and assign the newly created IP-in-IP tunnel to a SIP interface.

```
westy# configure terminal
westy(configure)# session-router
westy(session-router)# sip-interface
westy(sip-interface)# select
<realm-id>: LosAngeles
1: LosAngeles  172.192.1.15:5060
selection: 1
westy(sip-interface)# show
sip-interface
        state                   enabled
        realm-id                LosAngeles
        ...
        ...
        ...
westy(sip-interface)#
```

2. Use the **tunnel-name** parameter to assign the IP-in-IP tunnel to the current SIP interface.

```
westy(sip-interface)# tunnel-name sipSignaling
westy(sip-interface)# ?
```

3. Use the **sip-port** command to move to sip-port configuration mode.

```
westy(sip-interface)# sip-port
westy(sip-port)# ?
address            IP Address
port               port (default: 5060)
```

```
transport-protocol transport protocol
tls-profile        the profile name
allow-anonymous    allowed requests from SIP realm
ims-aka-profile    ims-aka profile name
select             select a sip port to edit
no                 delete a selected sip port
show               show sip port information
done               write sip port information
exit               return to previous menu
westy(sip-port)#
```

4. Use the **address**, **port**, and **transport-protocol** parameters to mirror the address of an existing SLB service port.

```
westy(sip-port)# address 10.0.0.1
westy(sip-port)# port 5060
westy(sip-port)# transport-protocol udp
westy(sip-port)#
```

5. Use **done**, **exit**, and **verify-config** to complete configuration of this sip-port configuration element.
6. Repeat Steps 1 through 5 as necessary to verify **realm-id**s, assign IP-in-IP tunnels, and create mirrored service ports on additional SIP interfaces.

Online Offline Configuration

The **set-system-state** ACLI command provides the ability to temporarily place a clustered SBC in the offline state. The offline setting puts the SBC into a state where it is powered on and available only for administrative purposes.

The transition to the offline state is graceful in that existing calls are not affected by the state transition. The SBC informs the SLB of the impending status change via a CCP message. Upon receiving such a message, the SLB ceases to forward new endpoints to the SBC, and places the SBC in the Shutdown state. The SBC, for its part, enters a state that results in the rejection of any incoming out-of-dialog SIP requests. Eventually all calls compete, registrations expire and are removed by the SLB, and returning endpoints are allotted to active SBCs.

Use the **set-system-state offline** ACLI command to place an SBC in the offline state.

```
ACMEPACKET# set-system-state offline
Are you sure you want to bring the system offline? [y/n]?: y
Setting system state to going-offline, process will complete when all current
calls have completed
ACMEPACKET#
```

Note: An SBC in the offline state plays no role in a balance or rebalance operation.

In a similar fashion use the **set-system-state online** ACLI command to place an SBC in the online state.

```
ACMEPACKET# set-system-state online
Are you sure you want to bring the system online? [y/n]?: y
Setting system state to online
ACMEPACKET#
```

4

SLB/Cluster Management & Diagnostics

SLB Statistics

The SLB provides the operator with a full set of statistical data for troubleshooting and diagnostic purposes. This section describes current statistical outputs and defines displayed values. It is important to become familiar with the data and the collection process when opening trouble tickets as service personnel will rely upon this information to assist you in diagnosing hardware, software, and/or network issues.

show run lbp-config

The **show run lbp-config** command displays load balancer policy attributes

```
utopias# show run lbp-config
lbp-config

        state                           enabled
        log-level                       CRITICAL
        untrusted-grace-period          30
        max-untrusted-percentage        20
        max-untrusted-upper-threshold   80
        max-untrusted-lower-threshold   70
        endpoint-capacity-upper-threshold 80
        endpoint-capacity-lower-threshold 70
        red-port                        2000
        red-max-trans                   500000
        red-sync-start-time             5000
        red-sync-comp-time              1000
        port-aware-balancing            enabled
        last-modified-by                admin@console
        last-modified-date              2015-10-26 19:11:58
task done
```

show balancer

The **show balancer** command is the root of all statistical data pertinent to SLB operation. Below is a list of valid arguments, which are described in further detail in the following sections:

```
ACMEPACKET# show balancer ?
end-points  show session load balancer end-points
members     show session load balancer cluster member summary
metrics     show load balancer metrics
```

```
realms      show load balancer realms
tunnels     show session load balancer statistics
statistics  show session load balancer IP-in-IP tunnel info
ACMEPACKET#
```

show balancer endpoints

The **show balancer endpoints** command displays a full list of all IP-to-SBC mappings resident in the SLB. As the SLB can hold up to ten million entries, the output of this command can and will grow very large, and extreme caution should be exercised when executing this command on a heavily trafficked SLB system.

```
ACMEPACKET# show balancer endpoints
IP address Port Access   Core     Flags    SBC  Handle
---------  ---- -------- -------- -------- ---- ------
15.0.0.24  5060 00134324 10134324 c0000000 1023 [wigglytuff@172.30.45.71]
15.0.0.22  5060 00134323 10134323 c0000000 1022 [jigglypuff@172.30.45.70]
15.0.0.20  5060 00134322 10134322 c0000000 1021 [tuono]
15.0.0.18  5060 00134321 10134321 c0000000 1020 [superduke]
15.0.0.16  5060 00134320 10134320 c0000000 1023 [wigglytuff@172.30.45.71]
15.0.0.14  5060 00134319 10134319 c0000000 1022 [jigglypuff@172.30.45.70]
15.0.0.12  5060 00134318 10134318 c0000000 1021 [tuono]
15.0.0.10  5060 00134317 10134317 c0000000 1020 [superduke]
15.0.0.8   5060 00134316 10134316 c0000000 1023 [wigglytuff@172.30.45.71]
15.0.0.6   5060 00134315 10134315 c0000000 1022 [jigglypuff@172.30.45.70]
15.0.0.4   5060 00134314 10134314 c0000000 1021 [tuono]
15.0.0.2   5060 00134313 10134313 c0000000 1020 [superduke]
ACMEPACKET#
```

The table provided by **show balancer endpoints** displays every endpoint mapping. In the above example, note that IP addresses in the 14.0.134.0/24 space are being distributed among a number of SBCs. The IP address and Port columns pinpoint a specific endpoint. The Index, Address, and Flags columns contain SLB internal reference identifiers for locating that specific endpoint in memory. The SBC Handle column identifies which SBC serves that endpoint; use the **show balancer members** command to display a mapping of SBC names to SBC handles.

You can use optional command arguments to filter/restrict command output.

show balancer endpoints <ip-address> restricts the display to one endpoint.

For example:

```
show balancer endpoints address 14.0.134.232
```

displays data for the specified IP endpoint

show balancer endpoints <ip-address>/<:port_num>restricts the display to a specific port on a specific IP address.

For example:

```
show balancer endpoints address 14.0.134.232:5060
```

displays data for port 5060 on the specified endpoint.

show balancer endpoints <ip-address>/<bit-mask-len> restricts the display to a contiguous range of endpoint addresses.

For example:

```
show balancer endpoints address 14.0.134.0/24
```

displays data for the 14.0.134.0 subnet.

```
show balancer endpoints address 14.0.134.240/28
```

displays data for endpoint addresses 14.0.134.240 through 14.0.134.255.

```
show balancer endpoints <ip-address>/<bit-mask-len><:port_num>
```

displays data for a specific port on a contiguous range of endpoint addresses.

show balancer members

The **show balancer members** command provides a list of all SBCs that have registered with the SLB.

```
ACMEPACKET# show balancer members
ural# show balancer members
SBC  Name                      Source Address   Destination Address  S/P/VLAN
Endpoints
---- ------------------------- --------------- -------------------- --------
---------
1020 superduke                 68.68.68.100     68.68.68.5           0/0/0
3
1021 tuono                     68.68.68.100     68.68.68.4           0/0/0
3
1022 jigglypuff@172.30.45.70   68.68.68.100     68.68.68.1           0/0/0
3
1023 wigglytuff@172.30.45.71   68.68.68.100     68.68.68.2            0/0/0
3

              max endpoints: 12
    max untrusted endpoints: 200
          current endpoints: 12
current untrusted endpoints: 0
               current SBCs: 4
ACMEPACKET#
```

SBC contains the SBC handle, an internal shorthand that identifies a specific SBC. The **show balancer members** command provides a handle-to-hostname mapping.

Name contains the SBC hostname. Standalone SBCs are displayed as hostname@IP address, and highly available SBCs (csbc1a in the above display) are displayed as hostname.

Source IP contains the local (SLB) tunnel address.

Destination IP contains the remote (SBC) tunnel address.

Slot, Port, and Vlan identify the local interface that supports the SLB-to-SBC tunnel.

endpoints contains the number of endpoint-SBC associations that the SLB created for each specific SBC,

max endpoints contains the licensed capacity of the SLB.

max untrusted endpoints contains the maximum allowed number of untrusted endpoints.

current endpoints contains the current number of endpoints, trusted and untrusted

current untrusted endpoints contains the current number of untrusted endpoints.

show balancer metrics

The **show balancer metrics** command displays a comparison between the number of local endpoints (that is, the associations between source addresses and each SBC) and the number of remote endpoints (that is, what the SBC reports to the SLB as the number of endpoints it has received via the tunneled interface). Note that in the example output below those two numbers are the same; this is true if and only if there are no users in the access network that have multiple phone lines sourced from the same IP address. Were that the case, the number of remote endpoints would be higher than the number of local endpoints.

This table is populated with the data received in the periodic heartbeats from the SBC to the SLB. As these heartbeats are somewhat infrequent (every two seconds by default), the data in this table should only be considered accurate within two seconds.

```
ACMEPACKET# show balancer metrics
                            local  remote                    max
SBC Name                    epts   epts    max reg   CPU    CPU
--- ----------------------- ------ ------- -------- ----   ----
 93 magichat@172.30.68.34   0      0       480000    2.7   90.0
 94 westy                   0      0       480000    2.7   90.0
```

```
 95 samadams@172.30.68.33     0      0       480000    2.8  90.0
 96 bass@172.30.68.35         0      0       480000    4.3  90.0
 97 sixtus@172.30.68.36       0      0       480000    2.9  90.0
 98 newcastle@172.30.68.37    0      0       480000    2.9  90.0
 99 guiness@172.30.68.33      0      0       480000    3.6  90.0
ACMEPACKET#
```

SBC contains the SBC handle.

Name contains the SBC hostname.

max reg contains the maximum number of endpoints the SLB will send to this specific SBC. Its value is derived from the product of the **session-multiplier** parameter in the cluster-config configuration element and the SBC's licensed session capacity. The SBC passes this value to the SLB during the SBC's registration process into the cluster.

CPU contains the last received information on the CPU percentage from this SBC.

max CPU contains the threshold percentage at which the SBC is removed from consideration for the assignment of new endpoints. The default value is 90%, and may be changed on an SBC by setting the load-limit value as a SIP configuration option.

show balancer realms

The **show balancer realms** command displays a composite list of realms that all member SBCs have registered with the SLB.

```
ACMEPACKET# show balancer realms
Realm        SBC Tunnel Name                      ref count endpoints
-----------  --- ------ ------------------------ --------- ---------
access        99   4092 newcastle@172.30.68.37           1     53535
access        98   4091 magichat@172.30.68.34            1     53535
access        97   4090 augustiner@172.30.68.41          1     53535
access        94   4086 bass@172.30.68.35                1     53535
access        93   4085 westy@172.30.68.42               1     53535
access        92   4084 sixtus@172.30.68.36              1     53535
access        96   4089 guiness@172.30.68.33             1     53535
net-13        99   4088 samadams@172.30.68.31            1     62550
net-13        91   4087 stbernie@172.30.68.43            1     62550
ACMEPACKET#
```

In this example, seven of the nine SBCs have registered the realm access and two have registered the realm net-13. The total number of endpoints for each of these services is indicated in the rightmost column. ref count is reserved for future use.

show balancer statistics

The **show balancer statistics** command displays statistical output pertinent to low-level events on the SLB. The contents and output of this command are subject to change, and will be documented in a subsequent document release.

```
ACMEPACKET# shower-balancer-statistics
LBP not initialized drops                  0
max capacity reached drops                 2
endpoint SBC mismatch errors               0
endpoint table read errors                 0
Tx packet failed count                     0
service not found count                    0
duplicate ept packet drops                 0
msgq drops                                 0
forwarded duplicates                       0
policy miss                            40508
realm miss                                 0
throttle drops                             0
throttle skips                             0
throttle policy skips                      0
```

```
total packets processed                40508
endpoints removed                        0
EPT delete errors                        0
endpoints added                          0
EPT add errors                           0
EPT update errors                        0
group not found                          0
LBP agent not found                      0
invalid endpoint                         0
insert error                             0
untrusted dropped                        0
untrusted age outs                     171
packets dropped in balance               0
packets dropped by standby               0
----------------------------
trusted endpoints (EPT db)               0
untrusted endpoints (EPT db)           337
----------------------------
total trusted endpoints                  0
total untrusted endpoints              337
total endpoints                        337
ACMEPACKET#
```

show balancer tunnels

When implemented on the SLB, the **show balancer tunnels** command generates a list of data for each tunnel between the SLB and its clustered SBCs. It includes the tunnel source and destination addresses, as well as an internal switch ID (swid) for this tunnel.

```
ACMEPACKET# show balancer tunnels
1020(1025/1026)::
outer src addr = 68.68.68.100
outer dst addr = 68.68.68.5
slot/port/vlan = 0/0/0
traffic policy selected: "" ;  traffic policy configured: implicit defaults.
  service: 172.16.2.3:5060 [access] protocols: 17/21588

1021(1025/1026)::
outer src addr = 68.68.68.100
outer dst addr = 68.68.68.4
slot/port/vlan = 0/0/0
traffic policy selected: "" ;  traffic policy configured: implicit defaults.
  service: 172.16.2.3:5060 [access] protocols: 17/21588

1022(1025/1026)::
outer src addr = 68.68.68.100
outer dst addr = 68.68.68.1
slot/port/vlan = 0/0/0
traffic policy selected: "" ;  traffic policy configured: implicit defaults.
  service: 172.16.2.3:5060 [access] protocols: 17/21588

1023(1025/1026)::
outer src addr = 68.68.68.100
outer dst addr = 68.68.68.2
slot/port/vlan = 0/0/0
traffic policy selected: "" ;  traffic policy configured: implicit defaults.
  service: 172.16.2.3:5060 [access] protocols: 17/21588

ACMEPACKET# show balancer tunnels
errors       fragments    statistics
```

Use the **error** argument for error reporting and troubleshooting.

```
ACMEPACKET# show balancer tunnels errors
src addr 68.68.68.100 / dst addr 68.68.68.5 / slot 0 / port 0 / vlan 0:
```

```
  Proto Encaps Errors Decaps Errors
  ----- ------------- -------------
  17               0             0

src addr 68.68.68.100 / dst addr 68.68.68.4 / slot 0 / port 0 / vlan 0:
  Proto Encaps Errors Decaps Errors
  ----- ------------- -------------
  17               0             0

src addr 68.68.68.100 / dst addr 68.68.68.1 / slot 0 / port 0 / vlan 0:
  Proto Encaps Errors Decaps Errors
  ----- ------------- -------------
  17               0             0

src addr 68.68.68.100 / dst addr 68.68.68.2 / slot 0 / port 0 / vlan 0:
  Proto Encaps Errors Decaps Errors
  ----- ------------- -------------
  17               0             0

unknown protocol:      0
do not fragment drops: 0
no matching tunnel:    0
service lookup failed: 0
IP frag msg failure:   0
mblk alloc failues:    0
IP frame too large:    0
unknown errors:        0
unknown errors:        0
ACMEPACKET#show balancer tunnels
errors       fragments    statistics
```

The **show balancer tunnels error** command can also be executed on an SBC cluster member. In this usage, the displayed data is restricted to errors between the specific cluster member and the SLB.

Use the **fragments** argument for information related to packet fragmentation/reassembly details.

```
ACMEPACKET# show balancer tunnels fragments
src addr 68.68.68.100 / dst addr 68.68.68.5 / slot 0 / port 0 / vlan 0:
  IP:Port:      172.16.2.3:5060
  Proto Encap Pkts Encap Octets Decap Pkts Decap Octets
  ----- ---------- ------------ ---------- ------------
  17             3         1239          0            0


src addr 68.68.68.100 / dst addr 68.68.68.4 / slot 0 / port 0 / vlan 0:
  IP:Port:      172.16.2.3:5060
  Proto Encap Pkts Encap Octets Decap Pkts Decap Octets
  ----- ---------- ------------ ---------- ------------
  17             3         1240          0            0


src addr 68.68.68.100 / dst addr 68.68.68.1 / slot 0 / port 0 / vlan 0:
  IP:Port:      172.16.2.3:5060
  Proto Encap Pkts Encap Octets Decap Pkts Decap Octets
  ----- ---------- ------------ ---------- ------------
  17             3         1243          0            0


src addr 68.68.68.100 / dst addr 68.68.68.2 / slot 0 / port 0 / vlan 0:
  IP:Port:      172.16.2.3:5060
  Proto Encap Pkts Encap Octets Decap Pkts Decap Octets
  ----- ---------- ------------ ---------- ------------
  17             3         1244          0            0
```

```
ACMEPACKET#show balancer tunnels
errors       fragments    statistics
```

The **show balancer tunnels fragments** command can also be executed on an SBC cluster member. In this usage, the displayed data is restricted to fragmentation operations between the specific cluster member and the SLB.

Use the **statistics** argument for information related to packet counts.

```
ACMEPACKET# show balancer tunnels statistics
src ip 182.16.203.83 / dst ip 182.16.203.87 / slot 0 / port 1 / vlan 0:
  IP:Port:  192.169.203.83:5050
  Proto Encap Pkts Encap Octets Decap Pkts Decap Octets
  ----- ---------- ------------ ---------- ------------
  6              0            0          0            0
  IP:Port:  192.169.203.83:5060
  Proto Encap Pkts Encap Octets Decap Pkts Decap Octets
  ----- ---------- ------------ ---------- ------------
  17         48011     24213914          0            0
src ip 182.16.203.83 / dst ip 182.16.203.86 / slot 0 / port 1 / vlan 0:
  IP:Port:  192.169.203.83:5060
  Proto Encap Pkts Encap Octets Decap Pkts Decap Octets
  ----- ---------- ------------ ---------- ------------
  17         48017     24217918          0            0
ACMEPACKET#
```

The **show balancer tunnels statistics** command can also be executed on an SBC cluster member. In this usage, the displayed data is restricted to traffic counts between the specific cluster member and the SLB.

Cluster Control Protocol Statistics

The CCP provides the operator with a full set of statistical data for troubleshooting and diagnostic purposes.

show ccd

The **show ccd** command is the root of all statistical data pertinent to CCP operation. Below is a list of valid arguments, which are described in further detail in the following sections:

```
ACMEPACKET# show ccd ?
ccp         Cluster Control Protocol Stats
rebalance   Display rebalance queue
reset       Reset Stats
sds         Controlled SDs
stats       Cluster Control Stats
ACMEPACKET#
```

show ccd ccp

The **show ccd ccp** command displays aggregated data (that is, from all cluster members) about specific CCP operations.

```
ACMEPACKET# show ccd ccp
--------------------
M01:0
--------------------
Svc Add               Recent      Total  PerMax
====================  ======  =========  ======
Ops Recvd                  0          8       4
Op Replies Sent            0          8       4
                      -------- Received -------   ----------  Sent --------
Status Code           Recent      Total  PerMax   Recent      Total  PerMax
-----------           ------  ---------  ------   ------  ---------  ------
200 OK                     0          0       0        0          8       4
EP Del                Recent      Total  PerMax
====================  ======  =========  ======
```

```
Ops Recvd                    0       3984    1013
Duplicate Ops                0         12       6
Op Replies Sent              0       3984    1013
                        -------- Received -------   ----------  Sent --------
Status Code             Recent      Total  PerMax   Recent      Total  PerMax
-----------             ------  ---------  ------   ------  ---------  ------
200 OK                       0          0       0        0       3984    1013
EP Promo                Recent      Total  PerMax
==================      ======  =========  ======
Ops Recvd                    0     115601    8187
Duplicate Ops                0        329      23
Op Replies Sent              0     115601    8187
                        -------- Received -------   ----------  Sent --------
Status Code             Recent      Total  PerMax   Recent      Total  PerMax
-----------             ------  ---------  ------   ------  ---------  -
200 OK                       0          0       0        0     115601    8187
Metrics                 Recent      Total  PerMax
==================      ======  =========  ======
Ops Recvd                   57      16330      75
Op Replies Sent             57      16331      75
                        -------- Received -------   ----------  Sent --------
Status Code             Recent      Total  PerMax   Recent      Total  PerMax
-----------             ------  ---------  ------   ------  ---------  -
200 OK                       0          0       0       57      16328      75
406 Not Accept               0          0       0        0          3       3
Prov Done               Recent      Total  PerMax
==================      ======  =========  ======
Ops Recvd                    0          6       3
Op Replies Sent              0          6       3
                        -------- Received -------   ----------  Sent --------
Status Code             Recent      Total  PerMax   Recent      Total  PerMax
-----------             ------  ---------  ------   ------  ---------  -
200 OK                       0          0       0        0          6       3
Going Down              Recent      Total  PerMax
==================      ======  =========  ======
Ops Recvd                    0          1       1
Op Replies Sent              0          1       1
                        -------- Received -------   ----------  Sent --------
Status Code             Recent      Total  PerMax   Recent      Total  PerMax
-----------             ------  ---------  ------   ------  ---------  -
200 OK                       0          0       0        0          1       1
Stop Down               Recent      Total  PerMax
==================      ======  =========  ======
Ops Recvd                    0          8       6
Op Replies Sent              0          9       6
                        -------- Received -------   ----------  Sent --------
Status Code             Recent      Total  PerMax   Recent      Total  PerMax
-----------             ------  ---------  ------   ------  ---------  -
200 OK                       0          0       0        0          6       3
406 Not Accept               0          0       0        0          3       3
ACMEPACKET#
```

Use the hostname argument to display data for a specific cluster member.

```
ACMEPACKET# show ccd ccp westy
--------------------
westy
--------------------
Svc Add                 Recent      Total  PerMax
==================      ======  =========  ======
Ops Recvd                    0          1       1
Op Replies Sent              0          1       1
                        -------- Received ------- ---------- Sent --------
Status Code             Recent      Total  PerMax Recent      Total  PerMax
```

```
-----------             ------  ---------  ------   ------ ---------  ------
200 OK                       0          0       0 0          1       1
EP Del                  Recent      Total  PerMax
==================   ======  =========  ======
Ops Recvd                    0          1       1
Op Replies Sent              0          1       1
                        -------- Received ------- ---------- Sent --------
Status Code             Recent      Total  PerMax Recent      Total  PerMax
-----------             ------  ---------  ------   ------ ---------  ------
200 OK                       0          0       0 0          1       1
EP Promo                Recent      Total  PerMax
==================   ======  =========  ======
Ops Recvd                    0       1002     947
Op Replies Sent              0       1002     947
                        -------- Received ------- ---------- Sent --------
Status Code             Recent      Total  PerMax Recent      Total  PerMax
-----------             ------  ---------  ------   ------ ---------  ------
200 OK                       0          0       0 0       1002     947
Metrics                 Recent      Total  PerMax
==================   ======  =========  ======
Ops Recvd                   20     167849      15
Op Replies Sent             20     167849      15
                        -------- Received ------- ---------- Sent --------
Status Code             Recent      Total  PerMax Recent      Total  PerMax
-----------             ------  ---------  ------   ------ ---------  ------
200 OK                       0          0       0 20     167849      15
Prov Done               Recent      Total  PerMax
==================   ======  =========  ======
Ops Recvd                    0          1       1
Op Replies Sent              0          1       1
                        -------- Received ------- ---------- Sent --------
Status Code             Recent      Total  PerMax Recent      Total  PerMax
-----------             ------  ---------  ------   ------ ---------  ------
200 OK                       0          0       0 0          1       1
Stop Down               Recent      Total  PerMax
==================   ======  =========  ======
Ops Recvd                    0          5       2
Op Replies Sent              0          5       2
                        -------- Received ------- ---------- Sent --------
Status Code             Recent      Total  PerMax Recent      Total  PerMax
-----------             ------  ---------  ------   ------ ---------  ------
200 OK                       0          0       0 0          5       2
ACMEPACKET#
```

show ccd sds

The **show ccd sds** command displays a table containing an overview of all of the data gleaned from the CCP from each SBC.

```
ACMEPACKET# show ccd sds
Session Director        Hdl  State     Tunnel Svcs Version     HW
----------------------- ---- --------- ------ ---- ---- ------ -----
augustiner@172.30.68.41   95 InService  2/2     2  6.2.0.30b8  SD3
bass@172.30.68.35         94 InService  2/2     2  6.2.0.30b8  SD3
guinness@172.30.68.33     96 InService  2/2     2  6.2.0.30b8  SD3
magichat@172.30.68.34     97 InService  2/2     2  6.2.0.30b8  SD3
newcastel@172.30.68.37    98 InService  2/2     2  6.2.0.30b8  SD3
samadams@172.30.68.31     99 InService  2/2     2  6.2.0.30b8  SD3
sixtus@172.30.68.36       92 InService  2/2     2  6.2.0.30b8  SD3
stbernie@172.30.68.43     91 InService  2/2     2  6.2.0.30b8  SD3
westy@172.30.68.42        93 InService  2/2     2  6.2.0.30b8  SD3
ACMEPACKET#
```

Session Director contains the hostname of the cluster SBCs that are connected to the SLB. As with all of the similar statistical output, standalone SBCs are displayed as hostname@eth0 IP address, and highly available SBCs are displayed as hostname.

Hdl contains the clustered SBC handle, an internal shorthand that identifies a specific cluster member. The **show balancer members** command provides a handle to hostname mapping.

State contains the current SBC state. Valid states are:

- Init — during initial handshaking with the SLB
- InService — healthy and operating normally
- Rebalance — during a cluster expansion/contraction operation
- LostControl — no longer communicating with the SLB

Tunnel contains the number of tunnels between the SBC and SLB.

Svcs contains the number of advertised services (protocols) that the SBC has negotiated with the SLB.

Version contains the software version running on that SBC.

HW identifies the hardware platform (in this case, SD3 identifies an Acme Packet 4500 SBC).

LastPing is not currently used.

When issued with an optional hostname argument, the **show ccd sds** command provides a detailed report for the target hostname.

```
ACMEPACKET# show ccd sds bass
Session Director: bass@172.30.68.35
+---------------------------------------------------------------------
|State     : InService       Handle       : 0x5f
|Tunnels   : 1               ServicePorts : 1
|HW Type   : SD3             SW Version   : 6.2.0.30b8
|Last Ping : 1080ms          App Count    : 1
|
|Service:        App  SvcPorts Tunnels endpoints DropCount
+--------------- ---- -------- ------- --------- ---------
access           SIP         1       1    285714         0
|
|#   Tunnel                              App  Handle     Svcs LastHB
+--- ---------------------------------- ---- ---------- ---- -----
|0   (1.1.1.100|1.1.1.15)               SIP  0xffb         1  375ms
Traffic Policy: Implicit Defaults
|
|#   CPU   MAX   CurReg    RegLimit  CurSess   MaxSess
+--- ----- ----- --------- --------- --------- ---------
|0    4.1% 90.0%    285714         0      7336     64000
|     4.1% 90.0%    285714    960000      7736     64000
|
|Service Port                           App  Handle       TunNdx Avail
+------------------------------------ ---- ---------- ------ -----
|access::192.168.168.100:5060<17>       H248     513(1)      0   yes
ACMEPACKET#
```

SBC State

- State — the current SBC state
- Handle — the SBC handle
- Tunnels — the current number of SBC tunnels
- ServicePorts — the current number of SBC service ports
- HW Type — the hardware platform (in this case, SD3 identifies an Acme Packet 4500 SBC)
- SW Version — the installed software revision level
- Last Ping — the number of elapsed milliseconds, since a ping/keepalive was received from this SBC
- App Count — the number of applications supported by the SBC

Services State

- Service — the realm advertised by the SBC in the Service Port ID
- App — the supported protocol: SIP
- SVCPorts — the current number of service ports
- Tunnels — the current number of tunnels
- endpoints — the cumulative number of endpoints for this service
- DropCount — the number of elements to drop when rebalancing this SBC

Tunnel State

- # — the tunnel index (0 or 1)
- Tunnel — the SLB and SBC tunnel IP address
- App — the supported protocol: SIP
- Handle — the handle for the tunnel
- Svcs — the number if service ports supporting the tunnel
- LastHB — the number of elapsed milliseconds since a heartbeat was received from the remote end of this tunnel

Tunnel Metrics

- # — the tunnel number (0 or 1)
- CPU — the current CPU utilization rate
- Max — the maximum supported CPU utilization rate, if this value is exceeded, the tunnel implements a load limit algorithm
- CurReg — the current number of registrations supported by the SBC
- regLimit — the maximum number of registrations supported by the SBC
- CurSess — the current call count reported by the SBC
- MaxSess — the maximum sessions for which the SBC is licensed

Service Port Data

- Service Port — the service path (the concatenation of realm, IP address, port number, and IP Level 4 protocol number — 17 for UDP, 6 for TCP)
- App — the supported protocol: SIP
- Handle — the handle for the service port
- TunNdx — the tunnel the service port is registered for
- Avail — current availability (yes or no) determined by the presence of heartbeats

show ccd stats

The **show ccd stats** command displays endpoint statistics for the SBC members of the cluster.

```
ACMEPACKET# show ccd stats
17:10:09-54
                          -------- Period -------    ---- LifeTime ----
 SD                      Active  Rate   High Total  Total PerMax    High
bass@172.30.68.35       I285714   0.0 285714    0 285.71K 13.76K 285.71K
guinness@172.30.68.33   I285714   0.0 285714    0 285.71K 13.76K 285.71K
magichat@172.30.68.34   I285714   0.0 285714    0 285.71K 13.76K 285.71K
newcastel@172.30.68.37  I285714   0.0 285714    0 285.71K 13.76K 285.71K
samadams@172.30.68.31   I285714   0.0 285714    0 285.71K 13.76K 285.71K
sixtus@172.30.68.36     I285714   0.0 285714    0 285.71K 13.76K 285.71K
westy                   I285714   0.0 285714    0 285.71K 13.76K 285.71K
Total endpoints: 153908
Total SDs      : 9
ACMEPACKET#
```

The Period stats provided represent an accumulation of data for the amount of time specified after the dash separator in the timestamp printed in the first line of output (in this example, the period represents 54 seconds).

The single ASCII character between the SD column and the Active column is the state of that SBC; the letter I represents InService.

The Rate column displays the transmission rate of new endpoint associations to that particular SBC. (In the sample, no new endpoints are arriving in the cluster, so all of the SBCs show a rate of 0.0.) The High field indicates the highest number of active endpoint associations for the current period.

When issued with an optional hostname argument, the **show ccd stats** command provides a detailed report for the target hostname.

```
ACMEPACKET# show ccd stats bass
15:09:25-59
SD bass@172.30.68.33 [InService]
State                  -- Period -- -------- Lifetime --------
            Active    High   Total      Total Permax     High
Tunnels          1       1       0          2      1        1
Service Ports    2       2       0          2      1        2
endpoints    53571   53571      0      53571  14399    53571
Contacts      53571   53571      0      53571  14399    53571
Sessions         0       0       0          0      0        0
Remote CPU       0       0       0          0      0        0
SD Something        ---- Lifetime ----
                          Recent         Total       PerMax
Heartbeats rcvd              30         27426           15
Heartbeats Missed             0             1            1
Tunnel Adds                   0             2            1
Tunnel Removes                0             1            1
Service Adds                  0             2            1
Service Removes               0             0            0
endpoint Removes             0             0            0
endpoint Promotes            0         53571        13561
endpoints Skipped            0             0            0
Rebalance Source              0             0            0
Rebalance Targe               0             0            0
Rebalance Request             0             0            0
Rebalance Replies             0             0            0
CPU Above Limit               0             0            0
CPU Above Threshold           0             0            0
Online Transitions            0             0            0
Offline transitions           0             0            0
Tunnel Add Fails              0             0            0
CCD Tunnel Add Fails          0             0            0
Tunnel Remove Fails           0             0            0
CCD Tunnel Remove Fails       0             0            0
Service Add Fails             0             0            0
CCD Svc Add Fails             0             0            0
Service Remove Fails          0             0            0
CCD Svc Remove Fails          0             0            0
Service Adds No Cfg           0             0            0
Bad Service Handle            0             0            0
endpoint Remove Fails        0             0            0
endpoint Prom Fail           0             0            0
ACMEPACKET#
```

The **Period** stats provided represent an accumulation of data for the amount of time specified after the dash separator in the timestamp printed in the first line of output (in this example, the period represents 59 seconds).

Tunnels contains the number of tunnels between the SLB and the target SBC, in this case, bass.

Service Ports contains the number of Service Ports advertised by the target SBC when it joined the cluster.

endpoints and **Contacts** contain the number of endpoint associations the SLB has assigned to the target SBC. If there is only one registering device at a given endpoint, a one-to-one correlation between endpoints and contacts is

expected. However, if the **atom-limit-divisor** parameter has been set to a non-default value, the number of contacts exceeds the number of endpoints.

Sessions contains the number of active calls.

The table below the overview data displays specific CCP message statistics.

HeartBeats rcvd contains the number of heartbeat/keepalive messages received from the target SBC. Heartbeats are sent every two seconds by the SBC.

HeartBeats Missed contains the number of scheduled heartbeat/keepalive messages not received from the target SBC.

The **Tunnel Adds** and **Tunnel Removes** counters are incremented when an SBC joins the cluster and leaves the cluster, respectively.

The **Service Adds** and **Service Removes** counters are incremented when an SBC advertises support for a service and withdraws support for a service, respectively. This generally happens only when an SBC first joins the cluster, or if the configuration on a clustered SBC is changed, saved, and activated.

The **endpoint Removes** counter tracks the number of SBC-originated Cluster Control messages that request the SLB to delete a forwarding rule. Such a request can be the result of (1) a rebalance operation (when the SLB asks for the SBC to nominate candidates for rebalancing), (2) an endpoint de-registration with the SBC, or (3) an endpoint is power down. Generally, whenever a registration cache entry on a clustered endpoint is removed by the SBC, it notifies the SLB to remove that binding.

The **endpoint Promotes** counter tracks the number of promotion messages the SBC sends to the SLB to validate an untrusted forwarding rule. When the SLB first creates a forwarding rule for a new endpoint, it treats it as untrusted. When the SBC receives a 200 OK for a REGISTER message from that endpoint's registrar, the SBC sends a Promote Cluster Control message to the SLB. At this point, the SLB modifies the particular forwarding rule and assigns it trusted status. If this Promote message is not received within the time configured as the untrusted-grace-time in the lbp-config, the SLB deletes the untrusted entry.

endpoints Skipped contains the number of endpoints in its registration cache that the SBC has skipped over during a rebalance request. Skipping may be done for one of two reasons: either the most appropriate user for rebalancing was in an active phone call (and **rebalance-skip-calls** was enabled in cluster-config), or the **rebalance-skip-ahead** value in cluster-config was set to a nonzero value. In this case, when the SBC is asked to nominate users for rebalance, it will skip over any users whose registration cache entry is due to expire within the number of milliseconds set as the **rebalance-skip-ahead** value.

Rebalance Source contains the number of times the target SBC was used as a source of endpoints during a rebalance operation (that is, it supplied endpoints to a cluster member that was added to the cluster after itself).

Rebalance Target contains the opposite: the number of times that SBC was the recipient of endpoints from other sources during a rebalance operation.

The **Rebalance Requests** and **Rebalance Replies** counters increment upon receipt of a Cluster Control message from the SLB to the SBC asking it to divest itself of endpoints, and the responsive Cluster Control message from the SBC that indicates the endpoints the SBC has chosen.

The **CPU Above Limit** and **CPU Above Threshold** counters increment whenever an SBC has reported a high CPU value, and has been taken out of consideration for new endpoint assignments. Generally, the CPU limit and threshold are the same value (90%). However, it is possible to configure the threshold to be lower using the sip-config **option load-limit**.

SBC Cluster Member Statistics

The SBC cluster member also provides the operator with summary statistical data for active endpoints

show sipd tunnels

The **show sipd tunnels** command displays what key type the SBC is using:

```
ACMEPACKET# sho sipd tunnels
|Tunnel       : 1.1.1.170|1.1.1.100
----------------------------------------------------------------
|Conf Name    : M00:0/T2
|State        : InService      Cur Ping TMOs   : 0/5
|LB           : utopias@10.196.Total Ping TMOs : 0
|SBC Atoms    : 0              Service Ports   : 1/1
|SP Atoms     : 0              Application     : SIP
|Last Event   : srcPortAware   Purge Timer     :
|Timer Event  : Heartbeat      Timer           : 546ms
|IPT Handle   : 0x3f           Network Intf    : 0|0.0
|ActiveLbId   : 2000008        Waiting On      :
|LostCtlCount : 0              Last Lost Cntrl : Never
|NextCfgCheck :                CCP Version     : 6/6
|Source Key   : src-port
|
|Service Port                     Perv| Cur|Next lbStat Handle Atoms
|------------                     ----|----|---- ------ ------ ------
|access:192.168.168.100:5060<17> CRng IS   -    200    513    0
```

Source Key should be set to src-port on an active or standalone SBC as soon as the tunnel is established - it should not usually be 'none'. On a standby HA peer SBC, this value may legitimately be none until either fail over, or the first SipContact is replicated by tSIPD threads.

show sip lb-endpoints

The **show sipd lb-endpoints** command displays SBC endpoint stats by realm or tunneled service ports, by sip-interface since each SIP interface is uniquely identified by its realm name.

While this command was not changed for the addition of source port keys, there are some important items to note. When all endpoints are behind a NAT and source ports are used in endpoint keys, the number of endpoints should match the number of atoms. Were all endpoints are behind a single NAT, and source address keys in use, There would be many atoms and only one endpoint. Obviously in mixed environments this will be less clear and thus this command less useful. However, in lab environments this can be useful.

S-Cz7.2.0M6

```
ACMEPACKET# sho sipd lb-endpoints
-------------------------------------
Realm Endpoint Stats
-------------------------------------
10:57:29-35
Service Realm192p1
               ------- Period -------      ------ Lifetime -----
               Active    High   Total      Total  PerMax    High
Endpoints      2                           2
2                      2                  2                           2
Atoms          2                           2
2                      2                  2                           2
                         ------- Lifetime -------
                         Recent      Total  PerMax
Refreshes                   0          0       0
Adds                        2          2       2
Low Skips                   0          0       0
High Skips                  0          0       0
Auth Promo Tries            0          0       0
noTrust Promo Tries         0          0       0
Promo Tries                 0          0       0
Remove Conflicts            0          0       0
Remote Deletes              0          0       0
SP Removes                  0          0       0
Expiry Deletes                        0          0       0
Session Deletes               0          0       0
```

```
Session Adds                    0           0       0
Move Deletes                    0           0       0
Move Del No Tells               0           0       0
SvcMove Deletes                 0           0       0
SvcMove Del NoTell              0           0       0
Auth Promotes                   0
0                       0
Auth Deletes                    0           0       0
Add Errors                      0           0       0
Delete Deny Sess                0           0       0
Delete Deny Reg                 0           0       0
Delete Deny Purge               0           0       0
Delete Missing                  0           0       0
Delete Errors                   0           0       0
Update Deny Purge               0           0       0
Auth Deny Purge                 0           0       0
Remote Sess Skips               0           0       0
Remote Del Fails                0           0       0
SP Remove Fails                 0           0       0
Expiry Del Fails                0           0       0
Sess Del Fails                  0           0       0
Sess Add Fails                  0           0       0
Move Del Fails                  0           0       0
Move No Tell Fails              0           0       0
SvcMove Del Fails               0           0       0
SvcMv NoTell Fails              0           0       0
Auth Promo Fails                0           0       0
Auth Del Fails                  0           0       0
App Cache Dels                  0           0       0
```

show sip ccp

The **show sip ccp** command displays a cluster-member-specific summary of CCP operations.

```
westy# show sip ccp
--------------------
M00:0.4:T2
--------------------

EP Del                  Recent      Total  PerMax
====================   ======  =========  ======
Ops Sent                     0          1       1
Op Replies Recvd             0          1       1

                        -------- Received ------- ---------- Sent --------
Status Code             Recent      Total  PerMax Recent      Total  PerMax
-----------             ------  ---------  ------   ------ ---------  ------
200 OK                       0          1       1 0          0       0

EP Promo                Recent      Total  PerMax
====================   ======  =========  ======
Ops Sent                     0        992     538
Op Replies Recvd             0        992     538

                        -------- Received ------- ---------- Sent --------
Status Code             Recent      Total  PerMax Recent      Total  PerMax
-----------             ------  ---------  ------   ------ ---------  ------
200 OK                       0        992     538 0          0       0

Metrics                 Recent      Total  PerMax
====================   ======  =========  ======
Ops Sent                    25        207      15
Op Replies Recvd            25        207      15
```

```
                      -------- Received -------  ---------- Sent --------
Status Code           Recent      Total  PerMax Recent      Total  PerMax
-----------           ------  ---------  ------   ------ ---------  ------
200 OK                    25        207      15 0          0       0

Stop Down             Recent      Total  PerMax
==================    ======  =========  ======
Ops Sent                   0          2       2
Op Replies Recvd           0          2       2

                      -------- Received -------  ---------- Sent --------
Status Code           Recent      Total  PerMax Recent      Total  PerMax
-----------           ------  ---------  ------   ------ ---------  ------
200 OK                     0          2       2 0          0       0
westy#
```

5

Subscriber-Aware Load Balancer SNMP Reference

Overview

This chapter provides an overview of SNMP support for Subscriber-Aware Load Balancer (SLB) features.

Enterprise Traps

The following table identifies the SLB proprietary traps supported by the SLB.

apSLBEndpointCapacityThresholdTrap	Generated when the number of endpoints on the SLB exceeds the configured threshold.
apSLBEndpointCapacityThresholdClearTrap	Generated when the number of endpoints on the SLB falls below the configured threshold.
apSLBUntrustedEndpointCapacityThresholdTrap	Generated when the number of untrusted endpoints on the SLB exceeds the configured threshold.
apSLBUntrustedEndpointCapacityThresholdClearTrap	Generated when the number of untrusted endpoints on the SLB falls below the configured threshold.

License MIB (ap-license.mib)

SNMP GET Query Name	Object Identifier Name: Number	Description
Object Identifier Name: apLicenseEntry (1.3.6.1.4.1.9148.3.5.1.1.1)		
apLicenseSLBEndpointCap	apLicenseEntry: 1.3.6.1.4.1.9148.3.5.1.1.1.23	SLB endpoint capacity

Subscriber-Aware Load Balancer MIB (ap-slb.mib)

SNMP GET Query Name	Object Identifier Name: Number	Description
Object Identifier Name: apSLBMIBObjects (1.3.6.1.4.1.9148.3.11.1)		
Object Identifier Name: apSLBMIBGeneralObjects (1.3.6.1.4.1.9148.3.11.1.1)		
apSLBStatsEndpointsCurrent	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.1	Number of endpoints currently on the SLB.
apSLBStatsEndpointsDenied	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.2	Number of endpoints denied by the SLB because the system has reached the maximum endpoint capacity.
apSLBEndpointCapacity	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.3	Maximum number of endpoints allowed on the SLB. This value is based on the installed SLB license(s).
apSLBEndpointCapacityUpperThresh	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.4	Percentage of endpoints relative to maximum threshold capacity.
apSLBEndpointCapacityLowerThresh	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.5	Percentage of endpoints relative to minimum threshold capacity.
apSLBStatsUntrustedEndpointsCurrent	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.6	Number of untrusted endpoints currently on the SLB.
apSLBStatsTrustedEndpointsCurrent	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.7	Number of trusted endpoints currently on the SLB.
apSLBStatsUntrustedEndpointsDenied	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.8	The number of untrusted endpoints denied by the SLB due to the total number of untrusted endpoints exceeding the configured maximum threshold.
apSLBStatsUntrustedEndpointsAgedOut	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.9	The number of untrusted endpoints aged out of the system because they were not authenticated within the configured grace period.
apSLBUntrustedEndpointCapacity	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.10	Maximum number of untrusted endpoints allowed on the SLB. This value is a configured percentage of the maximum endpoint capacity of the system.
apSLBUntrustedEndpointCapacityUpperThresh	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.11	Percentage of untrusted endpoint maximum threshold capacity in use.
apSLBUntrustedEndpointCapacityLowerThresh	apSLBMIBGeneralObjects: 1.3.6.1.4.1.9148.3.11.1.1.12	Percentage of untrusted enpoint minumum threshold capacity percentage.

Glossary