IOS Server Load Balancing Feature in IOS Release 12.2(18)SXF5

Feature History

Release	Modification
12.0(7)XE	This feature was introduced with support for the following platforms: • Multilayer Switch Feature Card (MSFC) and Supervisor Engine 1 for Cisco Catalyst 6500 family switches • Cisco 7200 series routers The following functions were provided: • Algorithms for Server Load Balancing, page 7 • Automatic Server Failure Detection, page 17 • Automatic Unfail, page 18 • Bind ID Support, page 8 • Client-Assigned Load Balancing, page 9 • Delayed Removal of TCP Connection Context, page 9 • Dynamic Feedback Protocol for IOS SLB, page 18 • Maximum Connections, page 11 • Port-Bound Servers, page 14 • Slow Start, page 17 • Sticky Connections, page 15 • SynGuard, page 17 • TCP Session Reassignment, page 16
12.1(1)E	The following functions were added: • Alternate IP Addresses, page 16 • Server NAT, page 12 • Stateless Backup, page 23 • Transparent Web Cache Load Balancing, page 16

12.1(2)E	The following functions were added: • Audio and Video Load Balancing, page 22 • Content Flow Monitor Support, page 9 • Client NAT, page 13 • Probes, page 20—HTTP Probes • Stateful Backup, page 23
12.1(3a)E	The following functions were added: • Firewall Load Balancing, page 9 • Probes, page 20—HTTP and Ping Probes • Protocol Support, page 21 • Active Standby, page 23 • WAP Load Balancing, page 27
12.1(5a)E	The following functions were added: • Avoiding Attacks on Server Farms and Firewall Farms, page 16 • Probes, page 20—HTTP, Ping, and WSP Probes
12.1(5)T	The Cisco IOS Release 12.1(1)E feature was integrated into Cisco IOS Release 12.1(5)T, supporting Cisco 7200 series routers only.
12.2	The Cisco IOS Release 12.1(5)T feature was integrated into Cisco IOS Release 12.2.
12.1(7)E	Support for the following platform was added: • Cisco 7100 series routers The following functions were added: • Multiple Firewall Farm Support, page 11 • Route Health Injection, page 15
12.1(8a)E	Support for the following platform was added: • MSFC2 and Supervisor Engine 2 for Cisco Catalyst 6500 family switches The following functions were added: • Backup Server Farms, page 18 • DFP Agent Subsystem Support, page 18
12.1(9)E	The following functions were added: • GPRS Load Balancing, page 24—Support for GPRS Tunneling Protocol (GTP) v0

12.1(11b)E	Support for the following platforms was added: • MSFC2, Supervisor Engine 1, and Supervisor Engine 2 for the Cisco 7600 series routers The following functions were added: • Static NAT, page 13 • Probes, page 20—DNS, HTTP, Ping, TCP, and WSP Probes • RADIUS Load Balancing, page 26—General packet radio service (GPRS) networks • AAA Load Balancing, page 22 • VPN Server Load Balancing, page 23
12.1(12c)E	The following functions were added: • Probes, page 20—Routed Probes • RADIUS Load Balancing, page 26—CDMA2000 and Multiple Service Gateway Server Farms
12.1(13)E	This release incorporated only minor corrections and clarifications.
12.2(14)S	This feature was integrated into Cisco IOS Release 12.2(14)S. Support for the following platforms was removed: • Cisco 7100 series routers • MSFC2, Supervisor Engine 1, and Supervisor Engine 2 for Cisco Catalyst 6500 family switches • MSFC2, Supervisor Engine 1, and Supervisor Engine 2 for the Cisco 7600 series routers
12.1(13)E3	Support for the following platforms was added: • Cisco 7100 series routers • MSFC2, Supervisor Engine 1, and Supervisor Engine 2 for Cisco Catalyst 6500 family switches • MSFC2, Supervisor Engine 1, and Supervisor Engine 2 for the Cisco 7600 series routers The following functions were added: • GPRS Load Balancing, page 24—Support for GTP v0 and GTP v1 • GPRS Load Balancing with GTP Cause Code Inspection, page 25 • Probes, page 20—DNS, HTTP, Ping, TCP, Custom UDP, and WSP Probes
12.2(14)ZA2	The following function was added: • Home Agent Director, page 26
12.2(14)ZA4	The following functions were added: • Automatic Server Failure Detection, page 17—Disabling Automatic Server Failure Detection

12.2(14)ZA5	The following functions were added: • Exchange Director Features, page 24 • Flow Persistence, page 28 • Stateful Backup of Redundant Route Processors, page 28
12.2(14)ZA6	This release incorporated only minor corrections and clarifications.
12.2(17d)SXB	Support for the following platforms was removed: • Cisco 7100 series routers • Cisco 7200 series routers • Supervisor Engine 1 for Cisco Catalyst 6500 family switches • Supervisor Engine 1 for the Cisco 7600 series routers
12.2(17d)SXB1	The following function was added: • GGSN-IOS SLB Messaging, page 19
12.2(18)SXD	Support for the following platforms was added: • Supervisor Engine 720 with an MSFC3 (SUP720-MSFC3) for Cisco Catalyst 6500 family switches • Supervisor Engine 720 with an MSFC3 (SUP720-MSFC3) for the Cisco 7600 series routers The following functions were added: • DFP and the Home Agent Director, page 19 • Home Agent Director, page 10
12.2(18)SXE	The following functions were added: • GTP IMSI Sticky Database, page 10 • Interface Awareness, page 11 • RADIUS Load Balancing, page 26— RADIUS Load Balancing IMSI Sticky Database
12.2(18)SXF	This release incorporated only minor corrections and clarifications.
12.2(18)SXF5	Support for the following platforms was added: • Supervisor Engine 32 with an MSFC2A (SUP32-MSFC2A) for Cisco Catalyst 6500 family switches • Supervisor Engine 32 with an MSFC2A (SUP32-MSFC2A) for the Cisco 7600 series routers

This document describes the Cisco IOS Server Load Balancing (IOS SLB) feature in Cisco IOS Release 12.2(18)SXF5. It includes the following sections:

Overview of the IOS SLB Feature

The IOS SLB feature is an IOS-based solution that provides load balancing for a variety of networked devices and services, including:

- Application servers, such as Hypertext Transfer Protocol (HTTP), Telnet, File Transfer Protocol (FTP), and so on
- Firewalls
- Service nodes, such as authentication, authorization, and accounting (AAA) servers, web caches, and so on

In addition, the IOS SLB Exchange Director enables advanced load-balancing routing capabilities for the following additional service nodes:

- Cisco Mobile Exchange (CMX) components:
  - Cisco Content Services Gateways (CSGs)

    If you are running with Supervisor Engine 32 (SUP32-MSFC2A), CSG Release 3.1(3)C7(1) or later is required.
  - Cisco gateway GPRS support nodes (GGSNs)
  - Cisco Service Selection Gateways (SSGs)
  - Cisco Home Agents
- Other components for mobile, Public Wireless LAN (PWLAN), and Service Provider networks:
  - Wireless Application Protocol (WAP) gateways
  - Protocol optimization gateways
  - Non-Cisco GGSNs and Home Agents
  - Other RADIUS-aware flow gateways. These gateways are proxies or routing nodes that receive RADIUS Authorization and Accounting requests for users that route flows through the gateways. The Exchange Director binds the RADIUS and data flows to the same gateway, ensuring that the gateway receives a complete and consistent view of the network activity for the user.

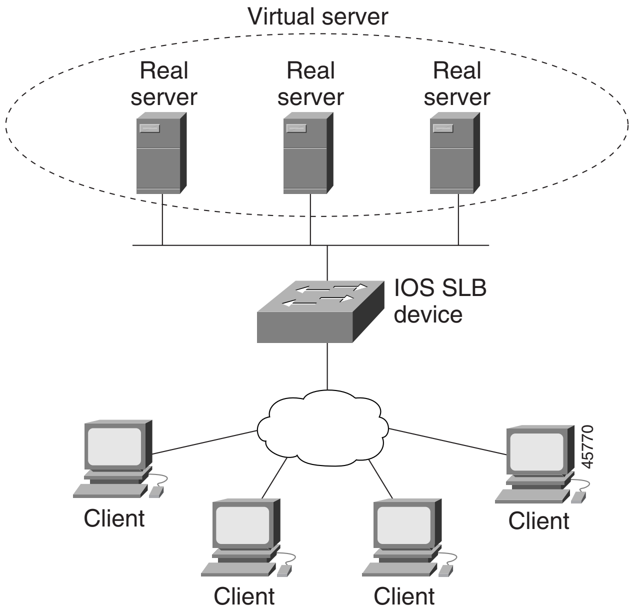
The Exchange Director also adds the following features:

- Enhanced failover capabilities for single-chassis failover within the CMX for Catalyst 6500 family switches and Cisco 7600 series routers. When used with Route Processor Redundancy Plus (RPR+), IOS SLB stateful backup for redundant route processors provides full IOS SLB stateful failover for these platforms.

- Flow persistence, which provides intelligent return routing of load-balanced IP flows.

Figure 1 illustrates a logical view of a simple IOS SLB network.

Figure 1 Logical View of IOS SLB



Features

This section describes the general features provided by IOS SLB, as well as the specific features provided by the Exchange Director for Cisco Mobile Exchange (CMX).

Note Some IOS SLB features are specific to a single platform and are not described in this feature document. For information about those features, refer to the appropriate platform-specific documentation.

- IOS SLB Features, page 6
- Exchange Director Features, page 24

IOS SLB Features

IOS SLB provides the following features:

- Routing Features, page 7
- Security Features, page 16
- Server Failure Detection and Recovery Features, page 17
- Protocol Support Features, page 21
- Redundancy Features, page 23

Routing Features

IOS SLB provides the following routing features:

Algorithms for Server Load Balancing

IOS SLB provides the following load-balancing algorithms:

You can specify one of these algorithms as the basis for choosing a real server for each new connection request that arrives at the virtual server.

For both algorithms, connections in closing state continue to be counted against the number of connections assigned to a real server. This impacts least connections more so than round robin, because the number of connections impacts the least connections more. IOS SLB adjusts the number of connections per real server, and the algorithm metrics, each time a connection is assigned.

Weighted Round Robin

The weighted round robin algorithm specifies that the real server used for a new connection to the virtual server is chosen from the server farm in a circular fashion. Each real server is assigned a weight, *n*, that represents its capacity to handle connections, as compared to the other real servers associated with the virtual server. That is, new connections are assigned to a given real server *n* times before the next real server in the server farm is chosen.

For example, assume a server farm comprised of real server ServerA with $n = 3$, ServerB with $n = 1$, and ServerC with $n = 2$. The first three connections to the virtual server are assigned to ServerA, the fourth connection to ServerB, and the fifth and sixth connections to ServerC.

Note Assigning a weight of n=1 to all of the servers in the server farm configures the IOS SLB device to use a simple round robin algorithm.

General packet radio service (GPRS) load balancing *without* GPRS Tunneling Protocol (GTP) cause code inspection enabled requires the weighted round robin algorithm. A server farm that uses weighted least connections can be bound to a virtual server providing GPRS load balancing without GTP cause code inspection enabled, but you cannot place the virtual server INSERVICE. If you try to do so, IOS SLB issues an error message.

The Home Agent Director requires the weighted round robin algorithm. A server farm that uses weighted least connections can be bound to a Home Agent Director virtual server, but you cannot place the virtual server INSERVICE. If you try to do so, IOS SLB issues an error message.

Weighted Least Connections

The weighted least connections algorithm specifies that the next real server chosen from a server farm for a new connection to the virtual server is the server with the fewest active connections. Each real server is assigned a weight for this algorithm, also. When weights are assigned, the server with the fewest connections is based on the number of active connections on each server, and on the relative capacity of each server. The capacity of a given real server is calculated as the assigned weight of that server divided by the sum of the assigned weights of all of the real servers associated with that virtual server, or $n_1/(n_1+n_2+n_3...)$.

For example, assume a server farm comprised of real server ServerA with n = 3, ServerB with n = 1, and ServerC with n = 2. ServerA would have a calculated capacity of 3/(3+1+2), or half of all active connections on the virtual server, ServerB one-sixth of all active connections, and ServerC one-third of all active connections. At any point in time, the next connection to the virtual server would be assigned to the real server whose number of active connections is farthest below its calculated capacity.

Note Assigning a weight of n=1 to all of the servers in the server farm configures the IOS SLB device to use a simple least-connection algorithm.

GPRS load balancing *without* GTP cause code inspection enabled *does not* support the weighted least connections algorithm.

GPRS load balancing *with* GTP cause code inspection enabled *does* support the weighted least connections algorithm.

The Home Agent Director *does not* support the weighted least connections algorithm.

Bind ID Support

The bind ID allows a single physical server to be bound to multiple virtual servers and report a different weight for each one. Thus, the single real server is represented as multiple instances of itself, each having a different bind ID. Dynamic Feedback Protocol (DFP) uses the bind ID to identify for which instance of the real server a given weight is specified. The bind ID is needed only if you are using DFP.

GPRS load balancing and the Home Agent Director do not support bind IDs.

Client-Assigned Load Balancing

Client-assigned load balancing allows you to limit access to a virtual server by specifying the list of client IP subnets that are permitted to use that virtual server. With this feature, you can assign a set of client IP subnets (such as internal subnets) connecting to a virtual IP address to one server farm or firewall farm, and assign another set of clients (such as external clients) to a different server farm or firewall farm.

GPRS load balancing and the Home Agent Director do not support client-assigned load balancing.

Content Flow Monitor Support

IOS SLB supports the Cisco Content Flow Monitor (CFM), a web-based status monitoring application within the CiscoWorks2000 product family. You can use CFM to manage Cisco server load-balancing devices. CFM runs on Windows NT and Solaris workstations, and is accessed using a web browser.

Delayed Removal of TCP Connection Context

Because of IP packet ordering anomalies, IOS SLB might "see" the termination of a TCP connection (a finish [FIN] or reset [RST]) followed by other packets for the connection. This problem usually occurs when there are multiple paths that the TCP connection packets can follow. To correctly redirect the packets that arrive after the connection is terminated, IOS SLB retains the TCP connection information, or context, for a specified length of time. The length of time the context is retained after the connection is terminated is controlled by a configurable delay timer.

Firewall Load Balancing

As its name implies, firewall load balancing enables IOS SLB to balance flows to firewalls. Firewall load balancing uses a load-balancing device on each side of a group of firewalls (called a firewall farm) to ensure that the traffic for each flow travels to the same firewall, ensuring that the security policy is not compromised.

You can configure more than one firewall farm in each load-balancing device.

Layer 3 firewalls, which have ip-addressable interfaces, are supported by IOS SLB firewall load balancing if they are subnet-adjacent to the firewall load-balancing device and have unique MAC addresses. The device does not modify the IP addresses in the user packet. To send the packet to the chosen firewall, the device determines which interface to use and changes the Layer 2 headers accordingly. This type of routing is the standard dispatched routing used by IOS SLB.

Layer 2 firewalls, which do not have IP addresses, are transparent to IOS SLB firewall load balancing. IOS SLB supports Layer 2 firewalls by placing them between two ip-addressable interfaces.

Whereas many Layer 3 firewalls might exist off a single Layer 3 interface on the load-balancing device (for example, a single LAN), only one Layer 2 firewall can exist off each interface.

When configuring the load-balancing device, you configure a Layer 3 firewall using its IP address, and a Layer 2 firewall using the IP address of the interface of the device on the "other side" of the firewall.

To balance flows across the firewalls in a firewall farm, IOS SLB firewall load balancing performs a route lookup on each incoming flow, examining the source and destination IP addresses (and optionally the source and destination TCP or User Datagram Protocol [UDP] port numbers). Firewall load balancing applies a hash algorithm to the results of the route lookup and selects the best firewall to handle the connection request.

Note IOS SLB firewall load balancing *must* examine incoming packets and perform route lookup. On Catalyst 6500 Family Switches, some additional packets might need to be examined. Firewall load balancing impacts internal (secure) side routing performance and must be considered in the complete design.

To maximize availability and resilience in a network with multiple firewalls, configure a separate equal-weight route to each firewall, rather than a single route to only one of the firewalls.

IOS SLB firewall load balancing provides the following capabilities:

- Connections initiated from either side of the firewall farm are load-balanced.
- The load is balanced among a set of firewalls—the firewall farm.
- All packets for a connection travel through the same firewall. Subsequent connections can be "sticky," ensuring that they are assigned to the same firewall.
- Probes are used to detect and recover from firewall failures.
- Redundancy is provided. Hot Standby Router Protocol (HSRP), stateless backup, and stateful backup are all supported.
- Multiple interface types and routing protocols are supported, enabling the external (Internet side) load-balancing device to act as an access router.
- Proxy firewalls are supported.

GTP IMSI Sticky Database

IOS SLB can select a gateway general packet radio service (GPRS) support node (GGSN) for a given International Mobile Subscriber ID (IMSI), and forward all subsequent Packet Data Protocol (PDP) create requests from the same IMSI to the selected GGSN.

To enable this feature, IOS SLB uses a GPRS Tunneling Protocol (GTP) IMSI sticky database, which maps each IMSI to its corresponding real server, in addition to its session database.

IOS SLB creates a sticky database object when it processes the first GTP PDP create request for a given IMSI. IOS SLB removes the sticky object when it receives a notification to do so from the real server, or as a result of inactivity. When the last PDP belonging to an IMSI is deleted on the GGSN, the GGSN notifies IOS SLB to remove the sticky object.

Home Agent Director

The Home Agent Director load balances Mobile IP Registration Requests (RRQs) among a set of home agents (configured as real servers in a server farm). Home agents are the anchoring points for mobile nodes. Home agents route flows for a mobile node to its current foreign agent (point of attachment).

The Home Agent Director has the following characteristics:

- Can operate in dispatched mode or in directed server NAT mode, but not in directed client NAT mode. In dispatched mode, the home agents must be Layer 2-adjacent to the IOS SLB device.
- Can operate in both fast and CEF switching modes.
- Does not support stateful backup. See the "Stateful Backup" section on page 23 for more information.
- Delivers RRQs destined to the virtual Home Agent Director IP address to one of the real home agents, using the weighted round robin load-balancing algorithm. See the "Weighted Round Robin" section on page 7 for more information about this algorithm.

- Requires DFP in order to allocate RRQs based on capacity.

For more information about Mobile IP, home agents, and related topics, refer to the *Cisco IOS IP Configuration Guide*, Release 12.2.

Interface Awareness

Some environments require IOS SLB on both sides of a farm of CSGs, SSGs, or firewalls. For example, you might want IOS SLB to perform RADIUS load balancing on one side of a farm and firewall load balancing on the other, or firewall load balancing on both sides of a firewall farm.

Such "sandwich" environments require IOS SLB to take into account the input interface when mapping packets to virtual servers, firewall farms, connections, and sessions. In IOS SLB, this function is called interface awareness. When interface awareness is configured, IOS SLB processes only traffic arriving on configured access interfaces. (An access interface is any Layer 3 interface.)

Maximum Connections

IOS SLB allows you to configure maximum connections for server and firewall load balancing.

- For server load balancing, you can configure a limit on the number of active connections that a real server is assigned. If the maximum number of connections is reached for a real server, IOS SLB automatically switches all further connection requests to other servers until the connection number drops below the specified limit.
- For firewall load balancing, you can configure a limit on the number of active TCP or UDP connections that a firewall farm is assigned. If the maximum number of connections is reached for the firewall farm, new connections are dropped until the connection number drops below the specified limit.

Multiple Firewall Farm Support

You can configure more than one firewall farm in each load-balancing device.

Network Address Translation (NAT)

Cisco IOS NAT, RFC 1631, allows unregistered "private" IP addresses to connect to the Internet by translating them into globally registered IP addresses. As part of this functionality, Cisco IOS NAT can be configured to advertise only one address for the entire network to the outside world. This configuration provides additional security and network privacy, effectively hiding the entire internal network from the world behind that address. NAT has the dual functionality of security and address conservation, and is typically implemented in remote access environments.

This section includes information about the following topics:

- Session Redirection, page 12
- Dispatched Mode, page 12
- Directed Mode, page 12
- Server NAT, page 12
- Client NAT, page 13
- Static NAT, page 13
- Server Port Translation, page 14

Session Redirection

Session redirection involves redirecting packets to real servers. IOS SLB can operate in one of two session redirection modes, dispatched mode or directed mode.

Note In both dispatched and directed modes, IOS SLB must track connections. Therefore, you must design your network so that there is no alternate network path from the real servers to the client that bypasses the load-balancing device.

Dispatched Mode

In dispatched mode, the virtual server address is known to the real servers; you must configure the virtual server IP address as a loopback address, or secondary IP address, on each of the real servers. IOS SLB redirects packets to the real servers at the media access control (MAC) layer. Since the virtual server IP address is not modified in dispatched mode, the real servers must be Layer 2-adjacent to IOS SLB, or intervening routers might not be able to route to the chosen real server.

For Catalyst 6500 family switches, dispatched mode with hardware data packet acceleration generally yields better performance than directed mode.

Refer to the "Configuring Logical Interfaces" chapter of the *Cisco IOS Interface Configuration Guide*, Release 12.2 for more information about configuring the loopback address.

Directed Mode

In directed mode, the virtual server can be assigned an IP address that is not known to any of the real servers. IOS SLB translates packets exchanged between a client and a real server, using NAT to translate the virtual server IP address to a real server IP address.

IOS SLB supports the following types of NAT:

- "Server NAT" section on page 12
- "Client NAT" section on page 13
- "Static NAT" section on page 13
- "Server Port Translation" section on page 14

Note You can use both server NAT and client NAT for the same connection.

IOS SLB does not support FTP or firewall load balancing in directed mode. Therefore, FTP and firewall load balancing cannot use NAT.

IOS SLB supports only client NAT for TCP and UDP virtual servers.

IOS SLB supports only server NAT (but not server port translation) for Encapsulation Security Payload (ESP) virtual servers or Generic Routing Encapsulation (GRE) virtual servers.

Server NAT

Server NAT involves replacing the virtual server IP address with the real server IP address (and vice versa). Server NAT provides the following benefits:

- Servers can be many hops away from the load-balancing device.
- Intervening routers can route to them without requiring tunnelling.
- Loopback and secondary interfaces are not required on the real server.

- The real server need not be Layer 2-adjacent to IOS SLB.
- The real server can initiate a connection to a virtual server on the same IOS SLB device.

Client NAT

If you use more than one load-balancing device in your network, replacing the client IP address with an IP address associated with one of the devices results in proper routing of outbound flows to the correct device. Client NAT also requires that the ephemeral client port be modified since many clients can use the same ephemeral port. Even in cases where multiple load-balancing devices are not used, client NAT can be useful to ensure that packets from load-balanced connections are not routed around the device.

Static NAT

With static NAT, address translations exist in the NAT translation table as soon as you configure static NAT commands, and they remain in the translation table until you delete the static NAT commands.

You can use static NAT to allow some users to utilize NAT and allow other users on the same Ethernet interface to continue with their own IP addresses. This option enables you to provide a default NAT behavior for real servers, differentiating between responses from a real server, and connection requests initiated by the real server.

For example, you can use server NAT to redirect Domain Name System (DNS) inbound request packets and outbound response packets for a real server, and static NAT to process connection requests from that real server.

Note Static NAT is not required for DNS, but it is recommended, because it hides your real server IP addresses from the outside world.

IOS SLB supports the following static NAT options, configured using the **ip slb static** command:

- Static NAT with dropped connections—The real server is configured to have its packets dropped by IOS SLB, if the packets do not correspond to existing connections. This option is usually used in conjunction with the subnet mask or port number option on the **real** command in static NAT configuration mode, such that IOS SLB builds connections to the specified subnet or port, and drops all other connections from the real server.
- Static NAT with a specified address—The real server is configured to use a user-specified virtual IP address when translating addresses.
- Static NAT with per-packet server load balancing—The real server is configured such that IOS SLB is not to maintain connection state for packets originating from the real server. That is, IOS SLB is to use server NAT to redirect packets originating from the real server. Per-packet server load balancing is especially useful for DNS load balancing. IOS SLB uses DNS probes to detect failures in the per-packet server load-balancing environment.

  Note Static NAT with per-packet server load balancing does not load-balance fragmented packets.

- Static NAT with sticky connections—The real server is configured such that IOS SLB is not to maintain connection state for packets originating from the real server, unless those packets match a sticky object:
  - If IOS SLB finds a matching sticky object, it builds the connection.
  - If IOS SLB does not find a matching sticky object, it forwards the packets without building the connection.

IOS SLB uses the following logic when handling a packet from a real server:

Step 1 Does the packet match a real server?

- If no, IOS SLB has no interest in the packet.
- If yes, continue.

Step 2 Does the packet match an existing connection?

- If yes, IOS SLB uses NAT to redirect the packet, in accordance with the connection control block.
- If no, continue.

Step 3 Is the real server configured to use static NAT?

- If no, IOS SLB handles the packet as usual. This functionality is also called static NAT pass-through.
- If yes, continue.

Step 4 Is the real server configured to have its packets dropped by IOS SLB, if the packets do not correspond to existing connections?

- If yes, IOS SLB drops the packet.
- If no, continue.

Step 5 Is the real server configured for per-packet server load balancing?

- If yes, IOS SLB uses NAT to redirect the packet.
- If no, continue.

Step 6 Is the real server configured to maintain connection state for sticky connections?

- If no, IOS SLB builds the connection.
- If yes, IOS SLB searches for a matching sticky object. Continue.

Step 7 Can IOS SLB find a matching sticky object?

- If no, IOS SLB drops the packet.
- If yes, IOS SLB builds the connection.

Server Port Translation

Server port translation, also known as port address translation, or PAT, is a form of server NAT that involves the translation of virtual server ports instead of virtual server IP addresses. Virtual server port translation does not require translation of the virtual server IP address, but you can use the two types of translation together.

IOS SLB supports server port translation for TCP and UDP only.

Port-Bound Servers

When you define a virtual server, you must specify the TCP or UDP port handled by that virtual server. However, if you configure NAT on the server farm, you can also configure port-bound servers. Port-bound servers allow one virtual server IP address to represent one set of real servers for one service, such as HTTP, and a different set of real servers for another service, such as Telnet.

Packets destined for a virtual server address for a port that is not specified in the virtual server definition are not redirected.

IOS SLB supports both port-bound and non-port-bound servers, but port-bound servers are recommended.

IOS SLB firewall load balancing does not support port-bound servers.

Route Health Injection

By default, a virtual server's IP address is advertised (added to the routing table) when you bring the virtual server into service (using the **inservice** command). If you have a preferred host route to a website's virtual IP address, you can advertise that host route, but you have no guarantee that the IP address is available. However, you can use the **advertise** command to configure IOS SLB to advertise the host route only when IOS SLB has verified that the IP address is available. IOS SLB withdraws the advertisement when the IP address is no longer available. This function is known as route health injection.

Sticky Connections

Sometimes, a client transaction can require multiple consecutive connections, which means new connections from the same client IP address or subnet must be assigned to the same real server. These connections are especially important in firewall load balancing, because the firewall might need to profile the multiple connections in order to detect certain attacks.

You can use the optional **sticky** command to enable IOS SLB to force connections from the same client to the same load-balanced server within a server farm. For firewall load balancing, the connections between the same client-server pair are assigned to the same firewall. New connections are considered to be sticky as long as the following conditions are met:

- The real server is in either OPERATIONAL or MAXCONNS_THROTTLED state.
- The sticky timer is defined on a virtual server or on a firewall farm.

This binding of new connections to the same server or firewall is continued for a user-defined period after the last sticky connection ends.

To get the client-server address sticky behavior needed for "sandwich" firewall load balancing, you must enable sticky on both sides of the firewall farm. In this configuration, client-server sticky associations are created when an initial connection is opened between a client-server address pair. After this initial connection is established, IOS SLB maintains the sticky association in the firewall load-balancing devices on either side of the farm, and applies the sticky association to connections initiated from either the client or server IP address, by both firewall load-balancing devices.

Client subnet sticky is enabled when you specify a subnet mask on the **sticky** command. Subnet sticky is useful when the client IP address might change from one connection to the next. For example, before reaching IOS SLB, the client connections might pass through a set of NAT or proxy firewalls that have no sticky management of their own. Such a situation can result in failed client transactions if the servers do not have the logic to cope with it. In cases where such firewalls assign addresses from the same set of subnets, IOS SLB's sticky subnet mask can overcome the problems that they might cause.

Sticky connections also permit the coupling of services that are handled by more than one virtual server or firewall farm. This option allows connection requests for related services to use the same real server. For example, web server (HTTP) typically uses TCP port 80, and HTTPS uses port 443. If HTTP virtual servers and HTTPS virtual servers are coupled, connections for ports 80 and 443 from the same client IP address or subnet are assigned to the same real server.

Virtual servers that are in the same sticky group are sometimes called buddied virtual servers.

GPRS load balancing and the Home Agent Director do not support sticky connections.

TCP Session Reassignment

IOS SLB tracks each TCP SYN sent to a real server by a client attempting to open a new connection. If several consecutive SYNs are not answered, or if a SYN is replied to with an RST, the TCP session is reassigned to a new real server. The number of SYN attempts is controlled by a configurable reassign threshold.

IOS SLB firewall load balancing does not support TCP session reassignment.

Transparent Web Cache Load Balancing

IOS SLB can load-balance HTTP flows across a cluster of transparent web caches. To set up this function, configure the subnet IP addresses served by the transparent web caches, or some common subset of them, as virtual servers. Virtual servers used for transparent web cache load balancing do not answer pings on behalf of the subnet IP addresses, and they do not affect traceroute.

In some cases, such as when its cache does not contain needed pages, a web cache might need to initiate its own connections to the Internet. Those connections should not be load-balanced back to the same set of web caches. To address this need, IOS SLB allows you to configure **client exclude** statements, which exclude connections initiated by the web caches from the load-balancing scheme.

IOS SLB firewall load balancing does not support transparent web cache load balancing.

Security Features

IOS SLB provides the following security features:

- Alternate IP Addresses, page 16
- Avoiding Attacks on Server Farms and Firewall Farms, page 16
- Slow Start, page 17
- SynGuard, page 17

Alternate IP Addresses

IOS SLB enables you to telnet to the load-balancing device using an alternate IP address. To do so, use either of the following methods:

- Use any of the interface addresses to telnet to the load-balancing device.
- Define a secondary IP address to telnet to the load-balancing device.

This function is similar to that provided by the LocalDirector (LD) Alias command.

Avoiding Attacks on Server Farms and Firewall Farms

IOS SLB relies on a site's firewalls to protect the site from attacks. In general, IOS SLB is no more susceptible to direct attack than is any switch or router. However, a highly secure site can take the following steps to enhance its security:

- Configure real servers on a private network to keep clients from connecting directly to them. This configuration ensures that the clients must go through IOS SLB to get to the real servers.
- Configure input access lists on the access router or on the IOS SLB device to deny flows from the outside network aimed directly at the interfaces on the IOS SLB device. That is, deny *all* direct flows from unexpected addresses.

- To protect against attackers trying to direct flows to real or nonexistent IP addresses in the firewall subnet, configure the firewalls in a private network.
- Configure firewalls to deny *all* unexpected flows targeted at the firewalls, especially flows originating from the external network.

Slow Start

In an environment that uses weighted least connections load balancing, a real server that is placed in service initially has no connections, and could therefore be assigned so many new connections that it becomes overloaded. To prevent such an overload, slow start controls the number of new connections that are directed to a real server that has just been placed in service.

GPRS load balancing and the Home Agent Director do not support slow start.

SynGuard

SynGuard limits the rate of TCP start-of-connection packets (SYNchronize sequence numbers, or SYNs) handled by a virtual server to prevent a type of network problem known as a SYN flood denial-of-service attack. A user might send a large number of SYNs to a server, which could overwhelm or crash the server, denying service to other users. SynGuard prevents such an attack from bringing down IOS SLB or a real server. SynGuard monitors the number of SYNs handled by a virtual server at specific intervals and does not allow the number to exceed a configured SYN threshold. If the threshold is reached, any new SYNs are dropped.

IOS SLB firewall load balancing and the Home Agent Director do not support SynGuard.

Server Failure Detection and Recovery Features

IOS SLB provides the following server failure detection and recovery features:

- Automatic Server Failure Detection, page 17
- Automatic Unfail, page 18
- Backup Server Farms, page 18
- DFP Agent Subsystem Support, page 18
- Dynamic Feedback Protocol for IOS SLB, page 18
- GGSN-IOS SLB Messaging, page 19
- Probes, page 20

Automatic Server Failure Detection

IOS SLB automatically detects each failed Transmission Control Protocol (TCP) connection attempt to a real server, and increments a failure counter for that server. (The failure counter is not incremented if a failed TCP connection from the same client has already been counted.) If a server's failure counter exceeds a configurable failure threshold, the server is considered out of service and is removed from the list of active real servers.

For RADIUS load balancing, the IOS SLB performs automatic server failure detection when a RADIUS request is not answered by the real server.

If you have configured all-port virtual servers (that is, virtual servers that accept flows destined for all ports except GTP ports), flows can be passed to servers for which no application port exists. When the servers reject these flows, IOS SLB might fail the servers and remove them from load balancing. This situation can also occur in slow-to-respond AAA servers in RADIUS load-balancing environments. To prevent this situation, you can disable automatic server failure detection.

Note If you disable automatic server failure detection using the **no faildetect inband** command, Cisco strongly recommends that you configure one or more probes.

If you specify the **no faildetect inband** command, the **faildetect numconns** command is ignored, if specified.

Automatic Unfail

When a real server fails and is removed from the list of active servers, it is assigned no new connections for a length of time specified by a configurable retry timer. After that timer expires, the server is again eligible for new virtual server connections and IOS SLB sends the server the next qualifying connection. If the connection is successful, the failed server is placed back on the list of active real servers. If the connection is unsuccessful, the server remains out of service and the retry timer is reset. The unsuccessful connection must have experienced at least one retry, otherwise the next qualifying connection would also be sent to that failed server.

Backup Server Farms

A backup server farm is a server farm that can be used when none of the real servers defined in a primary server farm is available to accept new connections. When configuring backup server farms, keep in mind the following considerations:

- A server farm can act as both primary and backup at the same time.
- The same real server cannot be defined in both primary and backup at the same time.
- Both primary and backup require the same NAT configuration (none, client, server, or both). In addition, if NAT is specified, both server farms must use the same NAT pool.

DFP Agent Subsystem Support

IOS SLB supports the DFP Agent Subsystem feature, also called global load balancing, which enables client subsystems other than IOS SLB to act as DFP agents. With the DFP Agent Subsystem, you can use multiple DFP agents from different client subsystems at the same time.

For more information about the DFP Agent Subsystem, refer to the *DFP Agent Subsystem* feature document for Cisco IOS Release 12.2(18)SXD.

Dynamic Feedback Protocol for IOS SLB

With IOS SLB Dynamic Feedback Protocol (DFP) support, a DFP manager in a load-balancing environment can initiate a TCP connection with a DFP agent. Thereafter, the DFP agent collects status information from one or more real host servers, converts the information to relative weights, and reports the weights to the DFP manager. The DFP manager factors in the weights when load balancing the real servers. In addition to reporting at user-defined intervals, the DFP agent sends an early report if there is a sudden change in a real server's status.

The weights calculated by DFP override the static weights you define using the **weight** command in server farm configuration mode. If DFP is removed from the network, IOS SLB reverts to the static weights.

You can define IOS SLB as a DFP manager, as a DFP agent for another DFP manager, or as both at the same time. In such a configuration, IOS SLB sends periodic reports to the other DFP manager, which uses the information to choose the best server farm for each new connection request. IOS SLB then uses the same information to choose the best real server within the chosen server farm.

DFP also supports the use of multiple DFP agents from different client subsystems (such as IOS SLB and GPRS) at the same time.

See the following sections for more information:

- DFP and GPRS Load Balancing, page 19
- DFP and the Home Agent Director, page 19

DFP and GPRS Load Balancing

In GPRS load balancing, you can define IOS SLB as a DFP manager and define a DFP agent on each GGSN in the server farm. Thereafter, the DFP agent can report the weights of the GGSNs. The DFP agents calculate the weight of each GGSN based on CPU utilization, processor memory, and the maximum number of Packet Data Protocol (PDP) contexts (mobile sessions) that can be activated for each GGSN. As a first approximation, DFP calculates the weight as the number of existing PDP contexts divided by the maximum allowed PDP contexts:

(existing PDP contexts)/(maximum PDP contexts)

Maximum PDP contexts are specified using the **gprs maximum-pdp-context-allowed** command, which defaults to 10,000 PDP contexts. If you accept the default value, DFP might calculate a very low weight for the GGSN:

(existing PDP contexts)/10000 = Low GGSN weight

Keep this calculation in mind when specifying maximum PDP contexts using the **gprs maximum-pdp-context-allowed** command. For example, Cisco 7200 series routers acting as GGSNs are often configured with a maximum of 45,000 PDP contexts.

DFP and the Home Agent Director

For the Home Agent Director, you can define IOS SLB as a DFP manager and define a DFP agent on each home agent in the server farm, and the DFP agent can report the weights of the home agents. The DFP agents calculate the weight of each home agent based on CPU utilization, processor memory, and the maximum number of bindings that can be activated for each home agent:

(maximum-number-of-bindings - current-number-of-bindings)/maximum-number-of-bindings * (cpu-utilization + memory-utilization)/32 * maximum-DFP-weight = reported-weight

To set the *maximum-number-of-bindings*, use the **ip mobile home-agent max-binding** command. To set the *maximum-DFP-weight* sent by the home agent to IOS SLB, use the **ip mobile home-agent dfp-max-weight** command. For detailed information about these Mobile IP commands, refer to the *Cisco Mobile Wireless Home Agent Release 2.0* feature module.

GGSN-IOS SLB Messaging

This feature enables a GGSN to notify IOS SLB when certain conditions occur. The notifications enable IOS SLB to make intelligent decisions, which in turn improves GPRS load balancing and failure detection.

The notifications sent by the GGSN use GTP with message types from the unused space (reserved for future use) and the following information elements (IEs):

- Notification type, which indicates the notification condition. For example, this could be a notification to IOS SLB to reassign the session to an alternate GGSN, when the current GGSN fails on Call Admission Control (CAC).
- Identifier of the relevant session (session key).
- Other IEs specific to the notification type. For example, for a notification to reassign, GGSN includes the create response, which it would otherwise have sent to the SGSN. This enables IOS SLB to relay this response back to SGSN when the maximum number of reassignments due to notification reach the configured limit.

GGSN-IOS SLB messaging is supported in both dispatched mode and directed modes.

Probes

IOS SLB supports DNS, HTTP, ping, TCP, custom UDP, and WSP probes:

- A DNS probe sends domain name resolve requests to real servers, and verifies the returned IP addresses.
- An HTTP probe establishes HTTP connections to real servers, sends HTTP requests to the real servers, and verifies the responses. HTTP probes are a simple way to verify connectivity for devices being server load-balanced, and for firewalls being firewall load-balanced (even devices on the other side of a firewall).

  HTTP probes also enable you to monitor applications being server load-balanced. With frequent probes, the operation of each application is verified, not just connectivity to the application.

  HTTP probes do not support HTTP over Secure Socket Layer (HTTPS). That is, you cannot send an HTTP probe to an SSL server.
- A ping probe pings real servers. Like HTTP probes, ping probes are a simple way to verify connectivity for devices and firewalls being load-balanced.
- A TCP probe establishes and removes TCP connections. Use TCP probes to detect failures on TCP port 443 (HTTPS).
- A custom UDP probe can to support a variety of applications and protocols, including:
  - RADIUS Accounting/Authorization probes
  - GTP Echo probes
  - Connectionless WSP probes
  - XML-over-UDP probes for CSG user-database load-balancing
  - Mobile IP RRQ/RRP
- A WSP probe simulates requests for wireless content and verifies the retrieved content. Use WSP probes to detect failures in the Wireless Application Protocol (WAP) stack on port 9201.

You can configure more than one probe, in any combination of supported types, for each server farm, or for each firewall in a firewall farm.

You can also flag a probe as a routed probe, with the following considerations:

- Only one instance of a routed probe per server farm can run at any given time.
- Outbound packets for a routed probe are routed directly to a specified IP address.

IOS SLB probes use the SA Agent. You might want to specify the amount of memory that the SA Agent can use, using the **rtr low-memory** command. If the amount of available free memory falls below the value specified in the **rtr low-memory** command, then the SA Agent does not allow new operations to be configured. Refer to the description of the **rtr low-memory** command in the *Cisco IOS Configuration Fundamentals Command Reference*, Release 12.2 for more details.

Probes in Server Load Balancing

Probes determine the status of each real server in a server farm. All real servers associated with all virtual servers tied to that server farm are probed.

If a real server fails for one probe, it is failed for all probes. After the real server recovers, all probes must acknowledge its recovery before it is restored to service.

Probes in Firewall Load Balancing

Probes detect firewall failures. All firewalls associated with the firewall farm are probed.

If a firewall fails for one probe, it is failed for all probes. After the firewall recovers, all probes must acknowledge its recovery before it is restored to service.

Make sure you configure the HTTP probe to expect status code 401, to eliminate password problems. Refer to the description of the **expect** command in the "Command Reference" section on page 131 for more details.

Use the **ip http server** command to configure an HTTP server on the device. Refer to the description of the **ip http server** command in the *Cisco IOS Configuration Fundamentals Command Reference*, Release 12.2 for more details.

In a transparent web cache load-balancing environment, an HTTP probe uses the real IP address of the web cache, since there is no virtual IP address configured.

Protocol Support Features

IOS SLB provides the following protocol support features:

Protocol Support

IOS SLB supports the following protocols:

- Domain Name System (DNS)
- Encapsulation Security Payload (ESP)
- File Transfer Protocol (FTP)
- Generic Routing Encapsulation (GRE)
- GPRS Tunneling Protocol v0 (GTPv0)

- GPRS Tunneling Protocol v1 (GTPv1)
- Hypertext Transfer Protocol (HTTP)
- Hypertext Transfer Protocol over Secure Socket Layer (HTTPS)
- Internet Message Access Protocol (IMAP)
- IP in IP Encapsulation (IPinIP)
- Internet Key Exchange (IKE, was ISAKMP)
- Mapping of Airline Traffic over IP, Type A (MATIP-A)
- Network News Transport Protocol (NNTP)
- Post Office Protocol, version 2 (POP2)
- Post Office Protocol, version 3 (POP3)
- RealAudio/RealVideo via RTSP
- Remote Authentication Dial-In User Service (RADIUS)
- Simple Mail Transport Protocol (SMTP)
- Telnet
- Transmission Control Protocol (TCP) and standard TCP protocols
- User Datagram Protocol (UDP) and standard UDP protocols
- X.25 over TCP (XOT)
- Wireless Application Protocol (WAP), including:
  - Connectionless Secure WSP
  - Connectionless WSP
  - Connection-Oriented Secure WSP
  - Connection-Oriented WSP

AAA Load Balancing

IOS SLB provides RADIUS load-balancing capabilities for RADIUS authentication, authorization, and accounting (AAA) servers.

IOS SLB provides the following RADIUS load-balancing functions:

- Balances RADIUS requests among available RADIUS servers and proxy servers.
- Routes RADIUS request retransmissions (such as retransmissions of unanswered requests) to the same RADIUS server or proxy server as the original request.
- Provides session-based automatic failure detection.
- Supports both stateless backup and stateful backup.

In addition, IOS SLB can load-balance devices that proxy the RADIUS Authorization and Accounting flows in both traditional and mobile wireless networks. For more information, see the "RADIUS Load Balancing" section on page 26.

Audio and Video Load Balancing

IOS SLB can balance RealAudio and RealVideo streams via Real-Time Streaming Protocol (RTSP), for servers running RealNetworks applications.

VPN Server Load Balancing

IOS SLB can balance Virtual Private Network (VPN) flows, including the following flows:

- IP Security (IPSec) flows. An IPSec flow consists of a UDP control session and an ESP tunnel.
- Point-to-Point Tunneling Protocol (PPTP) flows. A PPTP flow consists of a TCP control session and a GRE tunnel.

Redundancy Features

An IOS SLB device can represent a single point of failure, and the servers can lose their connections to the backbone, if either of the following occurs:

- The IOS SLB device fails.
- A link from a switch to the distribution-layer switch becomes disconnected.

To reduce that risk, IOS SLB supports the following redundancy enhancements, based on HSRP:

- Stateless Backup, page 23
- Stateful Backup, page 23
- Active Standby, page 23

Stateless Backup

Stateless backup provides high network availability by routing IP flows from hosts on Ethernet networks without relying on the availability of a single Layer 3 switch. Stateless backup is particularly useful for hosts that do not support a router discovery protocol (such as the Intermediate System-to-Intermediate System [IS-IS] Interdomain Routing Protocol [IDRP]) and do not have the functionality to shift to a new Layer 3 switch when their selected Layer 3 switch reloads or loses power.

Stateful Backup

Stateful backup enables IOS SLB to incrementally backup its load-balancing decisions, or "keep state," between primary and backup switches. The backup switch keeps its virtual servers in a dormant state until HSRP detects failover; then the backup (now primary) switch begins advertising virtual addresses and processing flows. You can use HSRP to configure how quickly the failover is detected.

Stateful backup provides IOS SLB with a one-to-one stateful or idle backup scheme. This means that only one instance of IOS SLB is handling client or server flows at a given time, and that there is at most one backup platform for each active IOS SLB switch.

GPRS load balancing *without* GTP cause code inspection enabled does not support stateful backup.

The Home Agent Director does not support stateful backup.

Active Standby

Active standby enables two IOS SLBs to load-balance the same virtual IP address while at the same time acting as backups for each other. If a site has only one virtual IP address to load-balance, an access router is used to direct a subset of the flows to each IOS SLB using policy-based routing.

IOS SLB firewall load balancing does not support active standby. That is, you cannot configure two pairs of firewall load balancing devices (one pair on each side of the firewalls), with each device in each pair handling traffic and backing up its partner.

Exchange Director Features

IOS SLB supports the Exchange Director for the Cisco Mobile Exchange (CMX) for Catalyst 6500 family switches and Cisco 7600 series routers. The Exchange Director provides the following features:

GPRS Load Balancing

General packet radio service (GPRS) is the packet network infrastructure based on the European Telecommunications Standards Institute (ETSI) Global System for Mobile Communication (GSM) phase 2+ standards for transferring packet data from the GSM mobile user to the packet data network (PDN). The Cisco gateway GPRS support node (GGSN) interfaces with the serving GPRS support node (SGSN) using the GPRS Tunneling Protocol (GTP), which in turn uses UDP for transport. IOS SLB provides GPRS load balancing and increased reliability and availability for the GGSN.

When configuring the network shared by IOS SLB and the GGSNs, keep the following considerations in mind:

- Specify static routes (using **ip route** commands) and real server IP addresses (using **real** commands) such that the Layer 2 information is correct and unambiguous.
- Choose subnets carefully, using one of the following methods:
  - Do not overlap virtual template address subnets.
  - Specify next hop addresses to real servers, not to interfaces on those servers.
- IOS SLB assigns all PDP context creates from a specific IMSI to the same GGSN.
- IOS SLB supports both GTP Version 0 (GTP v0) and GTP Version 1 (GTP v1). Support for GTP enables IOS SLB to become "GTP aware," extending IOS SLB's knowledge into Layer 5.

IOS SLB supports two types of GPRS load balancing:

- GPRS Load Balancing without GTP Cause Code Inspection, page 24
- GPRS Load Balancing with GTP Cause Code Inspection, page 25

GPRS Load Balancing without GTP Cause Code Inspection

GPRS load balancing *without* GTP cause code inspection enabled is recommended for Cisco GGSNs. It has the following characteristics:

- Can operate in dispatched mode or in directed server NAT mode, but not in directed client NAT mode. In dispatched mode, the GGSNs must be Layer 2-adjacent to the IOS SLB device.
- Does not support stateful backup. See the "Stateful Backup" section on page 23 for more information.

- Delivers tunnel creation messages destined to the virtual GGSN IP address to one of the real GGSNs, using the weighted round robin load-balancing algorithm. See the "Weighted Round Robin" section on page 7 for more information about this algorithm.
- Requires DFP in order to account for secondary PDP contexts in GTP v1.

GPRS Load Balancing with GTP Cause Code Inspection

GPRS load balancing *with* GTP cause code inspection enabled allows IOS SLB to monitor all PDP context signaling flows to and from GGSN server farms. This enables IOS SLB to monitor GTP failure cause codes, detecting system-level problems in both Cisco and non-Cisco GGSNs.

Table 1 lists the PDP create response cause codes and the corresponding actions taken by IOS SLB.

Table 1 PDP Create Response Cause Codes and Corresponding IOS SLB Actions

Cause Code	IOS SLB Action
Request Accepted	Establish session
No Resource Available	Fail current real, reassign session, drop the response
All dynamic addresses are occupied	Fail current real, reassign session, drop the response
No memory is available	Fail current real, reassign session, drop the response
System Failure	Fail current real, reassign session, drop the response
Missing or Unknown APN	Forward the response
Unknown PDP Address or PDP type	Forward the response
User Authentication Failed	Forward the response
Semantic error in TFT operation	Forward the response
Syntactic error in TFT operation	Forward the response
Semantic error in packet filter	Forward the response
Syntactic error in packet filter	Forward the response
Mandatory IE incorrect	Forward the response
Mandatory IE missing	Forward the response
Optional IE incorrect	Forward the response
Invalid message format	Forward the response
Version not supported	Forward the response

GPRS load balancing *with* GTP cause code inspection enabled has the following characteristics:

- Must operate in directed server NAT mode.
- Supports stateful backup. See the "Stateful Backup" section on page 23 for more information.
- Tracks the number of open PDP contexts for each GGSN, which enables GGSN server farms to use the weighted least connections (**leastconns**) algorithm for GPRS load balancing. See the "Weighted Least Connections" section on page 8 for more information about this algorithm.
- Enables IOS SLB to deny access to a virtual GGSN if the carrier code of the requesting International Mobile Subscriber ID (IMSI) does not match a specified value.
- Enables IOS SLB to account for secondary PDP contexts even without DFP.

Home Agent Director

The Home Agent Director load balances Mobile IP Registration Requests (RRQs) among a set of home agents (configured as real servers in a server farm). Home agents are the anchoring points for mobile nodes. Home agents route flows for a mobile node to its current foreign agent (point of attachment).

The Home Agent Director has the following characteristics:

- Can operate in dispatched mode or in directed server NAT mode, but not in directed client NAT mode. In dispatched mode, the home agents must be Layer 2-adjacent to the IOS SLB device.
- Can operate in both fast and CEF switching modes.
- Does not support stateful backup. See the "Stateful Backup" section on page 23 for more information.
- Delivers RRQs destined to the virtual Home Agent Director IP address to one of the real home agents, using the weighted round robin load-balancing algorithm. See the "Weighted Round Robin" section on page 7 for more information about this algorithm.
- Requires DFP in order to allocate RRQs based on capacity.

For more information about Mobile IP, home agents, and related topics, refer to the *Cisco IOS IP Configuration Guide*, Release 12.2.

RADIUS Load Balancing

IOS SLB provides RADIUS load-balancing capabilities for RADIUS servers. In addition, IOS SLB can load-balance devices that proxy the RADIUS Authorization and Accounting flows in both traditional and mobile wireless networks, if desired. IOS SLB does this by correlating data flows to the same proxy that processed the RADIUS for that subscriber flow.

IOS SLB provides RADIUS load balancing in mobile wireless networks that use service gateways, such as the Cisco Service Selection Gateway (SSG) or the Cisco Content Services Gateway (CSG). The following mobile wireless networks are supported:

- GPRS networks. In a GPRS mobile wireless network, the RADIUS client is typically a GGSN.
- Simple IP CDMA2000 networks. CDMA2000 is a third-generation (3-G) version of Code Division Multiple Access (CDMA). In a simple IP CDMA2000 mobile wireless network, the RADIUS client is a Packet Data Service Node (PDSN).
- Mobile IP CDMA2000 networks. In a Mobile IP CDMA2000 mobile wireless network, both the Home Agent (HA) and the PDSN/Foreign Agent (PDSN/FA) are RADIUS clients.

IOS SLB provides the following RADIUS load-balancing functions:

- Balances RADIUS requests among available RADIUS servers and proxy servers.
- Routes RADIUS request retransmissions (such as retransmissions of unanswered requests) to the same RADIUS server or proxy server as the original request.
- Routes all of a subscriber's RADIUS flows, as well as all non-RADIUS data flows for the same subscriber, to the same service gateway.
- Supports multiple service gateway server farms (for example, one farm of SSGs and another of CSGs). IOS SLB examines the input interface in a packet to route it to the correct service gateway server farm.
- Can route data packets to a real server in the CSG farm, then to a real server in the SSG farm.
- Routes RADIUS Accounting-Request messages from a RADIUS client to the service gateway that processed the RADIUS Access-Request message for the subscriber. The service gateway can then clean up the host entry it has created for the subscriber.

- Uses the weighted round robin load-balancing algorithm. See the "Weighted Round Robin" section on page 7 for more information about this algorithm.
- Facilitates SSG single sign-on via the RADIUS protocol.
- Provides session-based automatic failure detection.
- Supports both stateless backup and stateful backup.

To perform RADIUS load balancing, IOS SLB uses the following RADIUS sticky databases:

- The IOS SLB RADIUS framed-IP sticky database associates each subscriber's IP address with a specific service gateway. In a GPRS mobile wireless network, IOS SLB uses the RADIUS framed-IP sticky database to route packets correctly.

Note Subscriber IP addresses are assigned by service gateways or by RADIUS clients. If subscriber IP addresses are assigned from disjoint per-service gateway pools (so that the next-hop service gateway can be chosen based on the source IP address), IOS SLB can use policy routing to route subscriber flows.

- The IOS SLB RADIUS calling-station-ID sticky database associates each subscriber's calling station ID with a specific service gateway.
- The IOS SLB RADIUS username sticky database associates each subscriber's username with a specific service gateway.
- In a CDMA2000 mobile wireless network, to route packets correctly, IOS SLB requires both the RADIUS framed-IP sticky database and either the RADIUS username sticky database or the RADIUS calling-station-ID sticky database.
- The IOS SLB RADIUS International Mobile Subscriber ID (IMSI) sticky database maps the IMSI address for each user to the corresponding gateway. This enables IOS SLB to forward all subsequent flows for the same user to the same gateway.

WAP Load Balancing

You can use IOS SLB to load-balance Wireless Session Protocol (WSP) sessions among a group of WAP gateways or servers on an IP bearer network. WAP runs on top of UDP on a set of well known ports, with each port indicating a different WAP mode:

- Connectionless WSP mode (IP/UDP [9200]/WSP). In connectionless WSP mode, WSP is a simple one-request/one-response protocol in which a single server-bound packet results in a server response of one or more packets.
- Connection-oriented WSP mode (IP/UDP [9201]/WTP/WSP). In connection-oriented WSP mode, WTP handles retransmissions of WDP events, and WSP operates using a defined session bring-up/tear-down sequence. IOS SLB uses a WAP-aware finite state machine (FSM), driven by events in WSP sessions, to reassign sessions. This FSM operates only on port 9201, where the WSP sessions are not encrypted and WTP handles retransmissions.
- Connectionless secure WSP mode (IP/UDP [9202]/WTLS/WSP). This mode functions the same as connectionless WSP mode, but with security provided by WTLS.
- Connection-oriented secure WSP mode (IP/UDP [9203]/WTLS/WTP/WSP). This mode functions the same as connection-oriented WSP mode, but with security provided by WTLS.

IOS SLB uses WSP probes to detect failures in the WAP stack on port 9201.

Stateful Backup of Redundant Route Processors

When used with RPR+, IOS SLB supports the stateful backup of redundant route processors for CMX for Catalyst 6500 family switches and Cisco 7600 series routers. This enables you to deploy Cisco Multiprocessor WAN Application Modules (MWAMs) in the same chassis as IOS SLB, while maintaining high availability of load-balancing assignments.

Flow Persistence

Flow persistence provides intelligent return routing of load-balanced IP flows to the appropriate node, without the need for coordinated hash mechanisms on both sides of the load-balanced data path, and without using Network Address Translation (NAT) or proxies to change client or server IP addresses.

Benefits

IOS SLB shares the same software code base as Cisco IOS and has all the software features sets of Cisco IOS software. IOS SLB is recommended for customers desiring complete integration of SLB technology into traditional Cisco switches and routers.

On Cisco Catalyst 6500 family switches, IOS SLB takes advantage of hardware acceleration to forward packets at very high speed when running in dispatched mode.

IOS SLB assures continuous, high availability of content and applications with proven techniques for actively managing servers and connections in a distributed environment. By distributing user requests across a cluster of servers, IOS SLB optimizes responsiveness and system capacity, and dramatically reduces the cost of providing Internet, database, and application services for large-, medium-, and small-scale sites.

IOS SLB facilitates scalability, availability, and ease of maintenance:

- The addition of new physical (real) servers, and the removal or failure of existing servers, can occur at any time, transparently, without affecting the availability of the virtual server.
- IOS SLB's slow start capability allows a new server to increase its load gradually, preventing failures caused by assigning the server too many new connections too quickly.
- IOS SLB supports fragmented packets and packets with IP options, buffering your servers from client or network vagaries that are beyond your control.
- IOS SLB firewall load balancing enables you to scale access to your Internet site. You can add firewalls without affecting existing connections, enabling your site to grow without impacting customers.

Using DFP enables IOS SLB to provide weights to another load-balancing system. IOS SLB can act as a DFP manager, receiving weights from host servers, and it can act as a DFP agent, sending weights to a DFP manager. The functions are enabled independently—you can implement either one, or both, at the same time.

Administration of server applications is easier. Clients know only about virtual servers; no administration is required for real server changes.

Security of the real server is provided because its address is never announced to the external network. Users are familiar only with the virtual IP address. You can filter unwanted flows based on both IP address and TCP or UDP port numbers. Additionally, though it does not eliminate the need for a firewall, IOS SLB can help protect against some denial-of-service attacks.

In a branch office, IOS SLB allows balancing of multiple sites and disaster recovery in the event of full-site failure, and distributes the work of load balancing.

Restrictions

IOS SLB has the following restrictions:

- **Does not support load balancing of flows between clients and real servers that are on the same local-area network (LAN) or virtual LAN (VLAN). The packets being load-balanced cannot enter and leave the load-balancing device on the same interface.**
- You cannot configure IOS SLB from different user sessions at the same time.
- Do not configure an IOS SLB virtual IP address on the same subnet as any real server IP address, unless all server farms that include the real server IP address are configured with **nat server**.
- Operates in a standalone mode and currently does not operate as a MultiNode Load Balancing (MNLB) Services Manager. Does not support IOS SLB and MNLB configured with the same virtual IP address, even if they are for different services. The presence of IOS SLB does not preclude the use of the existing MNLB Forwarding Agent with an external Services Manager (such as the LocalDirector) in an MNLB environment. (MNLB is sometimes called Cisco Application Services Architecture, or CASA.)
- Does not support coordinating server load-balancing statistics among different IOS SLB instances for backup capability.
- Supports FTP and firewall load balancing only in dispatched mode.
- Does not support Dynamic Host Configuration Protocol (DHCP) load balancing.
- When operating in dispatched mode, real servers must be Layer 2-adjacent, tag-switched, or via GRE tunnel.

  When operating in directed mode with server NAT, real servers need not be Layer 2-adjacent to IOS SLB. This function allows for more flexible network design, since servers can be placed several Layer 3 hops away from the IOS SLB switch.
- When operating in directed mode as a member of a multicast group, IOS SLB can receive multicast flows but cannot send multicast flows. This is not a restriction when operating in dispatched mode.
- Supports client NAT and server port translation for TCP and UDP virtual servers only.
- When balancing streams to a virtual IP address (VIP) that is the same as one of the IOS interface addresses (loopback, Ethernet, and so on), IOS SLB treats all UDP packets to that address as traceroute packets and replies with “host unreachable” ICMP packets. This occurs even if the IOS listens to the target UDP port. To avoid this issue, configure the virtual server as a network (address/31), not as a host (address/32).
- Do not use the virtual IP address (VIPs) configured in the IOS SLB virtual server for UDP-based router management applications such as SNMP. Doing so can result in high CPU usage. (This is not a problem for a UDP virtual server that is configured with destination port number 0.)
- The DFP agent requires a delay between hello messages of at least 3 seconds. Therefore, if your DFP manager provides a timeout specification, you must set the timeout to at least 3 seconds.
- When both IOS SLB and the Web Cache Communication Protocol (WCCP) are configured on a Catalyst 6500 family switch, and WCCP Input Redirection is configured with IOS SLB, Layer 2 WCCP forwarding must be used between the router and the cache. In this case, WCCP and IOS SLB both run in hardware and are processed in the correct order. If Generic Routing Encapsulation (GRE) forwarding is used, then IOS SLB takes precedence over WCCP and there is no redirection, because GRE forwarding is done on the MSFC. Note that the WCCP forwarding method, either Layer 2 or GRE, is configured on the cache engine and not on the switch.

- If you do not configure an access interface using the **access** command in server farm, virtual server, or firewall farm configuration mode, IOS SLB automatically configures wildcards for the server farm, virtual server, or firewall farm in all of its interfaces, including the VRF interfaces. If IOS SLB is not required on the VRF interfaces, use the **access** command to limit wildcards to those interfaces only.
- For static NAT:
  - Does not work with client NAT server farms. That is, if a real server is using a given virtual IP address for server NAT, and a server farm is associated with that same virtual IP address, then you cannot configure the server farm to use client NAT.
  - Requires that each real server be associated with only one virtual server, to ensure that IOS SLB can create connections correctly.
  - Requires a 0-port virtual server.
  - Does not support virtual service FTP.
  - Static NAT with per-packet server load balancing does not load-balance fragmented packets.
- For backup server farm support:
  - Does not support defining the same real server in both primary and backup server farms.
  - Requires the same NAT configuration (none, client, server, or both) for both primary and backup server farms. In addition, if NAT is specified, both server farms must use the same NAT pool.
  - Does not support HTTP redirect load balancing. If a primary server farm specifies a redirect virtual server, you cannot define that primary as a backup, nor can you define a backup for that primary.
- For firewall load balancing:
  - Is no longer limited to a single firewall farm in each load-balancing device.
  - Is limited to a single active firewall load-balancing device on each side of the firewall farm. Each firewall must have its own unique MAC address and must be Layer 2-adjacent to each device. The firewalls can be connected to individual interfaces on the device, or they can all share a VLAN and connect using a single interface.
  - Requires Ethernet between each firewall load-balancing device and each firewall.
  - On each firewall load-balancing device, requires that each Layer 2 firewall be connected to a single Layer 3 (IP) interface.
  - Flows with a destination IP address on the same subnet as the configured firewall IP addresses are not load-balanced. (Such flows could be a firewall console session or other flows on the firewall LAN.)
  - Does not support the following IOS SLB functions:
    - Active standby
    - Network Address Translation (NAT)
    - Port-bound servers
    - SynGuard
    - TCP session reassignment
    - Transparent web cache load balancing
- For “sandwich” configurations, if a flow is to be directed through two IOS SLB instances (virtual servers or firewall farms), the IOS SLB instances must reside in different Virtual Private Network (VPN) routing and forwardings (VRFs).

- VRF-aware IOS SLB does not operate "between" VRFs. That is, the server farm interface and the client traffic interface must use the same VRFs.
- For GPRS load balancing *without* GTP cause code inspection enabled:
  - If a real server is defined in two or more server farms, each server farm must be associated with a different virtual server.
  - Operates in either dispatched or directed server NAT mode only.
  - Does not load-balance network-initiated PDP context requests.
  - Does not support the following IOS SLB functions:
    - Bind IDs
    - Client-assigned load balancing
    - Slow Start
    - Stateful backup (unless GTP cause code inspection is enabled)
    - Sticky connections
    - Weighted least connections load-balancing algorithm
- For GPRS load balancing *with* GTP cause code inspection enabled:
  - If a real server is defined in two or more server farms, each server farm must be associated with a different virtual server.
  - Operates in directed server NAT mode only.
  - Cannot load-balance network-initiated PDP context requests.
  - Requires inbound and outbound signaling to flow through IOS SLB.
  - Requires either the SGSN or the GGSN to echo its peer.
  - Does not support the following IOS SLB functions:
    - Bind IDs
    - Client-assigned load balancing
    - Slow Start
    - Sticky connections
- For VPN server load balancing:
  - Does not support Internet Control Message Protocol (ICMP) and wildcard (0-protocol) virtual servers.
- For RADIUS load balancing for GPRS:
  - RADIUS load balancing requires the weighted round robin algorithm.
  - RADIUS load balancing does not support fragmented RADIUS packets.
  - All Accounting-Request and Access-Accept messages must include the RADIUS-assigned Framed-ip-address attribute. The source IP address for each subscriber flow must also match the value of the Framed-ip-address attribute in the Access-Accept message.
  - RADIUS accounting must be enabled on the RADIUS client, which is typically a Network Access Server (NAS).
- For RADIUS load balancing for CDMA2000:
  - RADIUS load balancing requires the weighted round robin algorithm.
  - RADIUS load balancing does not support fragmented RADIUS packets.

- All subscribers on the mobile network must be assigned a unique IP address (that is, no overlapping IP addresses) which can be routed in the mobile wireless network.
- Each User-Name attribute must correspond to a single subscriber, or at most to a very small number of subscribers. Otherwise, a single SSG might be burdened with an unexpectedly large load.
- For simple IP networks, the following additional restrictions apply:

  - The PDSN must include the User-Name attribute in all RADIUS Access-Request and Accounting-Start packets. The value of the User-Name attribute for a given subscriber must be the same in all the packets (except for Cisco PDSNs that provide MSID-based access).

  - The PDSN must include the Framed-ip-address attribute and the NAS-ip-address in all RADIUS Accounting-Start and Accounting-Stop packets. The value of the Framed-ip-address attribute must equal the source IP address in subscriber data packets routed by RADIUS load balancing for SSG service.

  - The PDSN must include the NAS-ip-address in all Accounting-Requests. For BSC/PCF hand-offs, the Accounting-Stop must include the 3GPP2-Session-Continue VSA with a value of **1**, to prevent the destruction of RADIUS load balancing sticky database objects for the subscriber.
- For Mobile IP networks, the following additional restrictions apply:

  - For a given subscriber session, the PDSN and HA must send the RADIUS Access-Request and Accounting-Start packets with the User-Name attribute. The value of the User-Name attribute in all PDSN and HA RADIUS packets must be the same for the session.

  - For a given subscriber session, the PDSN and HA must send RADIUS Accounting-Request packets with a Framed-ip-address attribute equal to the source IP address in subscriber data packets routed by RADIUS load balancing for SSG service. All RADIUS Accounting-Requests sent by the PDSN and HA must also include the NAS-ip-address attribute.

  - The PDSN must include the 3GPP2-Correlation-Identifier attribute in all Accounting-Requests.

• For the Home Agent Director:
  - A Registration Request (RRQ) must include the network access identifier (NAI) in order to be load-balanced.
  - An RRQ must include a home agent IP address of either 0.0.0.0 or 255.255.255.255 in order to be load-balanced.
  - For fast switching, the NAI in the RRQ cannot be more than 96 bytes deep in the packet. If the NAI is deeper than 96 bytes, IOS SLB handles the packet at the process level.
  - Operates in either dispatched or directed server NAT mode only.
  - Does not support the following IOS SLB functions:
    - Bind IDs
    - Client-assigned load balancing
    - Slow Start
    - Stateful backup
    - Sticky connections
    - Weighted least connections load-balancing algorithm

• For HTTP probes:

  - HTTP probes do not support HTTP over Secure Socket Layer (HTTPS). That is, you cannot send an HTTP probe to an SSL server.
- For UDP probes:
  - UDP probes do not support fragmented Response packets.
  - UDP probes do not support hosts that require a particular source port value in probe packets. UDP probes select an ephemeral port for each probe.
  - Protocols and applications that have Message Digest Algorithm Version 5 (MD5) checksums generated from payload must be captured by a "sniffer" to obtain a correct checksum.
- For Catalyst 6500 family switches and Cisco 7600 series routers:
  - Supports Native IOS only (c6sup images). Native IOS requires the MSFC and the Policy Feature Card (PFC). When running redundant MSFCs in the same Catalyst 6500 family switch, stateful backup between the two MSFCs is not supported, but stateless backup between the two MSFCs is supported.

    The term "MSFC" refers to an MSFC1, MSFC2, or MSFC3, except when specifically differentiated.

    The term "PFC" refers to a PFC1, PFC2, or PFC3, except when specifically differentiated.
  - Requires that the Multilayer Switching (MLS) flow mode operate in full-flow mode or in interface full-flow mode. IOS SLB automatically sets the flow mode for its own use. For more information about how to set the MLS flow, refer to the *Catalyst 6000 Family IOS Software Configuration Guide*.
  - When operating in dispatched mode, real servers must be Layer 2-adjacent to IOS SLB (that is, not beyond an additional router), with hardware data packet acceleration performed by the PFC. All real servers in the same server farm must be on the same VLAN. The loopback address must be configured in the real servers.
  - Requires that all real servers in a firewall farm be on the same VLAN. Real servers in different firewall farms can be on different VLANs.
  - The Catalyst 6500 family switch always responds to pings destined for the virtual IP address (VIP), even if all real servers are down. The Catalyst 6500 family switch does not forward packets destined for the VIP, even if all real servers are down and the switch has a valid route for the VIP.
  - Provides no hardware data packet acceleration in directed mode. (Hardware data packet acceleration is performed by the PFC, and in directed mode the packets are handled by the MSFC, not the PFC.)
  - For Supervisor Engine 2, "sandwich" configurations that require firewall load balancing are not supported, because such configurations require VRF, and VRF is not supported for Supervisor Engine 2.

Related Features and Technologies

- Content Flow Monitor (CFM)
- Dynamic Feedback Protocol (DFP)
- General packet radio service (GPRS)
- Home Agent (HA) Director
- Hot Standby Router Protocol (HSRP)

- Mobile IP
- Network Address Translation (NAT)
- Wireless Application Protocol (WAP)

Related Documents

- *Cisco IOS IP Configuration Guide*, Release 12.2
- *Cisco IOS IP Command Reference, Volume 1 of 3: Addressing and Services*, Release 12.2
- *Cisco IOS Mobile Wireless Configuration Guide*, Release 12.2
- *Cisco IOS Mobile Wireless Command Reference*, Release 12.2
- *Dynamic Feedback Protocol Support in Distributed Director*
- *Using Content Flow Monitor*

Supported Platforms

For the Cisco Catalyst 6500 Family Switches

- Supervisor Engine 2 with an MSFC2 (SUP2-MSFC2)
- Supervisor Engine 32 with an MSFC2A (SUP32-MSFC2A)
- Supervisor Engine 720 with an MSFC3 (SUP720-MSFC3)

For the Cisco 7600 Series Routers

- Supervisor Engine 2 with an MSFC2 (SUP2-MSFC2)
- Supervisor Engine 32 with an MSFC2A (SUP32-MSFC2A)
- Supervisor Engine 720 with an MSFC3 (SUP720-MSFC3)

Determining Platform Support Through Cisco Feature Navigator

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

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

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

http://www.cisco.com/register

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

http://www.cisco.com/go/cfn

Availability of Cisco IOS Software Images

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

Supported Standards, MIBs, and RFCs

Standards

- No new or modified standards

MIBs

- CISCO-SLB-MIB
- CISCO-SLB-CAPABILITY

Note Although the objects in these MIBs are defined as *read-create*, you cannot use the SNMP SET command to modify them. Instead, you must use the command line to set the associated command line keywords, after which the new values are reflected in SNMP.

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

http://tools.cisco.com/ITDIT/MIBS/servlet/index

If Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download MIBs from the Cisco MIBs page at the following URL:

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

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

http://www.cisco.com/register

RFCs

- Cisco IOS NAT, RFC 1631

Configuration Tasks

Configuring IOS SLB involves identifying server farms, configuring groups of real servers in server farms, and configuring the virtual servers that represent the real servers to the clients.

For configuration examples associated with these tasks, see the "Configuration Examples" section on page 69.

For a complete description of the IOS SLB commands in this section, see the "Command Reference" section on page 131. To locate documentation of other commands that appear in this section, search online using Cisco.com.

To configure IOS SLB, perform the tasks in the following sections:

Configuring Required and Optional IOS SLB Functions

To configure IOS SLB functions, perform the tasks in the following sections. Required and optional tasks are indicated.

- Verifying the Virtual Server, page 43 (Optional)
- Verifying the Clients, page 43 (Optional)
- Verifying IOS SLB Connectivity, page 44 (Optional)

Configuring a Server Farm and Real Server

Note You cannot configure IOS SLB from different user sessions at the same time.

To configure an IOS SLB server farm, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# ip slb serverfarm server-farm` `Router(config-slb-sfarm)#`	Adds a server farm definition to the IOS Server Load Balancing (IOS SLB) configuration and enters server farm configuration mode.
Step 2	`Router(config-slb-sfarm)# bindid [bind-id]`	(Optional) Specifies a bind ID on the server farm for use by Dynamic Feedback Protocol (DFP). **Note** GPRS load balancing and Home Agent Director do not support this command.
Step 3	`Router(config-slb-sfarm)# nat {client pool | server}`	(Optional) Configures Network Address Translation (NAT) client translation mode or NAT server address translation mode on the server farm.
Step 4	`Router(config-slb-sfarm)# predictor [roundrobin | leastconns]`	(Optional) Specifies the algorithm to be used to determine how a real server is selected. **Note** RADIUS load balancing requires the default setting (the weighted round robin algorithm). In GPRS load balancing without GTP cause code inspection enabled, you must accept the default setting (the weighted round robin algorithm). The Home Agent Director requires the default setting (the weighted round robin algorithm). See the following sections for more details: • Weighted Round Robin, page 7 • Weighted Least Connections, page 8
Step 5	`Router(config-slb-sfarm)# probe probe`	(Optional) Associates a probe with the real server.

	Command	Purpose
Step 6	Router(config-slb-sfarm)# **real** *ip-address* [*port*]	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode. **Note** In GPRS load balancing, specify the IP addresses (virtual template addresses, for Cisco GGSNs) of the real servers performing the GGSN function. In VPN server load balancing, specify the IP addresses of the real servers acting as VPN terminators. For the Home Agent Director, specify the IP addresses of the real servers acting as home agents.
Step 7	Router(config-slb-real)# **faildetect numconns** *number-of-conns* [**numclients** *number-of-clients*]	(Optional) Specifies the number of consecutive connection failures and, optionally, the number of unique client connection failures, that constitute failure of the real server. In GPRS load balancing, if there is only one SGSN in your environment, specify the **numclients** keyword with a value of 1. In RADIUS load balancing, for automatic session-based failure detection, specify the **numclients** keyword with a value of 1.
Step 8	Router(config-slb-real)# **maxclients** *number-of-conns*	(Optional) Specifies the maximum number of IOS Server Load Balancing (IOS SLB) RADIUS and GTP sticky subscribers that can be assigned to an individual virtual server.
Step 9	Router(config-slb-real)# **maxconns** *number-of-conns* [**sticky-override**]	(Optional) Specifies the maximum number of active connections allowed on the real server at one time.
Step 10	Router(config-slb-real)# **reassign** *threshold*	(Optional) Specifies the threshold of consecutive unacknowledged SYNchronize sequence numbers (SYNs) or Create Packet Data Protocol (PDP) requests that, if exceeded, result in an attempted connection to a different real server. **Note** In GPRS load balancing, you must specify a reassign threshold less than the SGSN's N3-REQUESTS counter value.
Step 11	Router(config-slb-real)# **retry** *retry-value*	(Optional) Specifies the interval, in seconds, to wait between the detection of a server failure and the next attempt to connect to the failed server.

	Command	Purpose
Step 12	`Router(config-slb-real)# weight setting`	(Optional) Specifies the real server's workload capacity relative to other servers in the server farm. **Note** If you use Dynamic Feedback Protocol (DFP), the static weights you define using the **weight** command in server farm configuration mode are overridden by the weights calculated by DFP. If DFP is removed from the network, IOS SLB reverts to the static weights.
Step 13	`Router(config-slb-real)# inservice`	Enables the real server for use by IOS Server Load Balancing (IOS SLB).

Note When performing server load balancing and firewall load balancing together on a Catalyst 6500 Family Switch, use the **mls ip slb wildcard search rp** command to reduce the probability of exceeding the capacity of the TCAM on the PFC. See the"Configuring Wildcard Searches" section on page 66 for more details.

Configuring a Virtual Server

IOS SLB supports up to 500 virtual servers.

To configure an IOS SLB virtual server, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# ip slb vserver virtual-server`	Identifies a virtual server and enters virtual server configuration mode.

Step 2	`Router(config-slb-vserver)# virtual ip-address [netmask [group]] {esp | gre | protocol}`
	or
	`Router(config-slb-vserver)# virtual ip-address [netmask [group]] {tcp | udp} [port | any] [service service]`
		Specifies the virtual server IP address, type of connection, and optional TCP or User Datagram Protocol (UDP) port number, Internet Key Exchange (IKE) or Wireless Session Protocol (WSP) setting, and service coupling.
		Note For RADIUS load balancing, specify the **service radius** keyword option.
		Note For GPRS load balancing:
		– Specify a virtual GGSN IP address as the virtual server, and specify the **udp** keyword option.
		– To load-balance GTP v1 sessions, specify port number 2123, if the GGSNs and SGSNs are in compliance with the ETSI standard, or specify port number 0 or **any** to configure an all-port virtual server (that is, a virtual server that accepts flows destined for all ports).
		– To load-balance GTP v0 sessions, specify port number 3386, if the GGSNs and SGSNs are in compliance with the ETSI standard, or specify port number 0 or **any** to configure an all-port virtual server.
		– To enable GPRS load balancing *without* GTP cause code inspection, specify the **service gtp** keyword option.
		– To enable GPRS load balancing *with* GTP cause code inspection, specify the **service gtp-inspect** keyword option.

	Command	Purpose
Step 3	`Router(config-slb-vserver)#` **`serverfarm`** *`primary-farm`* `[`**`backup`** *`backup-farm`* `[`**`sticky`**`]]`	Associates a real server farm with a virtual server, and optionally configures a backup server farm and specifies that sticky connections are to be used in the backup server farm. **Note** GPRS load balancing, RADIUS load balancing, and the Home Agent Director do not support the **sticky** keyword. For GPRS load balancing, if a real server is defined in two or more server farms, each server farm must be associated with a different virtual server.
Step 4	`Router(config-slb-vserver)#` **`access`** *`interface`* `[`**`route framed-ip`**`]`	(Optional) Enables framed-IP routing to inspect the ingress interface.
Step 5	`Router(config-slb-vserver)#` **`advertise`**	(Optional) Controls the installation of a static route to the Null0 interface for a virtual server address.
Step 6	`Router(config-slb-vserver)#` **`client`** `{`*`ip-address netmask`* `[`**`exclude`**`] | ` **`gtp carrier-code`** `[`*`code`*`]}`	(Optional) Specifies which clients are allowed to use the virtual server. **Note** GPRS load balancing supports only the **gtp carrier-code** option, and only if GTP cause code inspection is enabled.
Step 7	`Router(config-slb-vserver)#` **`delay`** `{`*`duration`* `|` **`radius framed-ip`** *`duration`*`}`	(Optional) Specifies the time IOS Server Load Balancing (IOS SLB) maintains TCP connection context after a connection has terminated.
Step 8	`Router(config-slb-vserver)#` **`gtp notification cac`** `[`*`reassign-count`*`]`	(Optional) Limits the number of times IOS SLB can reassign a session to a new real server for GGSN-IOS SLB messaging.
Step 9	`Router(config-slb-vserver)#` **`hand-off radius`** *`duration`*	(Optional) Changes the amount of time IOS Server Load Balancing (IOS SLB) waits for an ACCT-START message from a new Mobile IP foreign agent in the event of a foreign agent hand-off.
Step 10	`Router(config-slb-vserver)#` **`idle`** `[`**`gtp request`** `|` **`ipmobile request`** `|` **`radius`** `{`**`request`** `|` **`framed-ip`**`}]` *`duration`*	(Optional) Specifies the minimum time IOS Server Load Balancing (IOS SLB) maintains connection context in the absence of packet activity. **Note** In GPRS load balancing *without* GTP cause code inspection enabled, specify an idle timer greater than the longest possible interval between PDP context requests on the SGSN.
Step 11	`Router(config-slb-vserver)#` **`purge radius framed-ip acct on-off`**	(Optional) Enables IOS SLB to purge entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting ON or OFF message.
Step 12	`Router(config-slb-vserver)#` **`purge radius framed-ip acct stop`** `{`*`attribute-number`* `|` `{`**`26`** `|` *`vsa`*`}` `{`*`vendor-ID`* `|` **`3gpp`** `|` **`3gpp2`**`}` *`sub-attribute-number`*`}`	(Optional) Enables IOS SLB to purge entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting-Stop message.

	Command	Purpose
Step 13	`Router(config-slb-vserver)#` **`replicate casa`** *`listen-ip remote-ip port`* `[`*`interval`*`] [`**`password`** `[`*`encrypt`*`]` *`secret-string timeout`*`]`	(Optional) Configures a stateful backup of IOS Server Load Balancing (IOS SLB) decision tables to a backup switch. **Note** The Home Agent Director does not support this command. If you specify the **service gtp** keyword on the **virtual** command, and you do not specify the **gtp imsi** keyword on the **sticky** command, the **replicate casa** command is not supported (because sessions are not persistent, and there is nothing to replicate).
Step 14	`Router(config-slb-vserver)#` **`replicate interval`** *`interval`*	(Optional) Sets the replication delivery interval for an IOS Server Load Balancing (IOS SLB) virtual server. **Note** The Home Agent Director does not support this command. If you specify the **service gtp** keyword on the **virtual** command, and you do not specify the **gtp imsi** keyword on the **sticky** command, the **replicate casa** command is not supported (because sessions are not persistent, and there is nothing to replicate).
Step 15	`Router(config-slb-vserver)#` **`replicate slave`**	(Optional) Enables stateful backup of redundant route processors for an IOS Server Load Balancing (IOS SLB) virtual server. **Note** The Home Agent Director does not support this command. If you specify the **service gtp** keyword on the **virtual** command, and you do not specify the **gtp imsi** keyword on the **sticky** command, the **replicate casa** command is not supported (because sessions are not persistent, and there is nothing to replicate).
Step 16	`Router(config-slb-vserver)#` **`sticky`** `{`*`duration`* `[`**`group`** *`group-id`*`] [`**`netmask`** *`netmask`*`] |` **`gtp imsi`** `[`**`group`** *`group-id`*`] |` **`radius calling-station-id`** `|` **`radius framed-ip`** `[`**`group`** *`group-id`*`] |` **`radius username`** `[`**`msid-cisco`**`] [`**`group`** *`group-id`*`]}`	(Optional) Specifies that connections from the same client use the same real server, as long as the interval between client connections does not exceed the specified duration. **Note** In VPN server load balancing, specify a *duration* of at least 15 seconds. GPRS load balancing and the Home Agent Director do not support this command.

	Command	Purpose
Step 17	`Router(config-slb-vserver)#` **`synguard`** *`syn-count interval`*	(Optional) Specifies the rate of TCP SYNchronize sequence numbers (SYNs) handled by a virtual server in order to prevent a SYN flood denial-of-service attack. **Note** GPRS load balancing and the Home Agent Director do not support this command.
Step 18	`Router(config-slb-vserver)#` **`inservice`**	Enables the virtual server for use by IOS Server Load Balancing (IOS SLB).
Step 19	`Router(config-slb-vserver)#` **`client`** *`ip-address netmask`*	Specifies which clients are allowed to use the virtual server.

Verifying the Virtual Server

The following **show ip slb vservers** command verifies the configuration of the virtual servers PUBLIC_HTTP and RESTRICTED_HTTP:

```
Router# show ip slb vservers

slb vserver      prot  virtual               state         conns
-------------------------------------------------------------------
PUBLIC_HTTP      TCP   10.0.0.1:80           OPERATIONAL     0
RESTRICTED_HTTP  TCP   10.0.0.2:80           OPERATIONAL     0
Router#
```

Verifying the Server Farm

The following **show ip slb reals** command displays the status of server farms PUBLIC and RESTRICTED, the associated real servers, and their status:

```
Router# show ip slb real

real                     farm name        weight   state          conns
---------------------------------------------------------------------
10.1.1.1                  PUBLIC           8       OPERATIONAL      0
10.1.1.2                  PUBLIC           8       OPERATIONAL      0
10.1.1.3                  PUBLIC           8       OPERATIONAL      0
10.1.1.20                 RESTRICTED       8       OPERATIONAL      0
10.1.1.21                 RESTRICTED       8       OPERATIONAL      0
Router#
```

The following **show ip slb serverfarm** command displays the configuration and status of server farms PUBLIC and RESTRICTED:

```
Router# show ip slb serverfarm

server farm      predictor    nat   reals   bind id
---------------------------------------------------
PUBLIC           ROUNDROBIN   none  3       0
RESTRICTED       ROUNDROBIN   none  2       0
Router#
```

Verifying the Clients

The following **show ip slb conns** command verifies the restricted client access and status:

```
Router# show ip slb conns

vserver         prot client                real                state      nat
-------------------------------------------------------------------------------
RESTRICTED_HTTP TCP  10.4.4.0:80           10.1.1.20           CLOSING    none
Router#
```

The following **show ip slb conns** command displays detailed information about the restricted client access status:

```
Router# show ip slb conns client 10.4.4.0 detail
VSTEST_UDP, client = 10.4.4.0:80
  state = CLOSING, real = 10.1.1.20, nat = none
  v_ip = 10.0.0.2:80, TCP, service = NONE
  client_syns = 0, sticky = FALSE, flows attached = 0
Router#
```

Verifying IOS SLB Connectivity

To verify that the IOS SLB feature has been installed and is operating correctly, ping the real servers from the IOS SLB switch, then ping the virtual servers from the clients.

The following **show ip slb stats** command displays detailed information about the IOS SLB network status:

```
Router# show ip slb stats
 Pkts via normal switching:  0
 Pkts via special switching: 6
 Pkts dropped:               0
 Connections Created:        1
 Connections Established:    1
 Connections Destroyed:      0
 Connections Reassigned:     0
 Zombie Count:               0
 Connections Reused:         0
```

Normal switching is when IOS SLB packets are handled on normal IOS switching paths (CEF, fast switching, and process level switching). Special switching is when IOS SLB packets are handled on hardware-assisted switching paths.

See the "Monitoring and Maintaining the IOS SLB Feature" section on page 68 for additional commands used to verify IOS SLB networks and connections.

Configuring Firewall Load Balancing

This section describes the tasks required to configure a basic IOS SLB firewall load-balancing network.

IOS SLB firewall load balancing uses probes to detect and recover from failures. You must configure a probe on each real server in the firewall farm. Ping probes are recommended; see the "Configuring Ping Probes" section on page 50 for more details. If a firewall does not allow ping probes to be forwarded, use HTTP probes instead. See the "Configuring HTTP Probes" section on page 50 for more details. You can configure more than one probe, in any combination of supported types (DNS, HTTP, TCP, or ping), for each firewall in a firewall farm.

When performing server load balancing and firewall load balancing together on a Catalyst 6500 Family Switch, use the **mls ip slb wildcard search rp** command to reduce the probability of exceeding the capacity of the TCAM on the PFC. See the"Configuring Wildcard Searches" section on page 66 for more details.

This section describes the following IOS SLB firewall load-balancing configuration tasks. Required and optional tasks are indicated.

- Configuring the Firewall Farm, page 45 (Required)
- Verifying the Firewall Farm, page 47 (Optional)
- Verifying Firewall Connectivity, page 47 (Optional)

Configuring the Firewall Farm

To configure an IOS SLB firewall load-balancing network, enter the following commands in order, beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)#` **`ip slb firewallfarm`** *`firewall-farm`* `Router(config-slb-fw)#`	Adds a firewall farm definition to the IOS Server Load Balancing (IOS SLB) configuration and enters firewall farm configuration mode.
Step 2	`Router(config-slb-fw)#` **`real`** *`ip-address`*	Identifies a firewall by IP address as a member of a firewall farm and enters real server configuration mode.
Step 3	`Router(config-slb-fw-real)#` **`probe`** *`probe`*	Associates a probe with the firewall.
Step 4	`Router(config-slb-fw-real)#` **`weight`** *`setting`*	(Optional) Specifies the firewall's workload capacity relative to other firewalls in the firewall farm.
Step 5	`Router(config-slb-fw-real)#` **`inservice`**	Enables the firewall for use by the firewall farm and by IOS Server Load Balancing (IOS SLB).

Step 6	`Router(config-slb-fw)#` **`access`**
	`[`**`source`** *`source-ip netmask`*`]`
	`[`**`destination`** *`destination-ip netmask`*`]`
		(Optional) Routes specific flows to a firewall farm.

Step 7	`Router(config-slb-fw)#` **`predictor hash address`** `[`**`port`**`]`	(Optional) Specifies whether the source and destination TCP or User Datagram Protocol (UDP) port numbers, in addition to the source and destination IP addresses, are to be used when selecting a firewall.
Step 8	`Router(config-slb-fw)#` **`replicate casa`** *`listen-ip`* *`remote-ip port`* `[`*`interval`*`]` `[`**`password`** `[[`*`encrypt`*`]` *`secret-string`* `[`*`timeout`*`]]`	(Optional) Configures a stateful backup of IOS Server Load Balancing (IOS SLB) firewall load balancing decision tables to a backup switch.
Step 9	`Router(config-slb-vserver)#` **`replicate interval`** *`interval`*	(Optional) Sets the replication delivery interval for an IOS Server Load Balancing (IOS SLB) firewall farm. **Note** The Home Agent Director does not support this command. If you specify the **service gtp** keyword on the **virtual** command, and you do not specify the **gtp imsi** keyword on the **sticky** command, the **replicate casa** command is not supported (because sessions are not persistent, and there is nothing to replicate).

	Command	Purpose
Step 10	`Router(config-slb-vserver)#` **`replicate slave`**	(Optional) Enables stateful backup of redundant route processors for an IOS Server Load Balancing (IOS SLB) firewall farm. **Note** The Home Agent Director does not support this command. If you specify the **service gtp** keyword on the **virtual** command, and you do not specify the **gtp imsi** keyword on the **sticky** command, the **replicate casa** command is not supported (because sessions are not persistent, and there is nothing to replicate).
Step 11	`Router(config-slb-fw)#` **`protocol tcp`**	(Optional) Enters firewall farm TCP protocol configuration mode.
Step 12	`Router(config-slb-fw-tcp)#` **`delay`** *`duration`*	(Optional) For firewall farm TCP protocol configuration mode, specifies the time IOS Server Load Balancing (IOS SLB) firewall load balancing maintains TCP connection context after a connection has terminated.
Step 13	`Router(config-slb-fw-tcp)#` **`idle`** *`duration`*	(Optional) For firewall farm TCP protocol configuration mode, specifies the minimum time IOS Server Load Balancing (IOS SLB) firewall load balancing maintains connection context in the absence of packet activity.
Step 14	`Router(config-slb-fw-tcp)#` **`maxconns`** *`number-of-conns`*	(Optional) For firewall farm TCP protocol configuration mode, specifies the maximum number of active TCP connections allowed on the firewall farm at one time.
Step 15	`Router(config-slb-fw-tcp)#` **`sticky`** *`duration`* `[`**`netmask`** *`netmask`*`] [`**`source`** `|` **`destination`**`]`	(Optional) For firewall farm TCP protocol configuration mode, specifies that connections from the same IP address use the same firewall if either of the following conditions is met: • As long as any connection between the same pair of IP addresses exists (source/destination sticky). • For a period, defined by *duration*, after the last connection is destroyed.
Step 16	`Router(config-slb-fw)#` **`protocol datagram`**	(Optional) Enters firewall farm datagram protocol configuration mode.
Step 17	`Router(config-slb-fw-udp)#` **`idle`** *`duration`*	(Optional) For firewall farm datagram protocol configuration mode, specifies the minimum time IOS Server Load Balancing (IOS SLB) firewall load balancing maintains connection context in the absence of packet activity.

	Command	Purpose
Step 18	`Router(config-slb-fw-udp)# maxconns number-of-conns`	(Optional) For firewall farm datagram protocol configuration mode, specifies the maximum number of active datagram connections allowed on the firewall farm at one time.
Step 19	`Router(config-slb-fw-udp)# sticky duration [netmask netmask] [source | destination]`	(Optional) For firewall farm datagram protocol configuration mode, specifies that connections from the same IP address use the same firewall if either of the following conditions is met: • As long as any connection between the same pair of IP addresses exists (source/destination sticky). • For a period, defined by *duration*, after the last connection is destroyed.
Step 20	`Router(config-slb-fw)# inservice`	Enables the firewall farm for use by IOS Server Load Balancing (IOS SLB).

Verifying the Firewall Farm

The following **show ip slb reals** command displays the status of firewall farm FIRE1, the associated real servers, and their status:

```
Router# show ip slb real

real                  farm name        weight   state          conns
-------------------------------------------------------------------
10.1.1.2              FIRE1            8        OPERATIONAL    0
10.1.2.2              FIRE1            8        OPERATIONAL    0
```

The following **show ip slb firewallfarm** command displays the configuration and status of firewall farm FIRE1:

```
Router# show ip slb firewallfarm

firewall farm    hash        state         reals
------------------------------------------------
FIRE1            IPADDR      INSERVICE     2
```

Verifying Firewall Connectivity

To verify that IOS SLB firewall load balancing has been configured and is operating correctly:

Step 1 Ping the external real servers (the ones outside the firewall) from the IOS SLB firewall load-balancing switch.

Step 2 Ping the internal real servers (the ones inside the firewall) from the clients.

Step 3 Use the **show ip slb stats** command to display detailed information about the IOS SLB firewall load-balancing network status:

```
Router# show ip slb stats
 Pkts via normal switching:  0
 Pkts via special switching: 0
 Pkts dropped:               0
 Connections Created:        1911871
```

```
Connections Established:     1967754
Connections Destroyed:       1313251
Connections Reassigned:      0
Zombie Count:                0
Connections Reused:          59752
Connection Flowcache Purges:1776582
Failed Connection Allocs:    17945
Failed Real Assignments:     0
```

Normal switching is when IOS SLB packets are handled on normal IOS switching paths (CEF, fast switching, and process level switching). Special switching is when IOS SLB packets are handled on hardware-assisted switching paths.

Step 4 Use the **show ip slb real detail** command to display detailed information about the IOS SLB firewall load-balancing real server status:

```
Router# show ip slb real detail
10.1.1.3, FIRE1, state = OPERATIONAL, type = firewall
  conns = 299310, dummy_conns = 0, maxconns = 4294967295
  weight = 10, weight(admin) = 10, metric = 104, remainder = 2
  total conns established = 1074779, hash count = 4646
  server failures = 0
  interface FastEthernet1/0, MAC 0010.f68f.7020
```

Step 5 Use the **show ip slb conns** command to display detailed information about the active IOS SLB firewall load-balancing connections:

```
Router# show ip slb conns

vserver         prot client                real                  state     nat
-------------------------------------------------------------------------------
FirewallTCP     TCP  80.80.50.187:40000    10.1.1.4              ESTAB     none
FirewallTCP     TCP  80.80.50.187:40000    10.1.1.4              ESTAB     none
FirewallTCP     TCP  80.80.50.187:40000    10.1.1.4              ESTAB     none
FirewallTCP     TCP  80.80.50.187:40000    10.1.1.4              ESTAB     none
FirewallTCP     TCP  80.80.50.187:40000    10.1.1.4              ESTAB     none
```

Step 6 See the "Monitoring and Maintaining the IOS SLB Feature" section on page 68 for additional commands used to verify IOS SLB networks and connections.

Configuring Probes

IOS SLB uses probes to verify connectivity and detect failures. For a detailed description of each type of probe, see the "Probes" section on page 20.

By default, no probes are configured in IOS SLB. The following sections describe how to configure and verify probes. Required and optional tasks are indicated.

- Configuring Custom UDP Probes, page 49 (Required)
- Configuring DNS Probes, page 49 (Required)
- Configuring HTTP Probes, page 50 (Required)
- Configuring Ping Probes, page 50 (Required)
- Configuring TCP Probes, page 51 (Required)
- Configuring WSP Probes, page 51 (Required)
- Associating the Probe, page 51 (Required)

- Verifying the Probe, page 51 (Optional)

Configuring Custom UDP Probes

To configure a custom UDP probe, enter the following commands in order, beginning in global configuration mode:

	Command	Description
Step 1	`Router(config)#` **`ip slb probe`** *`probe`* **`custom udp`**	Configures the IOS Server Load Balancing (IOS SLB) probe name and enters custom User Datagram Protocol (UDP) probe configuration mode.
Step 2	`Router(config-slb-probe)#` **`address`** `[`*`ip-address`* `[`**`routed`**`]]`	(Optional) Configures an IP address to which to send the custom User Datagram Protocol (UDP) probe.
Step 3	`Router(config-slb-probe)#` **`interval`** *`seconds`*	(Optional) Configures the custom User Datagram Protocol (UDP) probe transmit timers.
Step 4	`Router(config-slb-probe)#` **`port`** *`port`*	Configures the port to which the custom User Datagram Protocol (UDP) probe is to connect.
Step 5	`Router(config-slb-probe)#` **`request data`** `{`*`start-byte`* `|` **`continue`**`}` *`hex-data-string`*	Defines the payload of the User Datagram Protocol (UDP) request packet to be sent by a custom UDP probe.
Step 6	`Router(config-slb-probe)#` **`response`** *`clause-number`* **`data`** *`start-byte hex-data-string`*	Defines the data string to match against custom User Datagram Protocol (UDP) probe response packets.

Configuring DNS Probes

To configure a DNS probe, enter the following commands in order, beginning in global configuration mode:

	Command	Description
Step 1	`Router(config)#` **`ip slb probe`** *`probe`* **`dns`**	Configures the IOS Server Load Balancing (IOS SLB) probe name and enters Domain Name System (DNS) probe configuration mode.
Step 2	`Router(config-slb-probe)#` **`address`** `[`*`ip-address`* `[`**`routed`**`]]`	(Optional) Configures an IP address to which to send the Domain Name System (DNS) probe.
Step 3	`Router(config-slb-probe)#` **`faildetect`** *`number-of-probes`*	(Optional) Specifies the number of consecutive unacknowledged Domain Name System (DNS) probes that constitute failure of the real server or firewall.
Step 4	`Router(config-slb-probe)#` **`interval`** *`seconds`*	(Optional) Configures the Domain Name System (DNS) probe transmit timers.
Step 5	`Router(config-slb-probe)#` **`lookup`** `[`*`ip-address`*`]`	(Optional) Configures an IP address of a real server that a Domain Name System (DNS) server should supply in response to a domain name resolve request.

Configuring HTTP Probes

To configure an HTTP probe, enter the following commands in order, beginning in global configuration mode:

	Command	Description
Step 1	`Router(config)#` **ip slb probe** *probe* **http**	Configures the IOS Server Load Balancing (IOS SLB) probe name and enters HTTP probe configuration mode.
Step 2	`Router(config-slb-probe)#` **address** [*ip-address* [**routed**]]	(Optional) Configures an IP address to which to send the HTTP probe.
Step 3	`Router(config-slb-probe)#` **credentials** {*username* [*password*]}	(Optional) Configures header values for the HTTP probe.
Step 4	`Router(config-slb-probe)#` **expect** [**status** *number*] [**regex** *expression*]	(Optional) Configures the expected HTTP status code or regular expression.
Step 5	`Router(config-slb-probe)#` **header** {**name** *field-name* [*field-value*]}	(Optional) Configures header values for the HTTP probe.
Step 6	`Router(config-slb-probe)#` **interval** *seconds*	(Optional) Configures the HTTP probe transmit timers.
Step 7	`Router(config-slb-probe)#` **port** *port*	(Optional) Configures the port to which the HTTP probe is to connect.
Step 8	`Router(config-slb-probe)#` **request** [**method** {**get** | **post** | **head** | **name** *name*}] [**url** *path*]	(Optional) Configures the URL path to request from the server, and the method used to perform the request to the server.

In addition, HTTP probes require a route to the virtual server. The route is not used, but it must exist to enable the sockets code to verify that the destination can be reached, which in turn is essential for HTTP probes to function correctly. The route can be either a host route (advertised by the virtual server) or a default route (specified using the **ip route 0.0.0.0 0.0.0.0** command, for example).

Configuring Ping Probes

To configure a ping probe, enter the following commands in order, beginning in global configuration mode:

	Command	Description
Step 1	`Router(config)#` **ip slb probe** *probe* **ping**	Configures the IOS Server Load Balancing (IOS SLB) probe name and enters ping probe configuration mode.
Step 2	`Router(config-slb-probe)#` **address** [*ip-address* [**routed**]]	(Optional) Configures an IP address to which to send the ping probe.
Step 3	`Router(config-slb-probe)#` **faildetect** *number-of-pings*	(Optional) Specifies the number of consecutive unacknowledged pings that constitute failure of the real server or firewall.
Step 4	`Router(config-slb-probe)#` **interval** *seconds*	(Optional) Configures the ping probe transmit timers.

Configuring TCP Probes

To configure a TCP probe, enter the following commands in order, beginning in global configuration mode:

	Command	Description
Step 1	`Router(config)#` **`ip slb probe`** *`probe`* **`tcp`**	Configures the IOS Server Load Balancing (IOS SLB) probe name and enters TCP probe configuration mode.
Step 2	`Router(config-slb-probe)#` **`address`** `[`*`ip-address`* `[`**`routed`**`]]`	(Optional) Configures an IP address to which to send the TCP probe.
Step 3	`Router(config-slb-probe)#` **`interval`** *`seconds`*	(Optional) Configures the TCP probe transmit timers.
Step 4	`Router(config-slb-probe)#` **`port`** *`port`*	Configures the port to which the TCP probe is to connect.

Configuring WSP Probes

To configure a WSP probe, enter the following commands in order, beginning in global configuration mode:

	Command	Description
Step 1	`Router(config)#` **`ip slb probe`** *`probe`* **`wsp`**	Configures the IOS Server Load Balancing (IOS SLB) probe name and enters Wireless Session Protocol (WSP) probe configuration mode.
Step 2	`Router(config-slb-probe)#` **`address`** `[`*`ip-address`* `[`**`routed`**`]]`	(Optional) Configures an IP address to which to send the Wireless Session Protocol (WSP) probe.
Step 3	`Router(config-slb-probe)#` **`interval`** *`seconds`*	(Optional) Configures the Wireless Session Protocol (WSP) probe transmit timers.
Step 4	`Router(config-slb-probe)#` **`url`** `[`*`path`*`]`	(Optional) Configures the Wireless Session Protocol (WSP) probe URL path.

Associating the Probe

After configuring a probe, you must associate it with a real server or firewall, using the **probe** command. See the "Configuring a Server Farm and Real Server" section on page 37 and the "Configuring Firewall Load Balancing" section on page 44 for more details.

Note You cannot associate a WSP probe with a firewall.

Verifying the Probe

To verify that a probe is configured correctly, use the **show ip slb probe** command:

```
Router# show ip slb probe

Server:Port             State         Outages   Current   Cumulative
```

```
----------------------------------------------------------------
10.1.1.1:80          OPERATIONAL        0  never    00:00:00
10.1.1.2:80          OPERATIONAL        0  never    00:00:00
10.1.1.3:80          OPERATIONAL        0  never    00:00:00
Router#
```

Configuring DFP

You can define IOS SLB as a DFP manager, as a DFP agent for another DFP manager, or as both at the same time. Depending on your network configuration, you might enter the commands for configuring IOS SLB as a DFP manager and the commands for configuring IOS SLB as a DFP agent on the same device or on different devices.

To configure IOS SLB as a DFP manager, and to identify a DFP agent with which IOS SLB can initiate connections, enter the following commands in order, beginning in global configuration mode:

	Command	Description
Step 1	`Router(config)#` **`ip slb dfp`** [**`password`** [[*`encrypt`*] *`secret-string`* [*`timeout`*]]	Configures Dynamic Feedback Protocol (DFP), supplies an optional password, and enters DFP configuration mode.
Step 2	`Router(config-slb-dfp)#` **`agent`** *`ip-address port`* [*`timeout`* [*`retry-count`* [*`retry-interval`*]]]	Identifies a Dynamic Feedback Protocol (DFP) agent to which IOS Server Load Balancing (IOS SLB) can connect.

To configure IOS SLB as a DFP agent, refer to the *DFP Agent Subsystem* feature document for Cisco IOS Release 12.2(18)SXB.

GPRS Load Balancing Configuration Task List

This section lists the tasks used to configure GPRS load balancing. Detailed configuration information is contained in the referenced sections of this or other documents. Required and optional tasks are indicated.

- Configuring a Server Farm and Real Server, page 37 (Required)

  When you configure the server farm and real server for GPRS load balancing, keep the following considerations in mind:

  – If GTP cause code inspection is not enabled, accept the default setting (the weighted round robin algorithm) for the **predictor** command.

    If GTP cause code inspection is enabled, you can specify either the weighted round robin (**roundrobin**) or the weighted least connections (**leastconns**) algorithm.

  – Specify the IP addresses (virtual template addresses, for Cisco GGSNs) of the real servers performing the GGSN function, using the **real** command.

  – Specify a reassign threshold less than the SGSN’s N3-REQUESTS counter value, using the **reassign** command.

- Configuring a Virtual Server, page 40 (Required)

  When you configure the **virtual** command, keep the following considerations in mind:

  – Specify a virtual GGSN IP address as the virtual server, and specify the **udp** keyword option.

   - To load-balance GTP v1 sessions, specify port number 2123, if the GGSNs and SGSNs are in compliance with the ETSI standard, or specify port number 0 or **any** to configure an all-port virtual server (that is, a virtual server that accepts flows destined for all ports).
   - To load-balance GTP v0 sessions, specify port number 3386, if the GGSNs and SGSNs are in compliance with the ETSI standard, or specify port number 0 or **any** to configure an all-port virtual server.
   - To enable GPRS load balancing *without* GTP cause code inspection, specify the **service gtp** keyword option.
   - To enable GPRS load balancing *with* GTP cause code inspection, specify the **service gtp-inspect** keyword option.

  In GPRS load balancing *without* GTP cause code inspection enabled, when you configure the idle timer using the **idle** command, specify an idle timer greater than the longest possible interval between PDP context requests on the SGSN.

- Configuring the virtual IP address as a loopback on each of the GGSNs in the server (Required for dispatched mode)

  This step is required only if you are using dispatched mode *without* GTP cause code inspection enabled. Refer to the "Configuring a Loopback Interface" section in the *Cisco IOS Interface Configuration Guide*, Release 12.2 for more information.

- Routing each GGSN to each associated SGSN (Required)

  The route can be static or dynamic, but the GGSN needs to be able to reach the SGSN. Refer to the "Configuring Network Access to the GGSN" section of the *Cisco IOS Mobile Wireless Configuration Guide*, Release 12.2 for more details.

- Routing each SGSN to the virtual templates on each associated Cisco GGSN, and to the GPRS load-balancing virtual server (Required)

  Refer to the configuration guide for your SGSN for more details.

- Configuring a GSN Idle Timer, page 53 (Optional)

  This step is applicable only if GTP cause code inspection is enabled.

Configuring a GSN Idle Timer

To configure a GPRS support node (GSN) idle timer, enter the following command in global configuration mode:

Command	Purpose
`Router(config)# ip slb timers gtp gsn duration`	Change the amount of time IOS Server Load Balancing (IOS SLB) maintains sessions to and from an idle gateway GPRS support node (GGSN) or serving GPRS support node (SGSN).

GGSN-IOS SLB Messaging Task List

This section lists the tasks used to configure GGSN-IOS SLB messaging. Detailed configuration information is contained in the referenced sections of this or other documents. Required and optional tasks are indicated.

- Configure the GGSN to support GGSN-IOS SLB messaging. (Required)

  When you configure GGSN-IOS SLB messaging support, configure all IOS SLB virtual servers that share the same GGSN to use the same NAT mode, either dispatched mode or directed mode, using the **gprs slb mode** command. The virtual servers cannot use a mix of dispatched mode and directed mode, because you can configure only one NAT mode on a given GGSN.

  For more information, refer to the *Cisco IOS Mobile Wireless Configuration Guide* for GGSN 5.0 for Cisco IOS Release 12.3(2)XU or later.

- Configuring a Server Farm and Real Server, page 37 (Required)

  When you configure the server farm and real server for GGSN-IOS SLB messaging, to prevent IOS SLB from failing the current real server when reassigning the session to a new real server, disable automatic server failure detection by specifying the **no faildetect inband** command.

- Configuring a Virtual Server, page 40 (Required)

  (Optional) When you configure the virtual server for GGSN-IOS SLB messaging, specify the **gtp notification cac** command to limit the number of times IOS SLB can reassign a session to a new real server.

RADIUS Load Balancing Configuration Task List

This section lists the tasks used to configure RADIUS load balancing. Detailed configuration information is contained in the referenced sections of this or other documents. Required and optional tasks are indicated.

- Configuring a Server Farm and Real Server, page 37 (Required)

  When you configure the server farm and real server for RADIUS load balancing, keep the following considerations in mind:

  - Accept the default setting (the weighted round robin algorithm) for the **predictor** command.
  - (Optional) Specify a value of 1 for the **numclients** keyword on the **faildetect numconns** command, if you want to enable session-based failure detection.
  - (Optional) To specify the maximum number of IOS SLB RADIUS and GTP sticky subscribers that can be assigned to an individual virtual server, use the **maxclients** command.

- Configuring a Virtual Server, page 40 (Required)

  When you configure the virtual server for RADIUS load balancing, keep the following considerations in mind:

  - Specify the **service radius** keyword option, using the **virtual** command.
  - (Optional) To enable framed-IP routing to inspect the ingress interface, specify the **access** *interface* **route framed-ip** command.

    If you configure the **access** *interface* **route framed-ip** command, you must also configure the **virtual** command with the **service radius** keywords specified.
  - (Optional) To change the amount of time IOS SLB waits for an ACCT-START message from a new Mobile IP foreign agent in the event of a foreign agent hand-off, configure a **hand-off radius** command.
  - (Optional) To set a duration for RADIUS entries in the IOS SLB session database, configure an **idle** command with the **radius request** keywords specified.
  - (Optional) To set a duration for entries in the IOS SLB RADIUS framed-IP sticky database, configure an **idle** command with the **radius framed-ip** keywords specified.

   - (Optional) To enable IOS SLB to create the IOS SLB RADIUS framed-IP sticky database and direct RADIUS requests and non-RADIUS flows from a given subscriber to the same service gateway, specify the **radius framed-ip** keywords on the **sticky** command.

     If you configure the **sticky radius framed-ip** command, you must also configure the **virtual** command with the **service radius** keywords specified.

   - (Optional) To enable IOS SLB to purge entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting ON or OFF message, specify the **purge radius framed-ip acct on-off** virtual server configuration command.

     To prevent IOS SLB from purging entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting ON or OFF message, specify the **no purge radius framed-ip acct on-off** virtual server configuration command.

   - (Optional) To enable IOS SLB to purge entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting-Stop message, specify the **purge radius framed-ip acct stop** virtual server configuration command.

     To prevent IOS SLB from purging entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting-Stop message, specify the **no purge radius framed-ip acct stop** virtual server configuration command.

   - (Optional—for CDMA2000 networks only) To enable IOS SLB to create the IOS SLB RADIUS calling-station-ID sticky database and direct RADIUS requests from a given subscriber to the same service gateway based on the calling station ID, specify the **radius calling-station-id** keywords on the **sticky** command.

     To enable IOS SLB to create the IOS SLB RADIUS username sticky database and direct RADIUS requests from a given subscriber to the same service gateway based on the username, specify the **radius username** keywords on the **sticky** command.

     If you configure the **sticky radius calling-station-id** command or the **sticky radius username** command, you must also configure the **virtual** command with the **service radius** keywords specified, and you must configure the **sticky radius framed-ip** command.

     You cannot configure both the **sticky radius calling-station-id** command and the **sticky radius username** command on the same virtual server.

- Enabling IOS SLB to Inspect Packets for RADIUS Framed-IP Sticky Routing, page 56 (Optional)
- Increasing the number of available MLS entries (Optional)

  If you are running IOS SLB in dispatched mode on a Catalyst 6500 Family Switch with Supervisor Engine 2, you can improve performance by configuring the **no mls netflow** command. This command increases the number of MLS entries available for hardware switching of end-user flows.

  Note If you are using IOS features that use the hardware NetFlow table, such as micro-flow QoS, reflexive ACLs, TCP intercept, or Web Cache Redirect, do not configure the **no mls netflow** command.

  For more information about configuring MLS NetFlow, refer to the *Catalyst 6000 Family IOS Software Configuration Guide*.

- Configuring Probes, page 48 (Required)

  To verify the health of the server, configure a ping probe.

Enabling IOS SLB to Inspect Packets for RADIUS Framed-IP Sticky Routing

You can enable IOS SLB to inspect packets whose source IP addresses match a configured IP address and subnet mask. If the source IP address of an inspected packet matches an entry in the IOS SLB RADIUS framed-IP sticky database, IOS SLB uses that entry to route the packet. Otherwise, IOS routes the packet.

To enable IOS SLB to inspect packets for routing using the RADIUS framed-IP sticky database, enter the following command in global configuration mode:

Command	Purpose
`Router(config)# ip slb route {framed-ip deny | ip-address netmask framed-ip | inter-firewall}`	Enables IOS Server Load Balancing (IOS SLB) to route packets using the RADIUS framed-IP sticky database, or to route packets from one firewall real server back through another firewall real server.

Exchange Director for CMX Configuration Task List

This section contains the following information:

- RADIUS Configuration for the Exchange Director, page 56
- Firewall Configuration for the Exchange Director, page 57

RADIUS Configuration for the Exchange Director

This section lists the tasks used to configure RADIUS for the Exchange Director. Detailed configuration information is contained in the referenced sections of this or other documents. Required and optional tasks are indicated.

- Configuring a Server Farm and Real Server, page 37 (Required)

  When you configure the server farm and real server for RADIUS for the Exchange Director, keep the following considerations in mind:

  - (Optional) Specify a value of 1 for the **numclients** keyword on the **faildetect numconns** command, if you want to enable session-based failure detection.
  - (Optional) To specify the maximum number of IOS SLB RADIUS and GTP sticky subscribers that can be assigned to an individual virtual server, use the **maxclients** command.

- Configuring a Virtual Server, page 40 (Required)

  When you configure the virtual server for RADIUS for the Exchange Director, keep the following considerations in mind:

  - Specify the **service radius** keyword option, using the **virtual** command.
  - (Optional) To enable framed-IP routing to inspect the ingress interface, specify the **access** *interface* **route framed-ip** command.

    If you configure the **access** *interface* **route framed-ip** command, you must also configure the **virtual** command with the **service radius** keywords specified.

  - (Optional) To change the amount of time IOS SLB waits for an ACCT-START message from a new Mobile IP foreign agent in the event of a foreign agent hand-off, configure a **hand-off radius** command.

  - (Optional) To set a duration for RADIUS entries in the IOS SLB session database, configure an **idle** command with the **radius request** keywords specified.
  - (Optional) To set a duration for entries in the IOS SLB RADIUS framed-IP sticky database, configure an **idle** command with the **radius framed-ip** keywords specified.
  - (Optional) To enable IOS SLB to create the IOS SLB RADIUS framed-IP sticky database and direct RADIUS requests and non-RADIUS flows from a given subscriber to the same service gateway, specify the **radius framed-ip** keywords on the **sticky** command.

    If you configure the **sticky radius framed-ip** command, you must also configure the **virtual** command with the **service radius** keywords specified.
  - (Optional—for CDMA2000 networks only) To enable IOS SLB to create the IOS SLB RADIUS calling-station-ID sticky database and direct RADIUS requests from a given subscriber to the same service gateway based on the calling station ID, specify the **radius calling-station-id** keywords on the **sticky** command.

    To enable IOS SLB to create the IOS SLB RADIUS username sticky database and direct RADIUS requests from a given subscriber to the same service gateway based on the username, specify the **radius username** keywords on the **sticky** command.

    If you configure the **sticky radius calling-station-id** command or the **sticky radius username** command, you must also configure the **virtual** command with the **service radius** keywords specified, and you must configure the **sticky radius framed-ip** command.

    You cannot configure both the **sticky radius calling-station-id** command and the **sticky radius username** command on the same virtual server.

- Enabling IOS SLB to Inspect Packets for RADIUS Framed-IP Sticky Routing, page 56 (Optional)
- Increasing the number of available MLS entries (Optional)

  If you are running IOS SLB in dispatched mode on a Catalyst 6500 Family Switch with Supervisor Engine 2, you can improve performance by configuring the **no mls netflow** command. This command increases the number of MLS entries available for hardware switching of end-user flows.

  Note If you are using IOS features that use the hardware NetFlow table, such as micro-flow QoS, reflexive ACLs, TCP intercept, or Web Cache Redirect, do not configure the **no mls netflow** command.

  For more information about configuring MLS NetFlow, refer to the *Catalyst 6000 Family IOS Software Configuration Guide*.
- Configuring Probes, page 48 (Required)

  To verify the health of the server, configure a ping probe.

Firewall Configuration for the Exchange Director

This section lists the tasks used to configure firewalls for the Exchange Director. Detailed configuration information is contained in the referenced sections of this or other documents. Required and optional tasks are indicated.

- Configuring the Firewall Farm (Required)

  To configure a firewall farm for the Exchange Director, enter the following commands in order, beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# **ip slb firewallfarm** *firewall-farm* Router(config-slb-fw)#	Adds a firewall farm definition to the IOS Server Load Balancing (IOS SLB) configuration and enters firewall farm configuration mode.
Step 2	Router(config-slb-fw)# **real** *ip-address*	Identifies a firewall by IP address as a member of a firewall farm and enters real server configuration mode.
Step 3	Router(config-slb-fw-real)# **probe** *probe*	Associates a probe with the firewall.
Step 4	Router(config-slb-fw-real)# **weight** *setting*	(Optional) Specifies the firewall's workload capacity relative to other firewalls in the firewall farm.
Step 5	Router(config-slb-fw-real)# **inservice**	Enables the firewall for use by the firewall farm and by IOS Server Load Balancing (IOS SLB).
Step 6	Router(config-slb-fw)# **access** [**source** *source-ip netmask*] [**destination** *destination-ip netmask*]	(Optional) Routes specific flows to a firewall farm.
Step 7	Router(config-slb-fw)# **predictor hash address** [**port**]	(Optional) Specifies whether the source and destination TCP or User Datagram Protocol (UDP) port numbers, in addition to the source and destination IP addresses, are to be used when selecting a firewall.
Step 8	Router(config-slb-fw)# **replicate casa** *listen-ip remote-ip port* [*interval*] [**password** [[*encrypt*] *secret-string* [*timeout*]]	(Optional) Configures a stateful backup of IOS Server Load Balancing (IOS SLB) firewall load balancing decision tables to a backup switch.
Step 9	Router(config-slb-fw)# **protocol tcp**	(Optional) Enters firewall farm TCP protocol configuration mode.
Step 10	Router(config-slb-fw-tcp)# **delay** *duration*	(Optional) For firewall farm TCP protocol configuration mode, specifies the time IOS Server Load Balancing (IOS SLB) firewall load balancing maintains TCP connection context after a connection has terminated.
Step 11	Router(config-slb-fw-tcp)# **idle** *duration*	(Optional) For firewall farm TCP protocol configuration mode, specifies the minimum time IOS Server Load Balancing (IOS SLB) firewall load balancing maintains connection context in the absence of packet activity.
Step 12	Router(config-slb-fw-tcp)# **maxconns** *number-of-conns*	(Optional) For firewall farm TCP protocol configuration mode, specifies the maximum number of active TCP connections allowed on the firewall farm at one time.

	Command	Purpose
Step 13	Router(config-slb-fw-tcp)# **sticky** *duration* [**netmask** *netmask*] [**source** | **destination**]	(Optional) For firewall farm TCP protocol configuration mode, specifies that connections from the same IP address use the same firewall if either of the following conditions is met: • As long as any connection between the same pair of IP addresses exists (source/destination sticky). • For a period, defined by *duration*, after the last connection is destroyed.
Step 14	Router(config-slb-fw)# **protocol datagram**	(Optional) Enters firewall farm datagram protocol configuration mode.
Step 15	Router(config-slb-fw-udp)# **idle** *duration*	(Optional) For firewall farm datagram protocol configuration mode, specifies the minimum time IOS Server Load Balancing (IOS SLB) firewall load balancing maintains connection context in the absence of packet activity.
Step 16	Router(config-slb-fw-udp)# **maxconns** *number-of-conns*	(Optional) For firewall farm datagram protocol configuration mode, specifies the maximum number of active datagram connections allowed on the firewall farm at one time.
Step 17	Router(config-slb-fw-udp)# **sticky** *duration* [**netmask** *netmask*] [**source** | **destination**]	(Optional) For firewall farm datagram protocol configuration mode, specifies that connections from the same IP address use the same firewall if either of the following conditions is met: • As long as any connection between the same pair of IP addresses exists (source/destination sticky). • For a period, defined by *duration*, after the last connection is destroyed.
Step 18	Router(config-slb-fw)# **inservice**	Enables the firewall farm for use by IOS Server Load Balancing (IOS SLB).

- Verifying the Firewall Farm (Optional)

  The following **show ip slb reals** command displays the status of firewall farm FIRE1, the associated real servers, and their status:

```
Router# show ip slb real

real                   farm name        weight   state           conns
-------------------------------------------------------------------
10.1.1.2               FIRE1            8        OPERATIONAL     0
10.1.2.2               FIRE1            8        OPERATIONAL     0
```

  The following **show ip slb firewallfarm** command displays the configuration and status of firewall farm FIRE1:

```
Router# show ip slb firewallfarm

firewall farm    hash        state          reals
------------------------------------------------
```

```
FIRE1            IPADDR      INSERVICE     2
```

- Verifying Firewall Connectivity (Optional)

  To verify that IOS SLB firewall load balancing has been configured and is operating correctly, use the following procedure:

Step 1 Ping the external real servers (the ones outside the firewall) from the IOS SLB firewall load-balancing switch.

Step 2 Ping the internal real servers (the ones inside the firewall) from the clients.

Step 3 Use the **show ip slb stats** command to display detailed information about the IOS SLB firewall load-balancing network status:

```
Router# show ip slb stats
 Pkts via normal switching:  0
 Pkts via special switching: 0
 Pkts dropped:               0
 Connections Created:        1911871
 Connections Established:    1967754
 Connections Destroyed:      1313251
 Connections Reassigned:     0
 Zombie Count:               0
 Connections Reused:         59752
 Connection Flowcache Purges:1776582
 Failed Connection Allocs:   17945
 Failed Real Assignments:    0
```

Normal switching is when IOS SLB packets are handled on normal IOS switching paths (CEF, fast switching, and process level switching). Special switching is when IOS SLB packets are handled on hardware-assisted switching paths.

Step 4 Use the **show ip slb real detail** command to display detailed information about the IOS SLB firewall load-balancing real server status:

```
Router# show ip slb real detail
10.1.1.3, FIRE1, state = OPERATIONAL, type = firewall
  conns = 299310, dummy_conns = 0, maxconns = 4294967295
  weight = 10, weight(admin) = 10, metric = 104, remainder = 2
  total conns established = 1074779, hash count = 4646
  server failures = 0
  interface FastEthernet1/0, MAC 0010.f68f.7020
```

Step 5 Use the **show ip slb conns** command to display detailed information about the active IOS SLB firewall load-balancing connections:

```
Router# show ip slb conns

vserver         prot client               real                  state     nat
-------------------------------------------------------------------------------
FirewallTCP     TCP  80.80.50.187:40000   10.1.1.4              ESTAB     none
FirewallTCP     TCP  80.80.50.187:40000   10.1.1.4              ESTAB     none
FirewallTCP     TCP  80.80.50.187:40000   10.1.1.4              ESTAB     none
FirewallTCP     TCP  80.80.50.187:40000   10.1.1.4              ESTAB     none
FirewallTCP     TCP  80.80.50.187:40000   10.1.1.4              ESTAB     none
```

Step 6 See the "Monitoring and Maintaining the IOS SLB Feature" section on page 68 for additional commands used to verify IOS SLB networks and connections.

- Configuring Probes, page 48 (Required)

The Exchange Director uses probes to detect and recover from failures. You must configure a probe on each real server in the firewall farm. Ping probes are recommended; see the "Configuring Ping Probes" section on page 50 for more details. If a firewall does not allow ping probes to be forwarded, use HTTP probes instead. See the "Configuring HTTP Probes" section on page 50 for more details. You can configure more than one probe, in any combination of supported types (DNS, HTTP, TCP, or ping), for each firewall in a firewall farm.

- Configuring Wildcard Searches, page 66 (Optional)

  Use the **mls ip slb wildcard search rp** command to reduce the probability of exceeding the capacity of the TCAM on the PFC.

VPN Server Load Balancing Configuration Task List

This section lists the tasks used to configure VPN server load balancing. Detailed configuration information is contained in the referenced sections of this or other documents. Required and optional tasks are indicated.

- Configuring a Server Farm and Real Server, page 37 (Required)

  When you configure the server farm and real server for VPN server load balancing, specify the IP addresses of the real servers acting as VPN terminators, using the **real** command.

- Configuring a Virtual Server, page 40 (Required)

  When you configure the virtual server for VPN server load balancing of IPSec flows, keep the following considerations in mind:

  - Configure a UDP virtual server, using the **virtual** command with the protocol set to **udp** and the port set to **isakmp**. The **isakmp** keyword enables the cryptographic key exchange to occur via IKE (port 500).
  - Configure an ESP virtual server, using the **virtual** command with the protocol set to **esp**.
  - Specify a sticky connection from the UDP virtual server to the ESP virtual server, and vice versa, using the **sticky** command with a *duration* of at least 15 seconds.

  When you configure the virtual server for VPN server load balancing of PPTP flows, keep the following considerations in mind:

  - Configure a TCP virtual server, using the **virtual** command with the **tcp** keyword and port number **1723** specified.
  - Configure a GRE virtual server, using the **virtual** command with the **gre** keyword specified.
  - Specify a sticky connection from the TCP virtual server to the GRE virtual server, and vice versa, using the **sticky** command with a *duration* of at least 15 seconds.

- Configuring Probes, page 48 (Required)

  To verify the health of the server, configure a ping probe.

Home Agent Director Configuration Task List

This section lists the tasks used to configure the Home Agent Director. Detailed configuration information is contained in the referenced sections of this or other documents. Required and optional tasks are indicated.

- Configuring a Server Farm and Real Server, page 37 (Required)

When you configure the server farm and real server for the Home Agent Director, keep the following considerations in mind:

  - Accept the default setting (the weighted round robin algorithm) for the **predictor** command.
  - Specify the IP addresses of the real servers acting as home agents, using the **real** command.

- Configuring a Virtual Server, page 40 (Required)

  When you configure the virtual server for the Home Agent Director using the **virtual** command, keep the following considerations in mind:

  - Specify the Home Agent Director's IP address as the virtual server.
  - Specify the **udp** keyword option.
  - Specify port number 434 if the home agents are in compliance with the IP Mobility Support, RFC 2002, or specify port number 0 or **any** to configure an all-port virtual server (that is, a virtual server that accepts flows destined for all ports).
  - Specify the **service ipmobile** keyword option.

- Configuring the virtual IP address as a loopback on each of the home agents in the server (Required for dispatched mode)

  Refer to the "Configuring a Loopback Interface" section in the *Cisco IOS Interface Configuration Guide*, Release 12.2 for more information.

- Configuring DFP, page 52 (Optional)

  When you configure DFP for the Home Agent Director, keep the following considerations in mind:

  - To control the maximum DFP weight sent by the home agent to IOS SLB, use the **ip mobile home-agent dfp-max-weight** command.
  - To set the source address and home agent address field in the Registration Reply (RRP) as the real home agent's address, use the **ip mobile home-agent dynamic-address** command.
  - To set the maximum number of bindings, use the **ip mobile home-agent max-binding** command.

  For detailed information about these Mobile IP commands, refer to the *Cisco Mobile Wireless Home Agent Release 2.0* feature module.

Configuring NAT

To configure the IOS SLB NAT client address pool for client NAT, enter the following command in global configuration mode:

Command	Purpose
Router(config)# **ip slb natpool** *pool start-ip end-ip* [**netmask** *netmask* | **prefix-length** *leading-1-bits*] [**entries** *init-address* [*max-address*]]	Configures the client address pool. **Note** GPRS load balancing does not support this command.

You need not configure the client address pool for server NAT.

You must also specify either NAT client translation mode or NAT server address translation mode on the server farm, using the **nat** command. See the "Configuring a Server Farm and Real Server" section on page 37 for more details. When you configure the virtual server for NAT, remember that you cannot configure client NAT for an ESP or GRE virtual server.

Configuring Static NAT

Static NAT enables you to allow some users to utilize NAT and allow other users on the same Ethernet interface to continue with their own IP addresses. This option enables you to provide a default NAT behavior for real servers, differentiating between responses from a real server, and connection requests initiated by the real server.

Note To avoid unexpected results, make sure your static NAT configuration mirrors your virtual server configuration.

To configure NAT for the server, enter the following commands in order, beginning in global configuration mode:

	Command	Description
Step 1	`Router(config)#` **`ip slb static`** `{`**`drop`** `|` **`nat`** `{`**`virtual`** `|` *`virtual-ip`* `[`**`per-packet`** `|` **`sticky`**`]}}`	Configures the real server's Network Address Translation (NAT) behavior and enters static NAT configuration mode. **Note** If you specify the *virtual-ip* argument and you do not specify the **per-packet** option, IOS Server Load Balancing (IOS SLB) uses server port translation to distinguish between connection requests initiated by different real servers.
Step 2	`Router(config-slb-static)#` **`real`** *`ip-address`* `[`*`port`*`]`	Configures one or more real servers to use static Network Address Translation (NAT).

Stateless Backup Configuration Task List

This section lists the tasks used to configure stateless backup over VLANs between IOS SLB devices. Detailed configuration information is contained in the referenced sections of this or other documents. Required and optional tasks are indicated.

- Configuring Required and Optional IOS SLB Functions, page 36 (Required for server load balancing)
- Configuring Firewall Load Balancing, page 44 (Required for firewall load balancing)
- Configuring the IP Routing Protocol (Required)

  Refer to the “IP Routing Protocols” chapter of the *Cisco IOS IP Configuration Guide*, Release 12.2 for more details.
- Configuring the VLAN between the IOS SLB devices (Required)

  Refer to the “Virtual LANs” chapter of the *Cisco IOS Switching Services Configuration Guide*, Release 12.2 for more details.
- Verifying the Stateless Backup Configuration, page 64 (Optional)

Note For active standby, in which multiple IOS SLB devices share a virtual IP address, you must use exclusive client ranges and you must use policy routing to forward flows to the correct IOS SLB device.

Verifying the Stateless Backup Configuration

For server load balancing, to verify that stateless backup has been configured and is operating correctly, use the following **show ip slb vservers** commands to display information about the IOS SLB virtual server status:

```
Router# show ip slb vservers

slb vserver      prot  virtual               state         conns
-------------------------------------------------------------------
VS1              TCP   10.10.10.12:23        OPERATIONAL     2
VS2              TCP   10.10.10.18:23        OPERATIONAL     2

Router# show ip slb vservers detail
VS1, state = OPERATIONAL, v_index = 10
  virtual = 10.10.10.12:23, TCP, service = NONE, advertise = TRUE
  server farm = SERVERGROUP1, delay = 10, idle = 3600
  sticky timer = 0, sticky subnet = 255.255.255.255
  sticky group id = 0
  synguard counter = 0, synguard period = 0
  conns = 0, total conns = 0, syns = 0, syn drops = 0
  standby group = None
VS2, state = INSERVICE, v_index = 11
  virtual = 10.10.10.18:23, TCP, service = NONE, advertise = TRUE
  server farm = SERVERGROUP2, delay = 10, idle = 3600
  sticky timer = 0, sticky subnet = 255.255.255.255
  sticky group id = 0
  synguard counter = 0, synguard period = 0
  conns = 0, total conns = 0, syns = 0, syn drops = 0
  standby group = None
```

For firewall load balancing, to verify that stateless backup has been configured and is operating correctly, use the following **show ip slb firewallfarm** commands to display information about the IOS SLB firewall farm status:

```
Router# show ip slb firewallfarm

firewall farm    hash        state         reals
------------------------------------------------
FIRE1            IPADDR      INSERVICE     2

Router# show ip slb firewallfarm details
FIRE1, hash = IPADDRPORT, state = INSERVICE, reals = 2
  FirewallTCP:
   sticky timer = 0, sticky subnet = 255.255.255.255
   idle = 3600, delay = 10, syns = 1965732, syn drop = 0
   maxconns = 4294967295, conns = 597445, total conns = 1909512
  FirewallUDP:
   sticky timer = 0, sticky subnet = 255.255.255.255
   idle = 3600
   maxconns = 1, conns = 0, total conns = 1
  Real firewalls:
    10.1.1.3, weight = 10, OPERATIONAL, conns = 298823
    10.1.1.4, weight = 10, OPERATIONAL, conns = 298622
  Total connections = 597445
```

Stateful Backup of Redundant Route Processors Configuration Task List

This section lists the tasks used to configure stateful backup of redundant route processors. Detailed configuration information is contained in the referenced sections of this document. Required and optional tasks are indicated.

- Configuring the Replication Message Rate for Slave Replication (Required)

  Specify the **ip slb replicate slave rate** command in global configuration mode.

- Configuring Required and Optional IOS SLB Functions, page 36 (Required for server load balancing)

  When you configure the virtual server for stateful backup of redundant route processors, keep the following considerations in mind:

  - Specify the **replicate slave** command.
  - (Optional) To set the replication delivery interval for the virtual server, configure a **replicate interval** command.

- Configuring Firewall Load Balancing, page 44 (Required for firewall load balancing)

  When you configure the firewall farm for stateful backup of redundant route processors, keep the following considerations in mind:

  - Specify the **replicate slave** command.
  - (Optional) To set the replication delivery interval for the firewall farm, configure a **replicate interval** command.

Configuring Database Entries

To configure an initial allocation and a maximum value for IOS SLB database entries, enter the following command in global configuration mode:

Command	Purpose
`Router(config)#` **`ip slb entries`** `[`**`conn`** `[`*`init-conn`* `[`*`max-conn`*`]] |` **`frag`** `[`*`init-frag`* `[`*`max-frag`*`] |` **`lifetime`** *`timeout`*`] |` **`gtp`** `{`**`gsn`** `[`*`init-gsn`* `[`*`max-gsn`*`] |` **`nsapi`** `[`*`init-nsapi`* `[`*`max-nsapi`*`] } |` **`sticky`** `[`*`init-sticky`* `[`*`max-sticky`*`]]]`	Specifies an initial allocation and a maximum value for IOS Server Load Balancing (IOS SLB) database entries.

Configuring Buffers for the Fragment Database

To configure the maximum number of buffers for the IOS SLB fragment database, enter the following command in global configuration mode:

Command	Purpose
`Router(config)#` **`ip slb maxbuffers frag`** *`buffers`*	Configures the maximum number of buffers for the IOS Server Load Balancing (IOS SLB) fragment database.

Clearing Databases and Counters

To clear IP IOS SLB databases and counters, enter one or more of the following commands in privileged EXEC mode:

Command	Purpose
Router# **clear ip slb connections** [**firewallfarm** *firewall-farm* | **serverfarm** *server-farm* | **vserver** *virtual-server*]	Clears the IOS Server Load Balancing (IOS SLB) connection database for one or more firewall farms, server farms, or virtual servers.
Router# **clear ip slb counters**	Clears the IOS Server Load Balancing (IOS SLB) counters.
Router# **clear ip slb sessions** [**firewallfarm** *firewall-farm* | **serverfarm** *server-farm* | **vserver** *virtual-server*]	Clears the IOS Server Load Balancing (IOS SLB) RADIUS session database for one or more firewall farms, server farms, or virtual servers.
Router# **clear ip slb sticky gtp imsi** [**id** *imsi*]	Clears entries from an IOS Server Load Balancing (IOS SLB) general packet radio service (GPRS) Tunneling Protocol (GTP) International Mobile Subscriber ID (IMSI) sticky database.
Router# **clear ip slb sticky radius** {**calling-station-id** [**id** *string*] | **framed-ip** [*framed-ip* [*netmask*]]}	Clears entries from an IOS Server Load Balancing (IOS SLB) RADIUS sticky database.

Configuring Wildcard Searches

To specify the behavior of IOS SLB wildcard searches, enter the following command in global configuration mode:

Command	Purpose
Router(config)# **mls ip slb search** {**wildcard** [**pfc** | **rp**] | **icmp**}	Specifies the behavior of IOS Server Load Balancing (IOS SLB) wildcard searches. This command is supported for Catalyst 6500 family switches only.

Purging and Reassigning Connections

You can enable IOS SLB to automatically remove connections to failed real servers and firewalls from the connection database even if the idle timers have not expired. This function is useful for applications that do not rotate the source port (such as IKE), and for protocols that do not have ports to differentiate flows (such as ESP).

You can also enable IOS SLB to automatically reassign to a new real server or firewall RADIUS sticky objects that are destined for a failed real server or firewall.

To configure IOS SLB's behavior when a real server fails, enter the following commands in order, beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)#` **ip slb serverfarm** *server-farm*	Enters server farm configuration mode.
Step 2	`Router(config-slb-sfarm)#` **failaction** [**purge** | **gtp purge** | **radius reassign**]	Configures IOS Server Load Balancing (IOS SLB)'s behavior when a real server fails.

To configure IOS SLB's behavior when a firewall fails, enter the following commands in order, beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)#` **ip slb firewallfarm** *firewall-farm*	Enters firewall farm configuration mode.
Step 2	`Router(config-slb-fw)#` **failaction purge**	Configures IOS Server Load Balancing (IOS SLB)'s behavior when a firewall fails.

Disabling Automatic Server Failure Detection

If you have configured all-port virtual servers (that is, virtual servers that accept flows destined for all ports except GTP ports), flows can be passed to servers for which no application port exists. When the servers reject these flows, IOS SLB might fail the servers and remove them from load balancing. This situation can also occur in slow-to-respond AAA servers in RADIUS load-balancing environments. To prevent this situation, you can disable automatic server failure detection.

To disable automatic server failure detection, enter the following command in real server configuration mode:

Command	Purpose
`Router(config-slb-real)#` **no faildetect inband**	Disables automatic server failure detection.

Note If you disable automatic server failure detection using the **no faildetect inband** command, Cisco strongly recommends that you configure one or more probes.

If you specify the **no faildetect inband** command, the **faildetect numconns** command is ignored, if specified.

Monitoring and Maintaining the IOS SLB Feature

To obtain and display runtime information about IOS SLB, use the following commands in EXEC mode:

<table>
<tr><th>Command</th><th>Purpose</th></tr>
<tr><td>Router# show ip slb conns [vserver virtual-server | client ip-address | firewall firewall-farm] [detail]</td><td>Displays all connections handled by IOS Server Load Balancing (IOS SLB), or, optionally, only those connections associated with a particular virtual server or client.</td></tr>
<tr><td>Router# show ip slb dfp [agent agent-ip port | manager manager-ip | detail | weights]</td><td>Displays information about Dynamic Feedback Protocol (DFP) and DFP agents, and about the weights assigned to real servers.</td></tr>
<tr><td>Router# show ip slb firewallfarm [detail]</td><td>Displays information about firewall farms.</td></tr>
<tr><td>Router# show ip slb fragments</td><td>Displays information from the IOS Server Load Balancing (IOS SLB) fragment database.</td></tr>
<tr><td>Router# show ip slb gtp {gsn [gsn-ip-address] | nsapi [nsapi-key] [detail]</td><td>Displays IOS Server Load Balancing (IOS SLB) GTP information.</td></tr>
<tr><td>Router# show ip slb natpool [name pool] [detail]</td><td>Displays information about the IOS Server Load Balancing (IOS SLB) Network Address Translation (NAT) configuration.</td></tr>
<tr><td>Router# show ip slb probe [name probe] [detail]</td><td>Displays information about probes defined to IOS Server Load Balancing (IOS SLB).</td></tr>
<tr><td>Router# show ip slb reals [sfarm server-farm] [detail]</td><td>Displays information about the real servers defined to IOS Server Load Balancing (IOS SLB).</td></tr>
<tr><td>Router# show ip slb replicate</td><td>Displays information about the IOS Server Load Balancing (IOS SLB) replication configuration.</td></tr>
<tr><td>Router# show ip slb serverfarms [name server-farm] [detail]</td><td>Displays information about the server farms defined to IOS Server Load Balancing (IOS SLB).</td></tr>
<tr><td>Router# show ip slb sessions [gtp | gtp-inspect | ipmobile | radius] [vserver virtual-server] [client ip-address netmask] [detail]</td><td>Displays information about sessions handled by IOS Server Load Balancing (IOS SLB).</td></tr>
<tr><td>Router# show ip slb static</td><td>Displays information about the IOS Server Load Balancing (IOS SLB) server Network Address Translation (NAT) configuration.</td></tr>
<tr><td>Router# show ip slb stats</td><td>Displays IOS Server Load Balancing (IOS SLB) statistics.</td></tr>
<tr><td>Router# show ip slb sticky [client ip-address netmask | radius calling-station-id [id string] | radius framed-ip [client ip-address netmask] | radius username [name string]]</td><td>Displays information about the sticky connections defined to IOS Server Load Balancing (IOS SLB).</td></tr>
<tr><td>Router# show ip slb vservers [name virtual-server] [redirect] [detail]</td><td>Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).</td></tr>
</table>

Configuration Examples

This section provides real-world examples of IOS SLB configurations. For a complete description of the IOS SLB commands in this section, see the "Command Reference" section on page 131. To locate documentation of other commands that appear in this section, search online using Cisco.com.

This section includes the following examples:

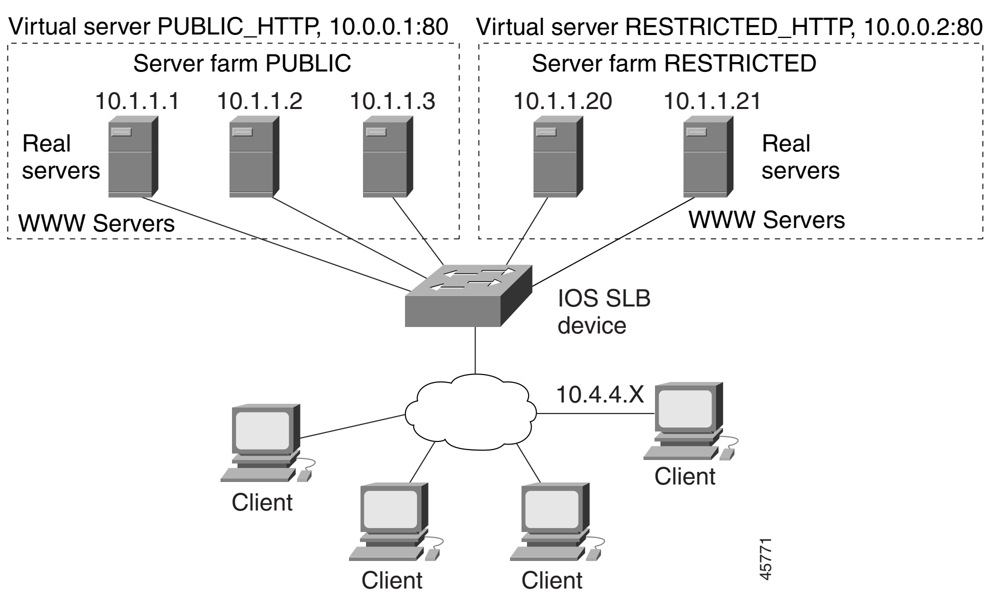
> **Note** The IP and network addresses in these examples are generic; you must replace them with the actual addresses for your network.

Basic IOS SLB Network Configuration Example

Figure 2 shows a sample IOS SLB network with the following components:

- Two server farms—one configured to allow access by the public and named PUBLIC, one configured to allow limited access and named RESTRICTED.
- Five real servers configured as follows:
  - Three real servers in the PUBLIC server farm with IP addresses 10.1.1.1, 10.1.1.2, and 10.1.1.3
  - Two real servers in the restricted server farm with IP addresses 10.1.1.20 and 10.1.1.21
- Two virtual servers—one configured to allow access by the public and named PUBLIC_HTTP and one configured to allow limited access and named RESTRICTED_HTTP.
  - Virtual server PUBLIC_HTTP is configured with IP address 10.0.0.1 load balancing TCP connections on the WWW port (80).
  - Virtual server RESTRICTED_HTTP is configured with IP address 10.0.0.2 load balancing TCP connections on the WWW port (80) and allows access only from clients from network 10.4.4.0 255.255.255.0.

Figure 2 Example IOS SLB Network



The following sections include examples of the configuration commands used to configure and verify the IOS SLB network shown in Figure 2:

- Server Farm Configuration, page 71
- Virtual Server Configuration, page 71
- Restricted Client Configuration, page 72

Server Farm Configuration

The following example shows the configuration for the server farm PUBLIC, associated with three real servers:

```
ip slb serverfarm PUBLIC
  real 10.1.1.1
    reassign 2
    faildetect numconns 4 numclients 2
    retry 20
    inservice
    exit
  real 10.1.1.2
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
    exit
  real 10.1.1.3
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
    end
```

The following example shows the configuration for the server farm RESTRICTED, associated with two real servers:

```
ip slb serverfarm RESTRICTED
  real 10.1.1.20
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
    exit
  real 10.1.1.21
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
    end
```

Virtual Server Configuration

The following example shows the configuration for the virtual servers PUBLIC_HTTP and RESTRICTED_HTTP:

```
ip slb vserver PUBLIC_HTTP
  virtual 10.0.0.1 tcp www
  serverfarm PUBLIC
  idle 120
  delay 5
  inservice
  exit
ip slb vserver RESTRICTED_HTTP
  virtual 10.0.0.2 tcp www
  serverfarm RESTRICTED
  idle 120
  delay 5
  inservice
  end
```

Restricted Client Configuration

The following example shows the configuration for the virtual server RESTRICTED_HTTP:

```
ip slb vserver RESTRICTED_HTTP
  no inservice
  client 10.4.4.0 255.255.255.0
  inservice
  end
```

Complete IOS SLB Configuration Example

The following example provides a complete configuration using many of the commands described in this feature document:

```
ip slb probe PROBE2 http
 request method POST url /probe.cgi?all
 header HeaderName HeaderValue
!
ip slb serverfarm PUBLIC
 nat server
 real 10.1.1.1
  reassign 4
  faildetect numconns 16
  retry 120
  inservice
 real 10.1.1.2
  reassign 4
  faildetect numconns 16
  retry 120
  inservice
probe PROBE2
!
ip slb serverfarm RESTRICTED
 predictor leastconns
 bindid 309
 real 10.1.1.1
  weight 32
  maxconns 1000
  reassign 4
  faildetect numconns 16
  retry 120
  inservice
 real 10.1.1.20
  reassign 4
  faildetect numconns 16
  retry 120
  inservice
 real 10.1.1.21
  reassign 4
  faildetect numconns 16
  retry 120
  inservice
!
ip slb vserver PUBLIC_HTTP
 virtual 10.0.0.1 tcp www
 serverfarm PUBLIC
!
```

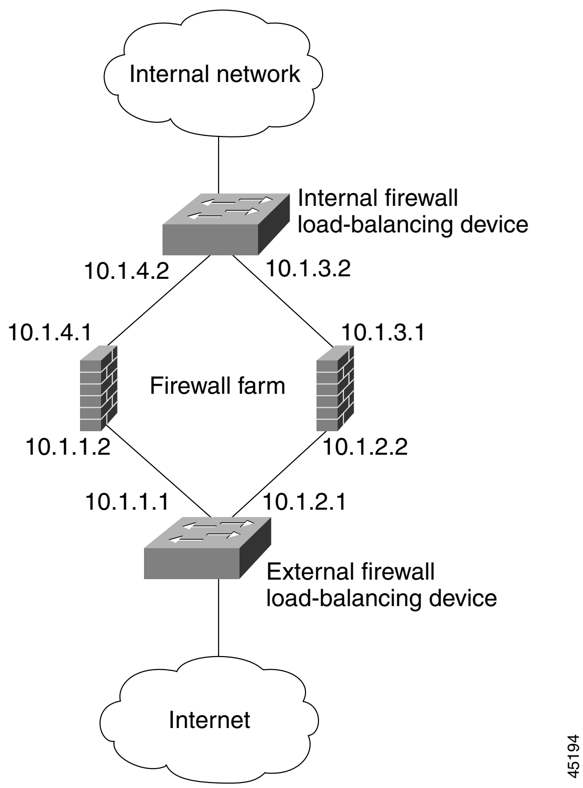
```
ip slb vserver RESTRICTED_HTTP
 virtual 10.0.0.2 tcp www
 serverfarm RESTRICTED
 no advertise
 sticky 60 group 1
 idle 120
 delay 5
 client 10.4.4.0 255.255.255.0
 synguard 3600000
 inservice
```

IOS SLB with Firewall Load Balancing Example

Figure 3 shows a sample IOS SLB firewall load-balancing network with the following components:

- Two firewalls with IP addresses as shown
- An internal firewall load-balancing device on the secure side of the firewalls
- An external firewall load-balancing device on the Internet side of the firewalls
- One firewall farm named FIRE1, containing both firewalls

Figure 3 IOS SLB with Layer 3 Firewalls in Different Subnets



When you configure IOS SLB firewall load balancing, the load-balancing devices use route lookup to recognize flows destined for the firewalls. To enable route lookup, you must configure each device with the IP address of each firewall that will route flows to that device.

In the following firewall farm configuration samples:

- The internal (secure side) firewall load-balancing device is configured with firewall IP addresses 10.1.3.1 and 10.1.4.1.
- The external (Internet side) firewall load-balancing device is configured with firewall IP addresses 10.1.1.2 and 10.1.2.2.

Internal Firewall Load-Balancing Device

The following example shows the configuration for ping probe PROBE1, HTTP probe PROBE2, and firewall farm FIRE1, associated with the two real servers for the load-balancing device on the internal (secure) side of the firewall:

```
!-----Ping probe
ip slb probe PROBE1 ping
!-----IP address of other load-balancing device
  address 10.1.1.1
  faildetect 4
!-----HTTP probe
  ip slb probe PROBE2 http
!-----IP address of other load-balancing device
  address 10.1.2.1
  expect status 401
!-----Firewall farm FIRE1
ip slb firewallfarm FIRE1
!-----First firewall
  real 10.1.4.1
    probe PROBE1
!-----Enable first firewall
    inservice
!-----Second firewall
    real 10.1.3.1
    probe PROBE2
!-----Enable second firewall
    inservice
```

External Firewall Load-Balancing Device

The following example shows the configuration for ping probe PROBE1, HTTP probe PROBE2, and firewall farm FIRE1, associated with the two real servers for the load-balancing device on the external (Internet) side of the firewall:

```
!-----Ping probe
ip slb probe PROBE1 ping
!-----IP address of other load-balancing device
  address 10.1.4.2
  faildetect 4
!-----HTTP probe
ip slb probe PROBE2 http
!-----IP address of other load-balancing device
  address 10.1.3.2
  expect status 401
!-----Firewall farm FIRE1
ip slb firewallfarm FIRE1
!-----First firewall
  real 10.1.1.2
    probe PROBE1
!-----Enable first firewall
    inservice
```

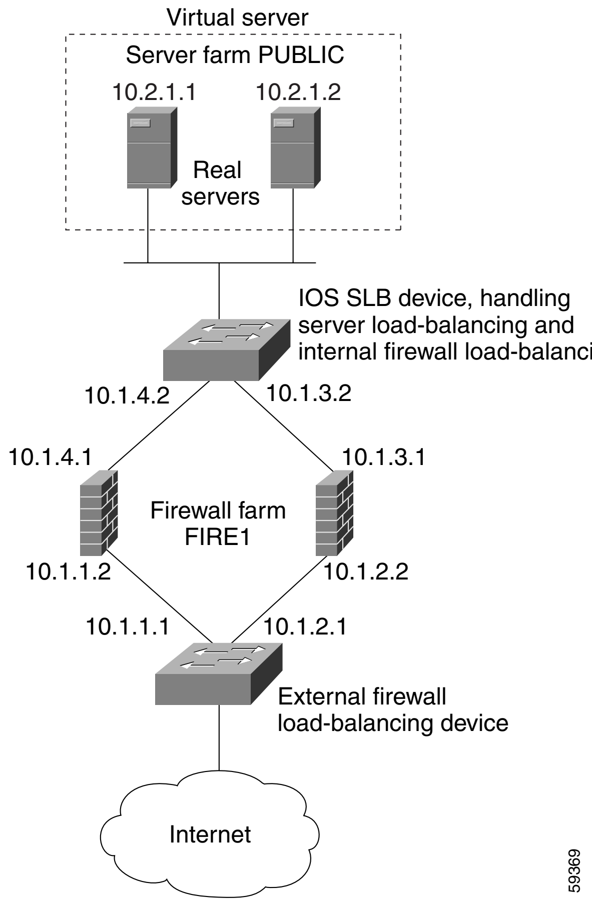
```
!-----Second firewall
  real 10.1.2.2
    probe PROBE2
!-----Enable second firewall
    inservice
    exit
  inservice
```

IOS SLB with Server Load Balancing and Firewall Load Balancing Example

Figure 4 shows a sample IOS SLB load-balancing network with server load balancing and firewall load balancing running together, and the following components:

- Two real servers with IP addresses as shown
- One server farm named PUBLIC, containing both real servers
- Two firewalls with IP addresses as shown
- One firewall farm named FIRE1, containing both firewalls
- An internal IOS SLB device on the secure side of the firewalls, performing server load balancing and firewall load balancing
- An external firewall load-balancing device on the Internet side of the firewalls

Figure 4 IOS SLB with Server Load Balancing and Firewall Load Balancing



In the following firewall farm configuration samples:

- The internal (secure side) firewall load-balancing device is configured with firewall IP addresses 10.1.3.1 and 10.1.4.1.
- The external (Internet side) firewall load-balancing device is configured with firewall IP addresses 10.1.1.2 and 10.1.2.2.

Internal Server and Firewall Load-Balancing Device

The following example shows the configuration for ping probes ABCPROBE and XYZPROBE, firewall farm FIRE1, and server farm PUBLIC for the load-balancing device on the internal (secure) side of the firewalls:

```
ip slb probe ABCPROBE ping
  address 10.1.1.1
ip slb probe XYZPROBE ping
  address 10.1.2.1
!
ip slb firewallfarm FIRE1
  real 10.1.4.1
    probe ABCPROBE
    inservice
```

```
  real 10.1.3.1
    probe XYZPROBE
    inservice
  inservice
!
ip slb serverfarm PUBLIC
  nat server
  real 10.2.1.1
    inservice
    real 10.2.1.2
    inservice
!
ip slb vserver HTTP1
  virtual 128.1.0.1 tcp www
  serverfarm PUBLIC
  idle 120
  delay 5
  inservice
```

Note On Catalyst 6500 family switches, you can also specify that IOS SLB wildcard searches are to be performed by the route processor, using the **mls ip slb search wildcard rp** command in global configuration mode.

External Firewall Load-Balancing Device

The following example shows the configuration for ping probes ABCPROBE and XYZPROBE and firewall farm FIRE1 for the load-balancing device on the external (Internet) side of the firewalls:

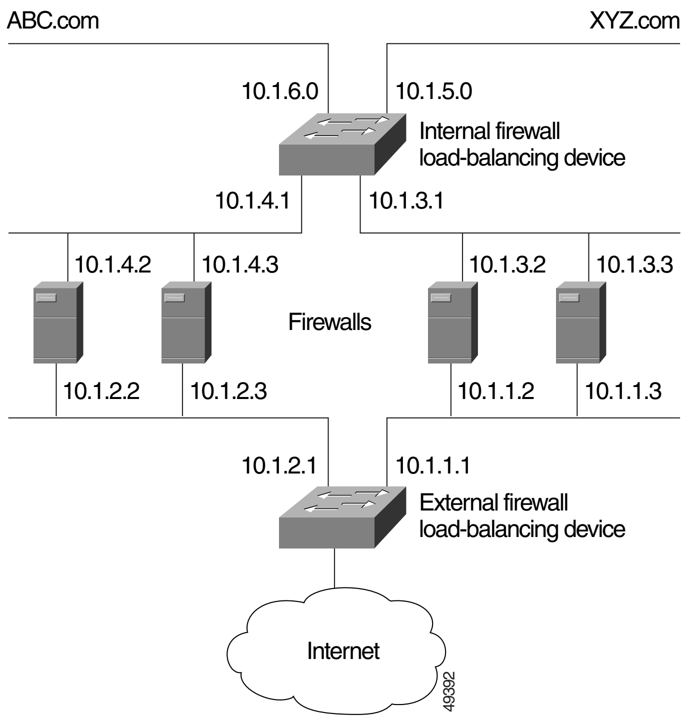
```
ip slb probe ABCPROBE ping
  address 10.1.4.2
  ip slb probe XYZPROBE ping
  address 10.1.3.2
  ip slb firewallfarm FIRE1
  real 10.1.1.2
    probe ABCPROBE
    inservice
    probe XYZPROBE
    inservice
```

IOS SLB with Multiple Firewall Farms Example

Figure 5 shows a sample IOS SLB load-balancing network with multiple firewall farms and the following components:

- Four firewalls with IP addresses as shown
- An internal firewall load-balancing device on the secure side of the firewalls
- An external firewall load-balancing device on the Internet side of the firewalls
- One firewall farm named ABCFARM, containing the two firewalls on the left.
- One firewall farm named XYZFARM, containing the two firewalls on the right.

Figure 5 IOS SLB with Multiple Firewall Farms



In the following firewall farm configuration samples:

- The internal (secure side) firewall load-balancing device is configured with firewall IP addresses 10.1.3.1 and 10.1.4.1.
- The external (Internet side) firewall load-balancing device is configured with firewall IP addresses 10.1.1.2 and 10.1.2.2.

Internal Firewall Load-Balancing Device

The following example shows the configuration for ping probes ABCPROBE and XYZPROBE and firewall farms ABCFARM and XYZFARM for the load-balancing device on the internal (secure) side of the firewalls:

```
ip slb probe ABCPROBE ping
  address 10.1.2.1
ip slb probe XYZPROBE ping
  address 10.1.1.1
ip slb firewallfarm ABCFARM
  access source 10.1.6.0 255.255.255.0
  inservice
  real 10.1.4.2
    probe ABCPROBE
    inservice
  real 10.1.4.3
    probe ABCPROBE
    inservice
ip slb firewallfarm XYZFARM
  access source 10.1.5.0 255.255.255.0
  inservice
  real 10.1.3.2
    probe XYZPROBE
    inservice
  real 10.1.3.3
    probe XYZPROBE
    inservice
```

External Firewall Load-Balancing Device

The following example shows the configuration for ping probes ABCPROBE and XYZPROBE and firewall farms ABCFARM and XYZFARM for the load-balancing device on the external (Internet) side of the firewalls:

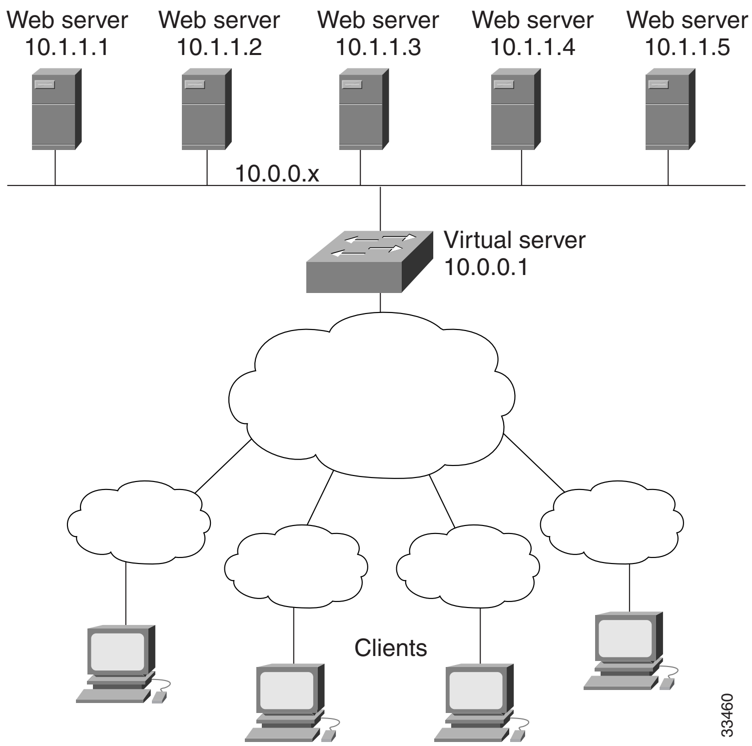
```
ip slb probe ABCPROBE ping
  address 10.1.4.1
ip slb probe XYZPROBE ping
  address 10.1.3.1
ip slb firewallfarm ABCFARM
  access destination 10.1.6.0 255.255.255.0
  inservice
  real 10.1.2.2
    probe ABCPROBE
    inservice
  real 10.1.2.3
    probe ABCPROBE
    inservice
ip slb firewallfarm XYZFARM
  access destination 10.1.5.0 255.255.255.0
  inservice
  real 10.1.1.2
    probe XYZPROBE
    inservice
  real 10.1.1.3
    probe XYZPROBE
    inservice
```

IOS SLB with Probes Example

Figure 6 shows a sample configuration with IOS SLB real server connections configured as part of a server farm, focusing on using ping and HTTP probes to monitor applications being server load-balanced.

Figure 6 Sample Ping and HTTP Probe Topology

:



The topology shown in Figure 6 is a heterogeneous server farm servicing a single virtual server. Following are the configuration statements for this topology, including a ping probe named PROBE1 and an HTTP probe named PROBE2:

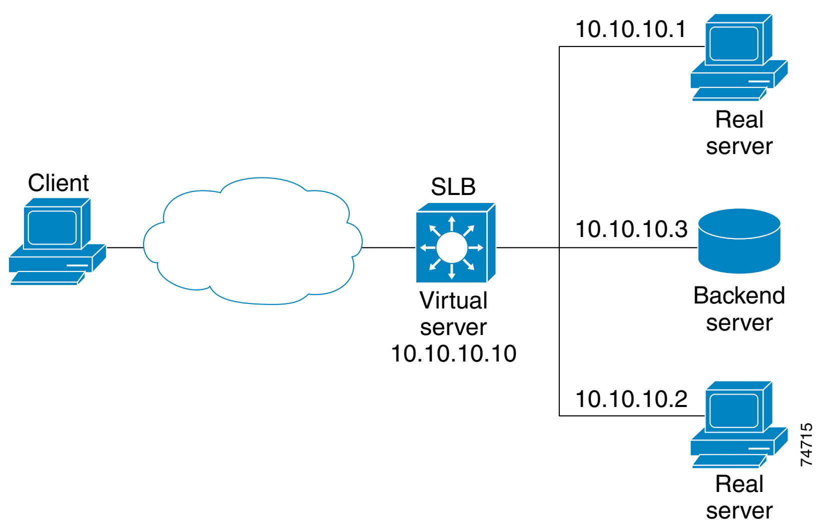
```
! Configure ping probe PROBE1, change CLI to IOS SLB probe configuration mode
ip slb probe PROBE1 ping
! Configure probe to receive responses from IP address 13.13.13.13
  address 13.13.13.13
! Configure unacknowledged ping threshold to 16
  faildetect 16
! Configure ping probe timer interval to send every 11 seconds
  interval 11
! Configure HTTP probe PROBE2
  ip slb probe PROBE2 http
! Configure request method as POST, set URL as /probe.cgi?all
  request method post url /probe.cgi?all
! Configure header HeaderName
  header HeaderName HeaderValue
! Configure basic authentication username and password
  credentials Semisweet chips
! Exit to global configuration mode
  exit
```

```
! Enter server farm configuration mode for server farm PUBLIC
ip slb serverfarm PUBLIC
! Configure NAT server and real servers on the server farm
  nat server
  real 10.1.1.1
   inservice
  real 10.1.1.2
   inservice
  real 10.1.1.3
   inservice
  real 10.1.1.4
   inservice
  real 10.1.1.5
   inservice
! Configure ping probe on the server farm
  probe PROBE1
! Configure HTTP probe on the server farm
  probe PROBE2
  end
```

IOS SLB with Routed Probe Example

Figure 7 shows a typical datacenter and IOS SLB configuration. Virtual server ACME_VSERVER is configured with two real servers (10.10.10.1 and 10.10.10.2) in server farm ACME_FARM. The user wants the real servers to fail based on the health of the backend server (10.10.10.3). To accomplish this configuration without sending health checks via the real servers, the user defines BACKEND, a routed ping probe to the backend server's IP address.

Figure 7 IOS SLB with a Routed Ping Probe



Following are the IOS SLB configuration statements for the configuration shown in Figure 7:

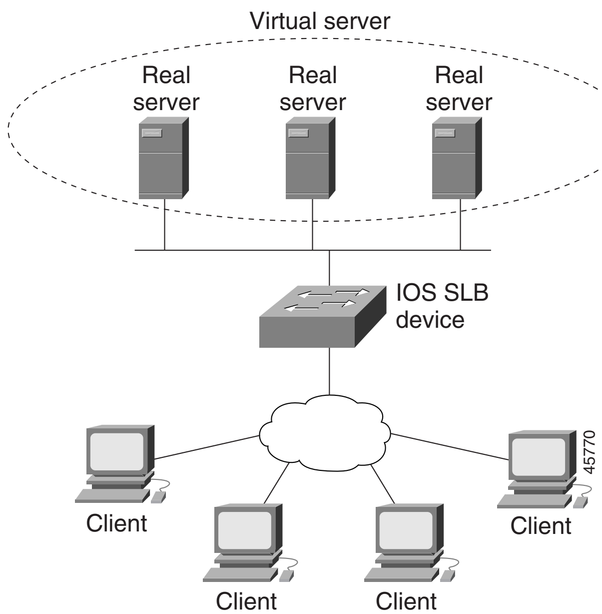
```
ip slb probe BACKEND ping
  address 10.10.10.3 routed

ip slb serverfarm ACME_SFARM
  nat server
  probe BACKEND
  real 10.10.10.1
   inservice
```

```
  real 10.10.10.2
   inservice
ip slb vserver ACME_VSERVER
  virtual 10.10.10.10 tcp 80
  serverfarm ACME_SFARM
  inservice
```

Layer 3 Switch Configured with IOS SLB Example

Figure 8 shows a sample configuration with IOS SLB server connections configured as part of a server farm.

Figure 8 Network Configuration for IOS SLB



As shown in the following sample configuration, the example topology has three public web servers and two restricted web servers for privileged clients in subnet 10.4.4.0. The public web servers are weighted according to their capacity, with server 10.1.1.2 having the lowest capacity and having a connection limit imposed on it. The restricted web servers are configured as members of the same sticky group, so that HTTP connections and Secure Socket Layer (SSL) connections from the same client use the same real server.

The network configuration to provide the previously described IOS SLB functionality follows:

```
ip slb probe PROBE2 http
  request method POST url /probe.cgi?all
  header HeaderName HeaderValue
  header Authorization Basic U2VtaXN3ZWV0OmNoaXBz
!
ip slb serverfarm PUBLIC
  nat server
  predictor leastconns
! First real server
  real 10.1.1.1
    reassign 4
    faildetect numconns 16
    retry 120
```

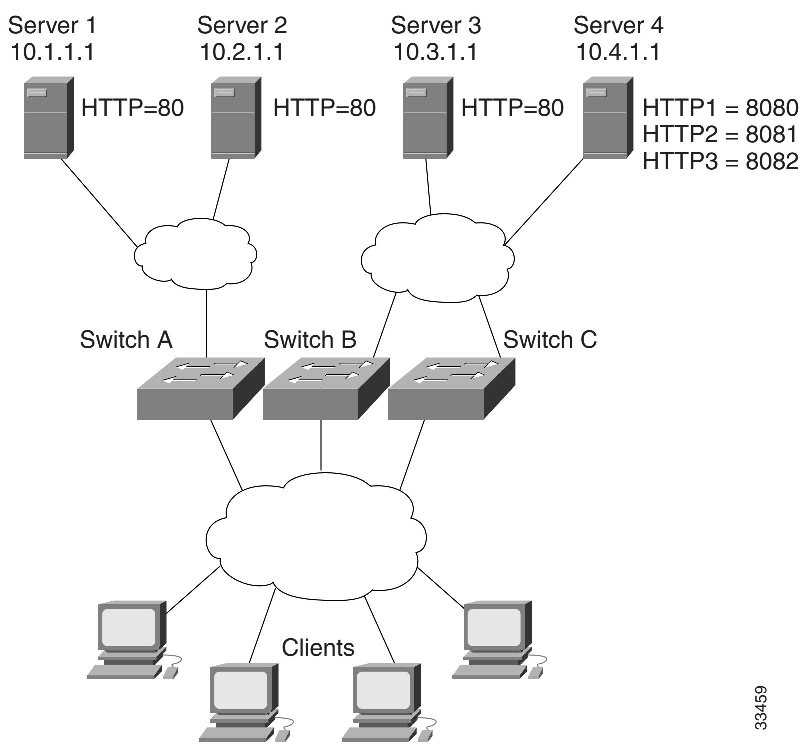
```
    inservice
! Second real server
  real 10.1.1.2
    reassign 4
    faildetect numconns 16
    retry 120
    inservice
! Third real server
  real 10.1.1.3
    reassign 4
    faildetect numconns 16
    retry 120
    inservice
! Probe
  probe PROBE2
! Restricted web server farm
ip slb serverfarm RESTRICTED
  predictor leastconns
! First real server
  real 10.1.1.20
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
! Second real server
  real 10.1.1.21
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
!
! Unrestricted web virtual server
ip slb vserver PUBLIC_HTTP
  virtual 10.0.0.1 tcp www
  serverfarm PUBLIC
  idle 120
  delay 5
  inservice
!
! Restricted HTTP virtual server
ip slb vserver RESTRICTED_HTTP
  virtual 10.0.0.1 tcp www
  serverfarm RESTRICTED
  client 10.4.4.0 255.255.255.0
  sticky 60 group 1
  idle 120
  delay 5
  inservice
!
! Restricted SSL virtual server
ip slb vserver RESTRICTED_SSL
  virtual 10.0.0.1 tcp https
  serverfarm RESTRICTED
  client 10.4.4.0 255.255.255.0
  sticky 60 group 1
  idle 120
  delay 5
  inservice
!
interface GigabitEthernet1/1
  switchport
  switchport access vlan 3
  switchport mode access
  no ip address
```

```
!
interface FastEthernet2/1
  switchport
  switchport access vlan 2
  switchport mode access
  no ip address
!
interface FastEthernet2/2
  switchport
  switchport access vlan 2
  switchport mode access
  no ip address
!
interface FastEthernet2/3
  switchport
  switchport access vlan 2
  switchport mode access
  no ip address
!
interface Vlan2
  ip address 10.1.1.100 255.255.255.0
!
interface Vlan3
  ip address 40.40.40.1 255.255.255.0
```

IOS SLB with NAT Example

Figure 9 shows a sample configuration with IOS SLB real server connections configured as part of a server farm, focusing on the configuration of the NAT server and address pool of clients.

Figure 9 Sample IOS SLB NAT Topology



The topology in Figure 9 has four web servers, configured as follows:

- Servers 1, 2, and 3 are running single HTTP server applications listening on port 80.
- Server 4 has multiple HTTP server applications listening on ports 8080, 8081, and 8082.

Server 1 and Server 2 are load-balanced using Switch A, which is performing server address translation.

Server 3 and Server 4 are load-balanced using Switch B and Switch C. These two switches are performing both server and client address translation since there are multiple paths between the clients and the servers. These switches also must perform server port translation for HTTP packets to and from Server 4.

Switch A Configuration Statements

```
ip slb serverfarm FARM1
! Translate server addresses
  nat server
! Server 1 port 80
  real 10.1.1.1
    reassign 2
    faildetect numconns 4 numclients 2
    retry 20
    inservice
! Server 2 port 80
  real 10.2.1.1
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
!
ip slb vserver HTTP1
! Handle HTTP (port 80) requests
  virtual 128.1.0.1 tcp www
  serverfarm FARM1
  idle 120
  delay 5
  inservice
```

Switch B Configuration Statements

```
ip slb natpool web-clients 128.3.0.1 128.3.0.254
! NAT address pool for clients
ip slb serverfarm FARM2
! Translate server addresses
  nat server
! Translate client addresses
  nat client web-clients
! Server 3 port 80
  real 10.3.1.1
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
! Server 4 port 8080
  real 10.4.1.1 port 8080
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
```

```
! Server 4 port 8081
  real 10.4.1.1 port 8081
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
! Server 4 port 8082
  real 10.4.1.1 port 8082
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
!
ip slb vserver HTTP2
! Handle HTTP (port 80) requests
  virtual 128.2.0.1 tcp www
  serverfarm FARM2
  idle 120
  delay 5
  inservice
```

Switch C Configuration Statements

```
ip slb natpool web-clients 128.5.0.1 128.5.0.254
! NAT address pool for clients
ip slb serverfarm FARM2
! Translate server addresses
  nat server
! Translate client addresses
  nat client web-clients
! Server 3 port 80
  real 10.3.1.1
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
! Server 4 port 8080
  real 10.4.1.1 port 8080
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
! Server 4 port 8081
  real 10.4.1.1 port 8081
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
! Server 4 port 8082
  real 10.4.1.1 port 8082
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
!
ip slb vserver HTTP2
! Handle HTTP (port 80) requests
  virtual 128.4.0.1 tcp www
  serverfarm FARM2
  idle 120
  delay 5
  inservice
```

IOS SLB with Static NAT Example

The following example shows configuration statements for the following items:

- A DNS probe, PROBE4, configured to supply real server IP address 13.13.13.13 in response to domain name resolve requests.
- A server farm, DNS, that is configured to use server NAT and PROBE4.
- An all-port virtual server, 10.11.11.11, associated with server farm DNS, that performs per-packet server load balancing for UDP connections.
- A real server, 10.1.1.3, associated with server farm DNS, configured for static NAT and per-packet server load balancing.

```
ip slb probe PROBE4 dns
 lookup 13.13.13.13
!
ip slb serverfarm DNS
 nat server
 probe PROBE4
 real 10.1.1.3
  inservice
!
ip slb vserver DNS
 virtual 10.11.11.11 UDP 0 service per-packet
 serverfarm DNS
!
ip slb static nat 10.11.11.11 per-packet
 real 10.1.1.3
```

IOS SLB with Stateless Backup Examples

There are several different ways in which you can configure IOS SLB stateless backup. The differences between the configurations depend on the networking capabilities of your load balancing devices, and on the capabilities of the distribution devices that direct client traffic to those load balancing devices.

- If a load balancing device is capable of Layer 2 switching and VLAN trunking (such as the Catalyst 6500 family switch), you can wire the device directly to its real servers, and it can handle outbound flows from the real servers while acting as a standby for IOS SLB. HSRP is used on the server-side VLANs of the load balancing device, with the real servers routing to the HSRP address.
- If a load balancing device is *not* capable of both Layer 2 switching and VLAN trunking, you must connect it and its real servers to a Layer 2 switch. This configuration is required in order to use HSRP on the server-side VLANs.
- If a distribution device is capable of Layer 3 switching, it can use route redistribution to direct flows to the active load balancing device.
- If a distribution device is capable of Layer 2 switching, it can use client-side HSRP on the load balancing device to direct flows to the active load balancing device.
- While HSRP offers faster failover times, routing converges quickly enough for most configurations. If you use both client-side and server-side HSRP on the load balancing devices, you must use HSRP interface tracking and priorities to synchronize the client-side and server-side HSRP groups.

This section contains the following examples, illustrating several different IOS SLB stateless backup configurations:

- Dynamic Routing and Trunking Example, page 88
- Dynamic Routing and No Trunking Example, page 90
- Static Routing and Trunking Example, page 92
- Static Routing and No Trunking Example, page 94

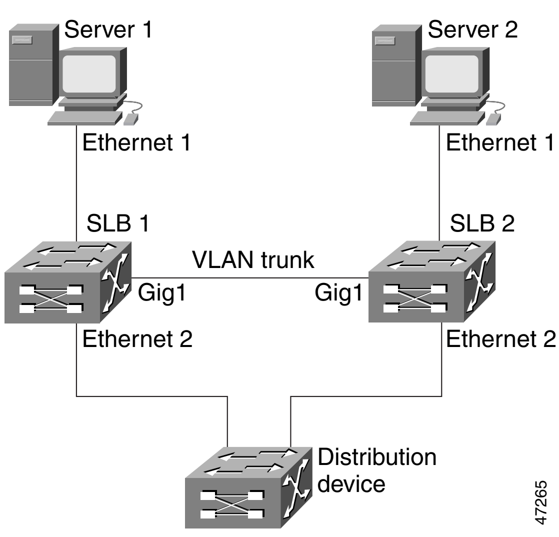
Note Stateful backup is omitted from these examples in the interest of simplicity. To see an example that uses stateful backup, see the "IOS SLB with Stateful Backup Example" section on page 96.

Dynamic Routing and Trunking Example

Figure 10 shows a sample IOS SLB stateless backup configuration with the following characteristics:

- The IP address for real server 1 is 10.10.1.3, and for real server 2 is 10.10.1.4, routed to clients through 10.10.1.100.
- The IP address for the virtual server is 10.10.14.1.
- The IP address for VLAN 1 is 10.10.1.0, with a subnet mask of 255.255.255.0.
- The IP address for Subnet 2 is 10.10.2.0, with a subnet mask of 255.255.255.0.
- The IP address for Subnet 3 is 10.10.3.0, with a subnet mask of 255.255.255.0.
- The distribution device uses EIGRP to learn the route to 10.10.14.1 via either 10.10.2.1 or 10.10.3.1, depending on which IOS SLB is active.

Figure 10 Stateless Backup with Layer 3 and Trunking



SLB 1 Configuration Statements

```
ip slb serverfarm SF1
  real 10.10.1.3
    reassign 2
    faildetect numconns 4 numclients 2
    retry 20
    inservice
  real 10.10.1.4
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
ip slb vserver VS1
  virtual 10.10.14.1 tcp www
  serverfarm SF1
  idle 120
  delay 5
  inservice standby SERVER
!
interface Ethernet1
  switchport
  switchport vlan 1
interface Ethernet2
  ip address 10.10.2.1 255.255.255.0
interface vlan 1
  ip address 10.10.1.1 255.255.255.0
  standby ip 10.10.1.100
  standby priority 10 preempt delay sync 20
  standby name SERVER
  standby track Ethernet2
  standby timers 1 3
router eigrp 666
  redistribute static
  network 10.0.0.0
```

SLB 2 Configuration Statements

```
ip slb serverfarm SF1
  real 10.10.1.3
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
  real 10.10.1.4
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
ip slb vserver VS1
  virtual 10.10.14.1 tcp www
  serverfarm SF1
  idle 120
  delay 5
  inservice standby SERVER
!
interface GigabitEthernet1
  no ip address
  switchport
  switchport trunk encapsulation isl
interface Ethernet1
  switchport
  switchport vlan 1
```

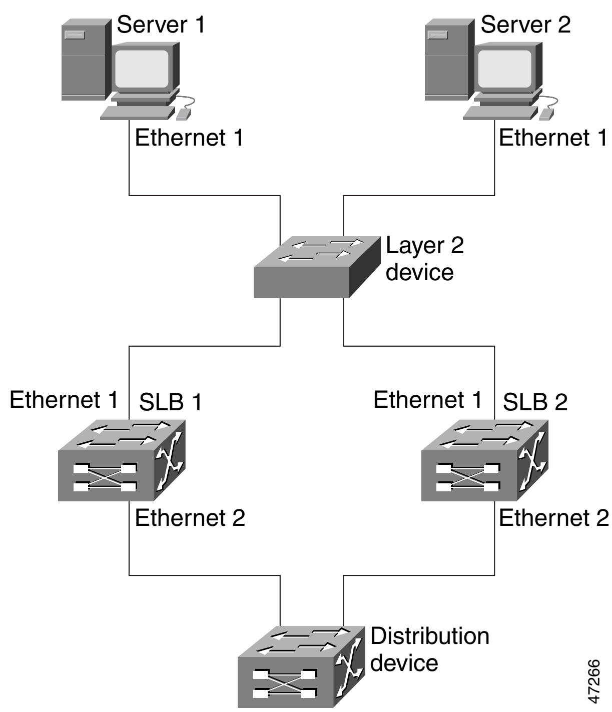
```
interface Ethernet2
  ip address 10.10.3.1 255.255.255.0
interface vlan 1
  ip address 10.10.1.2 255.255.255.0
  standby ip 10.10.1.100
  standby priority 5 preempt delay sync 20
  standby name SERVER
  standby track Ethernet2
  standby timers 1 3
router eigrp 666
  redistribute static
  network 10.0.0.0
```

Dynamic Routing and No Trunking Example

Figure 11 shows a sample IOS SLB stateless backup configuration with the following characteristics:

- The IP address for real server 1 is 10.10.1.3, and for real server 2 is 10.10.1.4, routed to clients through 10.10.1.100.
- The IP address for the virtual server is 10.10.14.1.
- The IP address for Subnet 2 is 10.10.2.0, with a subnet mask of 255.255.255.0.
- The IP address for Subnet 3 is 10.10.3.0, with a subnet mask of 255.255.255.0.
- The distribution device uses EIGRP to learn the route to 10.10.14.1 via either 10.10.2.2 or 10.10.3.2, depending on which IOS SLB is active.

Figure 11 Stateless Backup with Layer 3 and No Trunking



SLB 1 Configuration Statements

```
ip slb serverfarm SF1
  real 10.10.1.3
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
  real 10.10.1.4
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
ip slb vserver VS1
  virtual 10.10.14.1 tcp www
  serverfarm SF1
  idle 120
  delay 5
  inservice standby SERVER
!
interface Ethernet1
  ip address 10.10.1.1 255.255.255.0
  standby ip 10.10.1.100
  standby priority 10 preempt delay sync 20
  standby name SERVER
  standby track Ethernet2
  standby timers 1 3
interface Ethernet2
  ip address 10.10.2.1 255.255.255.0
router eigrp 666
  redistribute static
  network 10.0.0.0
```

SLB 2 Configuration Statements

```
ip slb serverfarm SF1
  real 10.10.1.3
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
  real 10.10.1.4
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
ip slb vserver VS1
  virtual 10.10.14.1 tcp www
  serverfarm SF1
  idle 120
  delay 5
  inservice standby SERVER
!
interface Ethernet1
  ip address 10.10.1.2 255.255.255.0
  standby ip 10.10.1.100
  standby priority 5 preempt delay sync 20
  standby name SERVER
  standby track Ethernet2
  standby timers 1 3
interface Ethernet2
  ip address 10.10.3.1 255.255.255.0
```

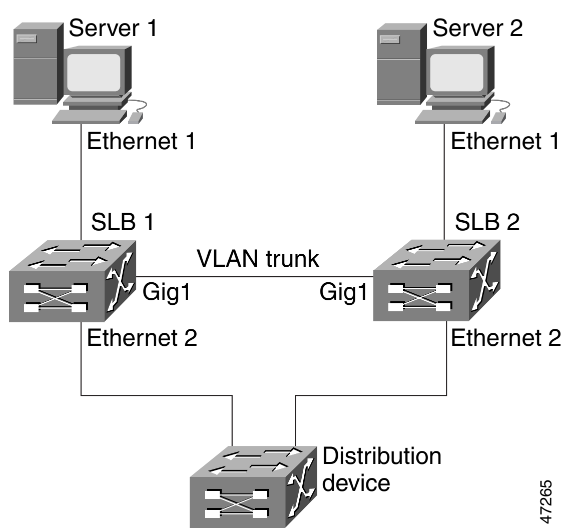
```
router eigrp 666
  redistribute static
  network 10.0.0.0
```

Static Routing and Trunking Example

Figure 12 shows a sample IOS SLB stateless backup configuration with the following characteristics:

- The IP address for real server 1 is 10.10.1.3, and for real server 2 is 10.10.1.4, routed to clients through 10.10.1.100.
- The IP address for the virtual server is 10.10.14.1.
- The IP address for VLAN 1 is 10.10.1.0, with a subnet mask of 255.255.255.0.
- The IP address for Subnet 2 is 10.10.2.0, with a subnet mask of 255.255.255.0.
- The IP address for Subnet 3 is 10.10.3.0, with a subnet mask of 255.255.255.0.
- The configuration uses static routing to the HSRP route on the distribution device.

Figure 12 Stateless Backup with Layer 2 and Trunking



SLB 1 Configuration Statements

```
ip slb serverfarm SF1
  real 10.10.1.3
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
  real 10.10.1.4
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
ip slb vserver VS1
  virtual 10.10.14.1 tcp www
  serverfarm SF1
  idle 120
  delay 5
  inservice standby SERVER
```

```
!
interface Ethernet1
  switchport
  switchport vlan 1
interface Ethernet2
  ip address 10.10.2.1 255.255.255.0
  standby ip 10.10.2.100
  standby priority 10 preempt delay sync 20
  standby track vlan1
  standby timers 1 3
interface vlan 1
  ip address 10.10.1.1 255.255.255.0
  standby ip 10.10.1.100
  standby priority 10 preempt delay sync 20
  standby name SERVER
  standby track Ethernet2
  standby timers 1 3
```

SLB 2 Configuration Statements

```
ip slb serverfarm SF1
  real 10.10.1.3
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
  real 10.10.1.4
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
ip slb vserver VS1
  virtual 10.10.14.1 tcp www
  serverfarm SF1
  idle 120
  delay 5
  inservice standby SERVER
!
interface GigabitEthernet1
  no ip address
  switchport
  switchport trunk encapsulation isl
interface Ethernet1
  switchport
  switchport vlan 1
interface Ethernet2
  ip address 10.10.2.2 255.255.255.0
  standby ip 10.10.2.100
  standby priority 5 preempt delay sync 20
  standby track vlan 1
  standby timers 1 3
interface vlan 1
  ip address 10.10.1.2 255.255.255.0
  standby ip 10.10.1.100
  standby priority 5 preempt delay sync 20
  standby name SERVER
  standby track Ethernet2
  standby timers 1 3
```

Distribution Device Configuration Statements

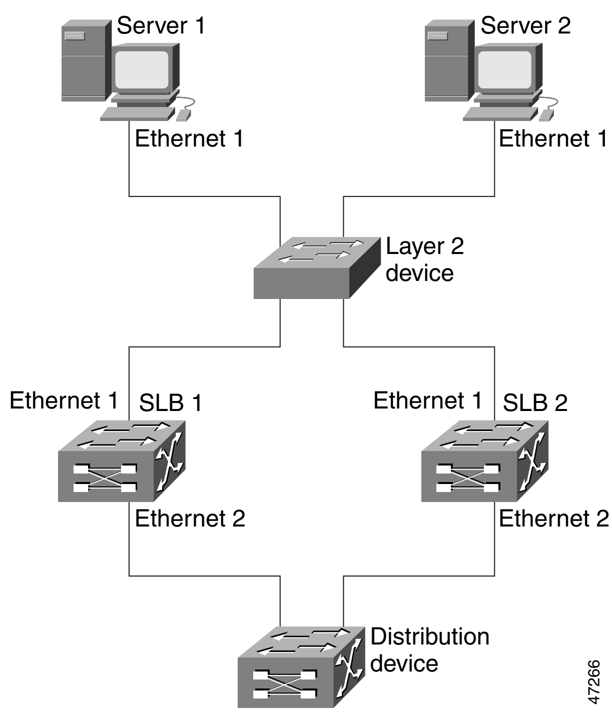
```
interface Ethernet1
  switchport
  switchport distribution vlan 2
interface Ethernet2
  switchport
  switchport distribution vlan 2
interface vlan2
  ip address 10.10.2.3 255.255.255.0
  no shut
ip route 10.10.14.1 255.255.255.255 10.10.2.100
```

Static Routing and No Trunking Example

Figure 13 shows a sample IOS SLB stateless backup configuration with the following characteristics:

- The IP address for real server 1 is 10.10.1.3, and for real server 2 is 10.10.1.4, routed to clients through 10.10.1.100.
- The IP address for the virtual server is 10.10.14.1.
- The IP address for Subnet 2 is 10.10.2.0, with a subnet mask of 255.255.255.0.
- The IP address for Subnet 3 is 10.10.3.0, with a subnet mask of 255.255.255.0.
- The configuration uses static routing to the HSRP route on the distribution device.

Figure 13 Stateless Backup with Layer 2 and No Trunking



SLB 1 Configuration Statements

```
ip slb serverfarm SF1
  real 10.10.1.3
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
  real 10.10.1.4
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
ip slb vserver VS1
  virtual 10.10.14.1 tcp www
  serverfarm SF1
  idle 120
  delay 5
  inservice standby SERVER
!
interface Ethernet1
  ip address 10.10.1.1 255.255.255.0
  standby ip 10.10.1.100
  standby priority 10 preempt delay sync 20
  standby name SERVER
  standby track Ethernet2
  standby timers 1 3
interface Ethernet2
  ip address 10.10.2.1 255.255.255.0
  standby ip 10.10.2.100
  standby priority 10 preempt delay sync 20
  standby track Ethernet1
  standby timers 1 3
```

SLB 2 Configuration Statements

```
ip slb serverfarm SF1
  real 10.10.1.3
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
  real 10.10.1.4
    reassign 2
    faildetect numconns 4
    retry 20
    inservice
ip slb vserver VS1
  virtual 10.10.14.1 tcp www
  serverfarm SF1
  idle 120
  delay 5
  inservice standby SERVER
!
interface Ethernet1
  ip address 10.10.1.2 255.255.255.0
  standby ip 10.10.1.100
  standby priority 5 preempt delay sync 20
  standby name SERVER
  standby track Ethernet2
  standby timers 1 3
```

```
interface Ethernet2
  ip address 10.10.2.2 255.255.255.0
  standby ip 10.10.2.100
  standby priority 5 preempt delay sync 20
  standby track Ethernet1
  standby timers 1 3
```

Distribution Device Configuration Statements

```
interface Ethernet1
  switchport
  switchport distribution vlan 2
interface Ethernet2
  switchport
  switchport distribution vlan 2
interface vlan2
  ip address 10.10.2.3 255.255.255.0
  no shut
ip route 10.10.14.1 255.255.255.255 10.10.2.100
```

IOS SLB with Stateful Backup Example

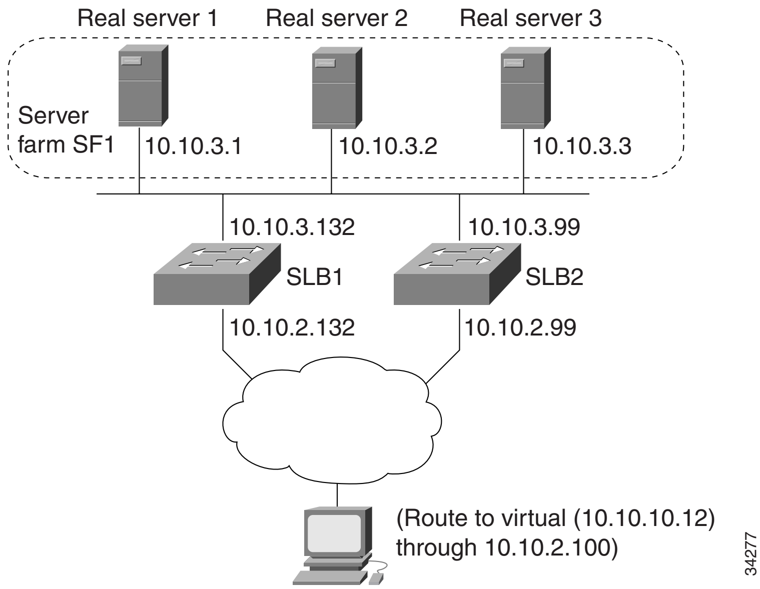
This sample configuration focuses on the IOS SLB real server connections configured as part of a server farm, with real and virtual servers over Fast Ethernet interfaces configured with stateful backup standby connections.

Figure 14 is an example of a stateful backup configuration, using HSRP on both the client and server sides to handle failover. The real servers route outbound flows to 10.10.3.100, which is the HSRP address on the server side interfaces. The client (or access router), routes to the virtual IP address (10.10.10.12) through 10.10.2.100, HSRP address on the client side.

Notice the loopback interfaces configured on both devices for the exchange of these messages. Each IOS SLB should also be given duplicate routes to the other switch loopback address. This configuration allows replication messages to flow despite an interface failure.

Note To allow HSRP to function properly, the **set spantree portfast** command must be configured on any Layer 2 device between the IOS SLB switches.

Figure 14 IOS SLB Stateful Environment



Switch SLB1 Configuration Statements

```
ip slb serverfarm SF1
  nat server
  real 10.10.3.1
   inservice
  real 10.10.3.2
   inservice
  real 10.10.3.3
   inservice
!
ip slb vserver VS1
  virtual 10.10.10.12 tcp telnet
  serverfarm SF1
  replicate casa 10.10.99.132 10.10.99.99 1024 password PASS
  inservice standby virt
!
interface loopback 1
  ip address 10.10.99.132 255.255.255.255
!
interface FastEthernet1
  ip address 10.10.3.132 255.255.255.0
  no ip redirects
  no ip mroute-cache
  standby priority 5 preempt
  standby name out
  standby ip 10.10.3.100
  standby track FastEthernet2
  standby timers 1 3
interface FastEthernet2
  ip address 10.10.2.132 255.255.255.0
  no ip redirects
  standby priority 5
  standby name virt
  standby ip 10.10.2.100
  standby timers 1 3
```

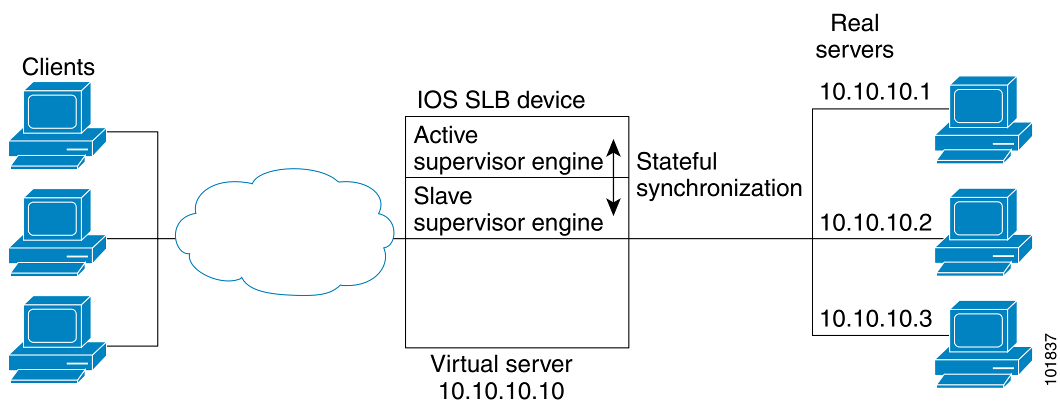
Switch SLB2 Configuration Statements

```
ip slb serverfarm SF1
  nat server
  real 10.10.3.1
   inservice
  real 10.10.3.2
   inservice
  real 10.10.3.3
   inservice
!
ip slb vserver VS1
  virtual 10.10.10.12 tcp telnet
  serverfarm SF1
  replicate casa 10.10.99.99 10.10.99.132 1024 password PASS
  inservice standby virt
!
interface loopback 1
  ip address 10.10.99.99 255.255.255.255
!
interface FastEthernet2
  ip address 10.10.2.99 255.255.255.0
  no ip redirects
  no ip route-cache
  no ip mroute-cache
  standby priority 10 preempt delay sync 20
  standby name virt
  standby ip 10.10.2.100
  standby track FastEthernet3
  standby timers 1 3
!
interface FastEthernet3
  ip address 10.10.3.99 255.255.255.0
  no ip redirects
  no ip route-cache
  no ip mroute-cache
  standby priority 10 preempt delay 20
  standby name out
  standby ip 10.10.3.100
  standby track FastEthernet2
  standby timers 1 3
```

IOS SLB with Stateful Backup of Redundant Route Processors Example

In Figure 15, the IOS SLB device includes two Supervisor engines configured for stateful backup. If the active Supervisor engine fails, the backup Supervisor engine takes over via RPR+ with IOS SLB synchronization information already populated. IOS SLB replicates state information for virtual server ACME_VSERVER (10.10.10.10) from the active Supervisor engine to the backup every 20 seconds. The real servers (10.10.10.1, 10.10.10.2, and 10.10.10.3) are configured in server farm ACME_SFARM.

Figure 15 IOS SLB with Redundant Route Processors



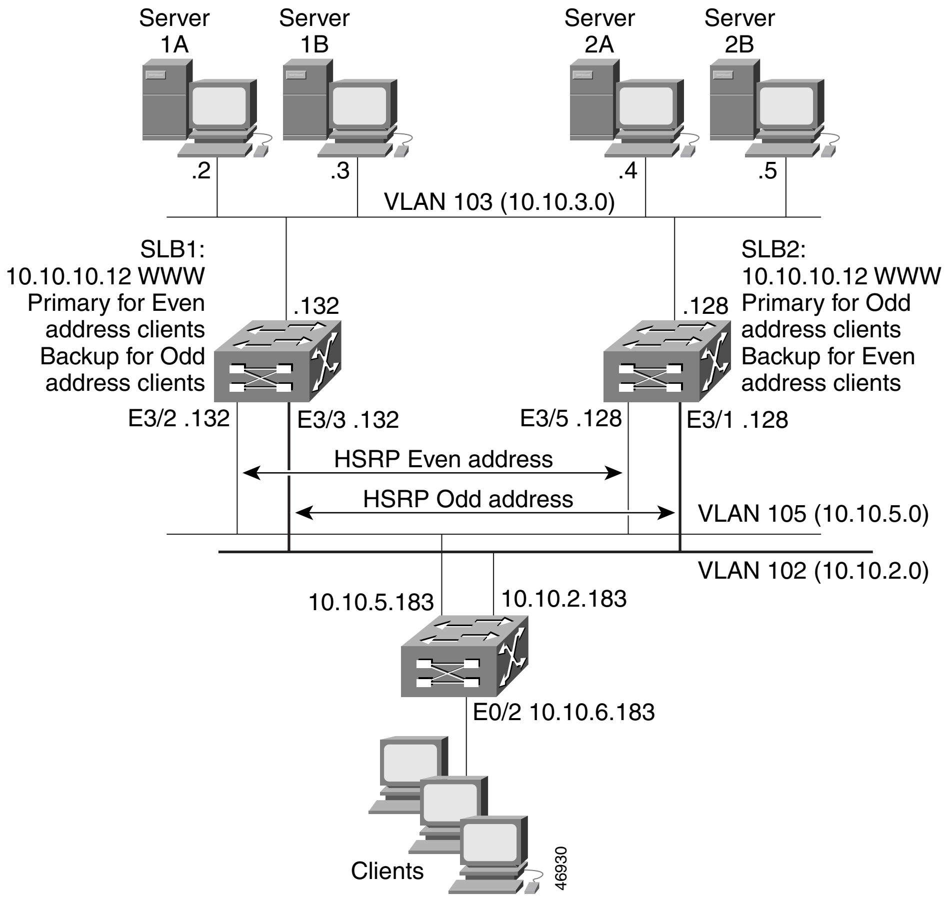
Following are the IOS SLB configuration statements for the configuration shown in Figure 15:

```
ip slb replicate slave rate 300

ip slb serverfarm ACME_SFARM
  nat server
  real 10.10.10.1
   inservice
  real 10.10.10.2
   inservice
  real 10.10.10.3
   inservice

ip slb vserver ACME_VSERVER
 virtual 10.10.10.10 tcp 80
 replicate interval 20
 replicate slave
 serverfarm ACME_SFARM
 inservice
```

IOS SLB with Active Standby Example

Figure 16 shows an IOS SLB network configured for active standby, with two IOS SLB devices load-balancing the same virtual IP address while backing up each other. If either device fails, the other takes over its load via normal HSRP failover and IOS SLB stateless redundancy.

Figure 16 IOS SLB Active Standby



The sample network configuration in Figure 16 has the following characteristics:

- SLB 1 balances servers 1A and 1B and SLB 2 balances 2A and 2B.
- A single virtual IP address (10.10.10.12 for web) is supported across the two IOS SLB devices.
- Client traffic is divided in an access router, sending clients with even IP addresses to HSRP1 (10.10.5.100) and clients with odd IP addresses to HSRP2 (10.10.2.100). SLB 1 is configured as primary for clients with odd IP addresses, and SLB 2 is primary for clients with even IP addresses.
- The IOS SLB devices balance the traffic to disjoint sets of real servers. (If client NAT was used in this example, this characteristic would not be a requirement).
- Each set of real servers has a default gateway configured to its IOS SLB device.
- The HSRP address on VLAN 105 is 10.10.5.100. The HSRP address on VLAN 102 is 10.10.2.100.

SLB 1 Configuration Statements

```
ip slb serverfarm EVEN
 nat server
 real 10.10.3.2
  reassign 2
  faildetect numconns 4 numclients 2
  retry 20
  inservice
 real 10.10.3.3
  reassign 2
  faildetect numconns 4
  retry 20
  inservice
!
ip slb serverfarm ODD
 nat server
 real 10.10.3.2
  reassign 2
  faildetect numconns 4
  retry 20
  inservice
 real 10.10.3.3
  reassign 2
  faildetect numconns 4
  retry 20
  inservice
!-----Same EVEN virtual server as in SLB 2
ip slb vserver EVEN
 virtual 10.10.10.12 tcp www
 serverfarm EVEN
 client 0.0.0.0 0.0.0.1
 idle 120
 delay 5
!-----See standby name in Ethernet 3/3 below
 inservice standby STANDBY_EVEN
!-----Same ODD virtual server as in SLB 2
ip slb vserver ODD
 virtual 10.10.10.12 tcp www
 serverfarm ODD
 client 0.0.0.1 0.0.0.1
 idle 120
 delay 5
!-----See standby name in Ethernet 3/2 below
 inservice standby STANDBY_ODD
!
interface Ethernet3/2
 ip address 10.10.5.132 255.255.255.0
 standby priority 20 preempt delay sync 20
!-----See standby name in SLB 2, Ethernet 3/5
 standby name STANDBY_ODD
 standby ip 10.10.5.100
 standby track Ethernet3/3
 standby timers 1 3
!
interface Ethernet3/3
 ip address 10.10.2.132 255.255.255.0
 standby priority 10
!-----See standby name in SLB 2, Ethernet 3/1
 standby name STANDBY_EVEN
 standby ip 10.10.2.100
 standby track Ethernet3/2
 standby timers 1 3
```

SLB 2 Configuration Statements

```
ip slb serverfarm EVEN
 nat server
 real 10.10.3.4
  reassign 2
  faildetect numconns 4
  retry 20
  inservice
 real 10.10.3.5
  reassign 2
  faildetect numconns 4
  retry 20
  inservice
!
ip slb serverfarm ODD
 nat server
 real 10.10.3.4
  reassign 2
  faildetect numconns 4
  retry 20
  inservice
 real 10.10.3.5
  reassign 2
  faildetect numconns 4
  retry 20
  inservice
!-----Same EVEN virtual server as in SLB 1
ip slb vserver EVEN
 virtual 10.10.10.12 tcp www
 serverfarm EVEN
 client 0.0.0.0 0.0.0.1
 idle 120
 delay 5
!-----See standby name in Ethernet 3/1 below
 inservice standby STANDBY_EVEN
!-----Same ODD virtual server as in SLB 1
ip slb vserver ODD
 virtual 10.10.10.12 tcp www
 serverfarm ODD
 client 0.0.0.1 0.0.0.1
 idle 120
 delay 5
!-----See standby name in Ethernet 3/5 below
 inservice standby STANDBY_ODD
!
interface Ethernet3/1
 ip address 10.10.2.128 255.255.255.0
 standby priority 20 preempt delay sync 20
!-----See standby name in SLB 1, Ethernet 3/3
 standby name STANDBY_EVEN
 standby ip 10.10.2.100
 standby track Ethernet3/5
 standby timers 1 3
!
interface Ethernet3/5
 ip address 10.10.5.128 255.255.255.0
 standby priority 10 preempt delay sync 20
!-----See standby name in SLB 1, Ethernet 3/2
 standby name STANDBY_ODD
 standby ip 10.10.5.100
 standby track Ethernet3/1
 standby timers 1 3
```

Access Router Configuration Statements

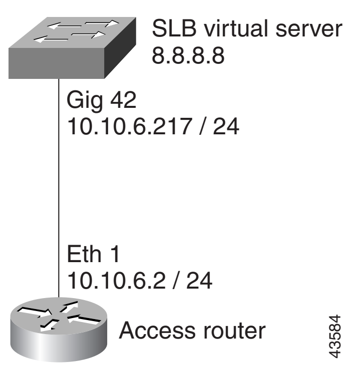
```
interface Ethernet0/0
 ip address 10.10.5.183 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
!
interface Ethernet0/1
 ip address 10.10.2.183 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
!
interface Ethernet0/2
 ip address 10.10.6.183 255.255.255.0
 no ip directed-broadcast
 no ip route-cache
 no ip mroute-cache
 ip policy route-map virts
!
access-list 100 permit ip 0.0.0.1 255.255.255.254 host 10.10.10.12
access-list 101 permit ip 0.0.0.0 255.255.255.254 host 10.10.10.12
route-map virts permit 10
match ip address 100
set ip next-hop 10.10.5.100
!
route-map virts permit 15
match ip address 101
set ip next-hop 10.10.2.100
```

IOS SLB with Redistribution of Static Routes Example

Figure 17 shows an IOS SLB network configured to distribute static routes to a virtual server's IP address. The route to the address is added to the routing table as **static** if you advertise the address when you bring the virtual server into service (using the **inservice** command). See the description of the **advertise** command in the "Command Reference" section on page 131 for more details about advertising virtual server IP addresses.

Because the routing configuration varies from protocol to protocol, sample configurations for several different routing protocols are given.

Figure 17 IOS SLB Redistribution of Static Routes



Routing Information Protocol (RIP)

Following is the RIP static route redistribution configuration for the IOS SLB switch shown in Figure 17:

```
router rip
 redistribute static
 network 10.0.0.0
 network 8.0.0.0
```

Following is the RIP static route redistribution configuration for the access router that is listening for routing updates shown in Figure 17:

```
router rip
 network 10.0.0.0
 network 8.0.0.0
```

Open Shortest Path First (OSPF)

Following is the OSPF static route redistribution configuration for the IOS SLB switch shown in Figure 17:

```
router ospf 1
 redistribute static subnets
 network 10.10.6.217 0.0.0.0 area 0
 network 8.8.8.0 0.0.0.255 area 0
```

Following is the OSPF static route redistribution configuration for the access router that is listening for routing updates shown in Figure 17:

```
router ospf 1
 network 10.10.6.2 0.0.0.0 area 0
 network 8.8.8.0 0.0.0.255 area 0
```

Interior Gateway Routing Protocol (IGRP)

Following is the IGRP static route redistribution configuration for the IOS SLB switch shown in Figure 17:

```
router igrp 1
 redistribute connected
 redistribute static
 network 8.0.0.0
 network 10.0.0.0
```

Following is the IGRP static route redistribution configuration for the access router that is listening for routing updates shown in Figure 17:

```
router igrp 1
 network 8.0.0.0
 network 10.0.0.0
```

Enhanced Interior Gateway Routing Protocol (Enhanced IGRP)

Following is the Enhanced IGRP static route redistribution configuration for the IOS SLB switch shown in Figure 17:

```
router eigrp 666
 redistribute static
 network 10.0.0.0
 network 8.0.0.0
```

Following is the Enhanced IGRP static route redistribution configuration for the access router that is listening for routing updates shown in Figure 17:

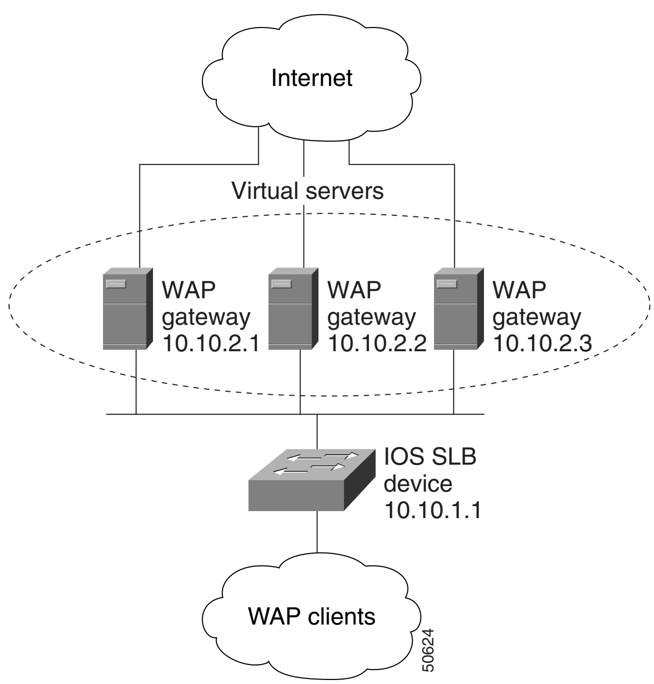
```
router eigrp 666
 network 10.0.0.0
 network 8.0.0.0
```

IOS SLB with WAP and UDP Load Balancing Examples

Figure 18 shows an IOS SLB network configured to balance WAP flows. In this example:

- WAP flows are balanced between WAP gateways 10.10.2.1, 10.10.2.2, and 10.10.2.3.
- The clients connect to 10.10.1.1, the IOS SLB virtual server address.
- For a given session, load-balancing decisions change if the connection idles longer than the virtual server's idle connection timer (3000 seconds in this example).

Figure 18 IOS SLB with WAP Load Balancing



There are two ways to configure IOS SLB load balancing for WAP:

- To load-balance sessions running in connection-oriented WSP mode, define a WSP probe and use WAP load balancing. WAP load balancing requires a WAP virtual server configured on one of the WAP ports.
- To load-balance sessions running in connectionless WSP, connectionless secure WSP, and connection-oriented secure WSP modes, define a ping or WSP probe and use standard UDP load balancing with a low idle timer.

WAP Load Balancing Example

The following example shows the configuration for the IOS SLB device shown in Figure 18, which balances WAP flows on UDP port 9201 (WSP/WTP/UDP):

```
ip slb probe PROBE3 wsp
  url http://localhost/test.txt
!
ip slb serverfarm WAPFARM
  nat server
  real 10.10.2.1
  inservice
  real 10.10.2.2
  inservice
  real 10.10.2.3
  inservice
  probe PROBE3
!
ip slb vserver VSERVER
  virtual 10.10.1.1 udp 9201
  serverfarm WAPFARM
  idle 3000
  inservice
```

UDP Load Balancing Example

The following example shows the configuration for the IOS SLB device shown in Figure 18, which balances WAP flows on UDP port 9203 (WSP/WTP/WTLS/UDP):

```
ip slb probe PROBE1 ping
!
ip slb serverfarm WAPFARM
  nat server
  real 10.10.2.1
  inservice
  real 10.10.2.2
  inservice
  real 10.10.2.3
  inservice
  probe PROBE1
!
ip slb vserver VSERVER
  virtual 10.10.1.1 udp 9203
  serverfarm WAPFARM
  idle 3000
  inservice
```

IOS SLB with Route Health Injection Examples

This section contains the following examples, illustrating several different IOS SLB route health injection configurations:

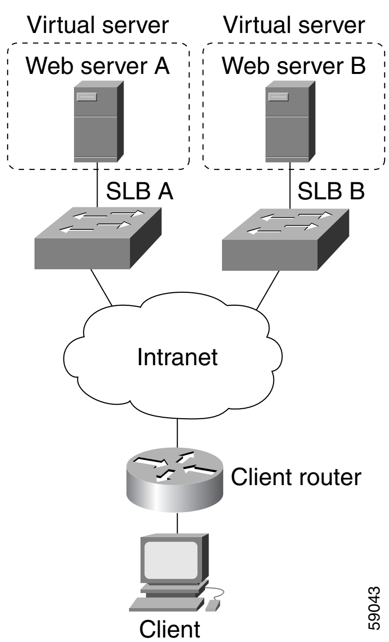
- Example with Two Distributed Sites with One Web Server Each, page 107
- Example with Two Distributed Sites with Two Web Servers Each, page 108
- Example with Two Distributed Sites with One Web Server and a Backup IOS SLB Switch Each, page 109

Example with Two Distributed Sites with One Web Server Each

Figure 19 shows an IOS SLB network configured with route health injection with the following characteristics:

- Both IOS SLB devices are configured with the same virtual IP address.
- Each IOS SLB device has a server farm containing only the locally attached web server as a real server.
- The path to SLB A has the lower weight.

Figure 19 Two Distributed Sites with One Web Server Each



When both web servers in Figure 19 are operational, the client router receives the host route from both IOS SLB devices.

If Web Server A fails, the virtual server for the virtual IP address on SLB A enters FAILED state and stops advertising the host route for the virtual IP address. The client router then begins using the route to SLB B.

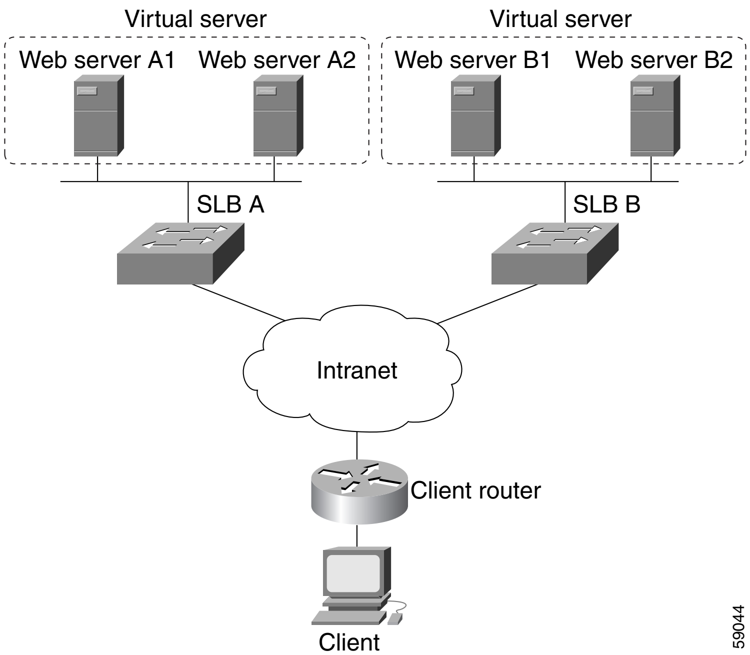
When Web Server A is again available, the virtual server again advertises the host route for the virtual IP address, and the client router begins using SLB A.

Example with Two Distributed Sites with Two Web Servers Each

Figure 20 shows an IOS SLB network configured with route health injection with the following characteristics:

- Both IOS SLB devices are configured with the same virtual IP address.
- Each IOS SLB device has a server farm containing two locally attached web servers as real servers.
- The path to SLB A has the lower weight.

Figure 20 Two Distributed Sites with Two Web Servers Each



When all web servers in Figure 20 are operational, the client router receives the host route from both IOS SLB devices.

If one web server in either server farm fails, the route continues to be advertised by the given IOS SLB device.

If both Web Server A1 and Web Server A2 fail, the virtual server for the virtual IP address on SLB A enters FAILED state and stops advertising the host route for the virtual IP address. The client router then begins using the route to SLB B.

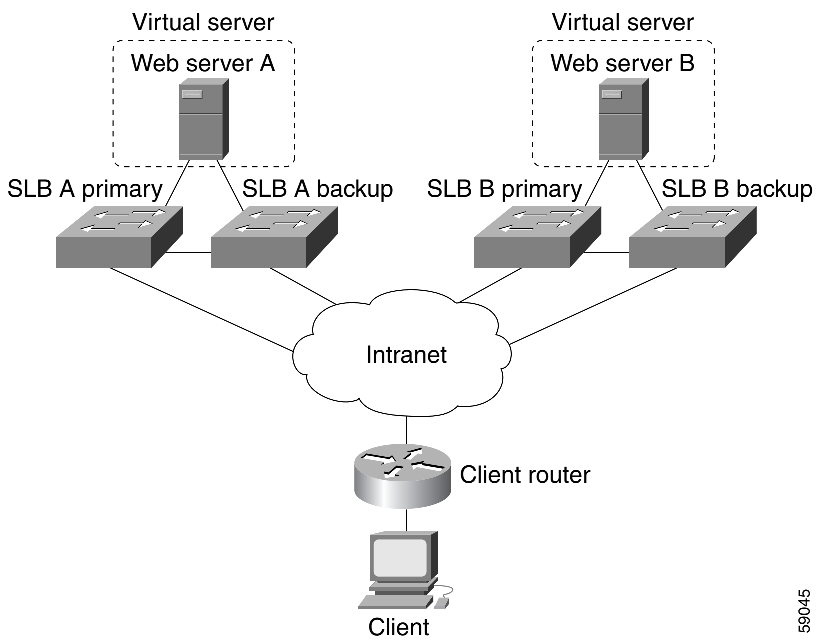
When either Web Server A1 or Web Server A2 is again available, the virtual server again advertises the host route for the virtual IP address, and the client router begins using SLB A.

Example with Two Distributed Sites with One Web Server and a Backup IOS SLB Switch Each

Figure 21 shows an IOS SLB network configured with route health injection with the following characteristics:

- Both IOS SLB devices are configured with the same virtual IP address.
- Each IOS SLB device has a server farm containing only the locally attached web server as a real server.
- Each site has a primary IOS SLB device and a backup IOS SLB device.
- The path to SLB A has the lower weight.

Figure 21 Two Distributed Sites with One Web Server and a Backup IOS SLB Switch Each



When both web servers in Figure 21 are operational, the client router receives the host route from both SLB A Primary and SLB B Primary.

If SLB A Primary fails, SLB A Backup begins advertising the host route to the virtual IP address. If SLB A Backup also fails, the virtual server for the virtual IP address on SLB A Primary and SLB A Backup enters FAILED state and stops advertising the host route for the virtual IP address. The client router then begins using the route to SLB B Primary (or to SLB B Backup, if SLB B Primary is not available).

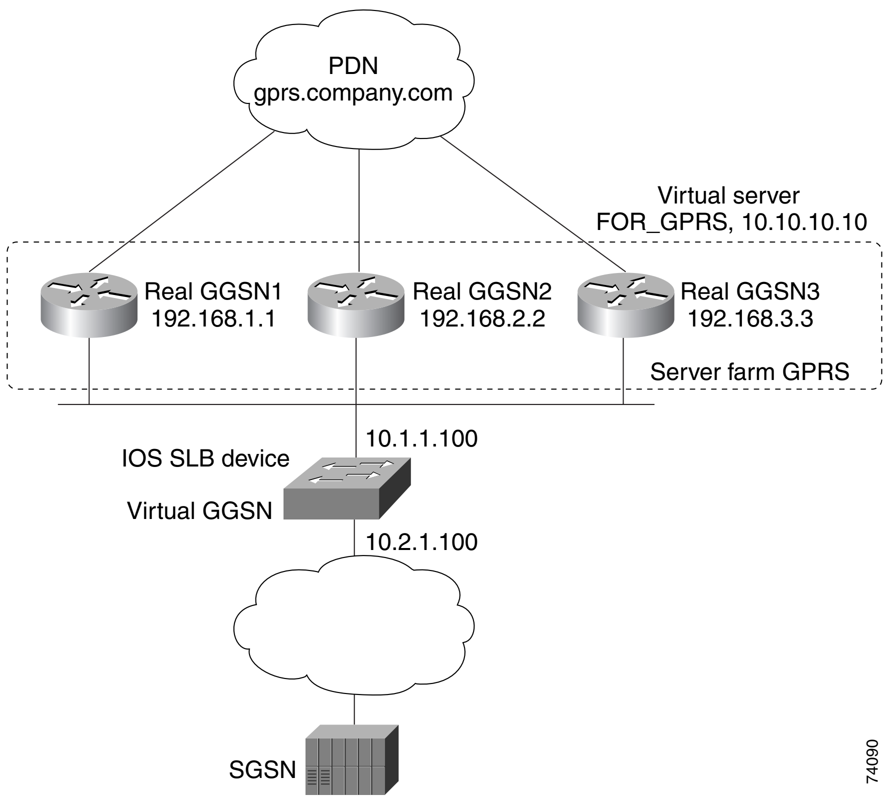
When either SLB A Primary or SLB A Backup is again available, the virtual server again advertises the host route for the virtual IP address, and the client router begins using SLB A Primary or SLB A Backup.

IOS SLB with GPRS Load Balancing Example

Figure 22 shows a typical GPRS load-balancing configuration *without* GTP cause code inspection enabled. In this configuration:

- IOS SLB can balance GPRS flows across multiple real GGSNs. The SGSN "sees" the real GGSNs as a single virtual GGSN. This configuration increases the flow-handling capability of the real GGSNs and increases the reliability and availability.
- The virtual template address of the SGSN is 10.111.111.111.
- The virtual template address of GGSN1 is 192.168.1.1.
- The virtual template address of GGSN2 is 192.168.2.2.
- The virtual template address of GGSN3 is 192.168.3.3.

Figure 22   IOS SLB with GPRS Load Balancing



Following are the configuration statements for the configuration shown in Figure 22:

- IOS SLB Configuration Statements, page 111
- GGSN1 Configuration Statements, page 111
- GGSN2 Configuration Statements, page 112
- GGSN3 Configuration Statements, page 113

For more detailed GGSN configuration examples, refer to the *Cisco IOS Mobile Wireless Configuration Guide*, Release 12.2.

IOS SLB Configuration Statements

```
hostname GTP_SLB
!
ip domain-name gprs.com
!
ip slb serverfarm GPRS
 real 192.168.1.1
  weight 1
  faildetect numconns 1 numclients 1
  inservice
!
 real 192.168.2.2
  weight 1
  faildetect numconns 1 numclients 1
  inservice
!
 real 192.168.3.3
  weight 1
  faildetect numconns 1 numclients 1
  inservice
!
ip slb vserver FOR_GPRS
 virtual 10.10.10.10 udp 3386 service gtp
 serverfarm GPRS
 inservice
!
ip slb dfp password Password1 0
 agent 10.1.1.201 1111 30 0 10
 agent 10.1.1.202 1111 30 0 10
 agent 10.1.1.203 1111 30 0 10
!
interface FastEthernet1/0
 description TO SERVERFARM GPRS
 ip address 10.1.1.100 255.255.255.0
 no ip redirects
 duplex half
!
interface FastEthernet3/0
 description TO SGSN
 ip address 10.2.1.100 255.255.255.0
 no ip mroute-cache
 duplex half
!
ip route 10.111.111.111 255.255.255.255 FastEthernet1/0
ip route 192.168.1.1 255.255.255.255 10.1.1.201
ip route 192.168.2.2 255.255.255.255 10.1.1.202
ip route 192.168.3.3 255.255.255.255 10.1.1.203
```

GGSN1 Configuration Statements

```
service gprs ggsn
!
hostname GGSN1
!
ip dfp agent gprs
 port 1111
 password Password1 0
 inservice
!
ip domain-name gprs.com
!
```

```
interface loopback 1
 description LOOPBACK SAME AS IOS SLB VSERVER ADDRESS
 ip address 10.10.10.10 255.255.255.255
 no ip route-cache
 no ip mroute-cache
!
interface FastEthernet1/0
 description TO SLB
 ip address 10.1.1.201 255.255.255.0
 ip directed-broadcast
 no ip mroute-cache
 duplex half
!
interface Virtual-Template1
 description GTP VIRTUAL TEMPLATE
 ip address 192.168.1.1 255.255.255.0
 encapsulation gtp
 gprs access-point-list gprs1
!
ip route 10.111.111.111 255.255.255.255 FastEthernet1/0
!
gprs access-point-list gprs1
  access-point 1
   access-point-name gprs.company.com
   access-mode non-transparent
   ip-address-pool dhcp-proxy-client
   dhcp-server 10.100.0.5 10.100.0.6
   dhcp-gateway-address 10.27.3.1
   exit
!
gprs maximum-pdp-context-allowed 45000
gprs qos map canonical-qos
gprs gtp path-echo-interval 0
gprs dfp max-weight 32
gprs slb cef 10.10.10.10
```

GGSN2 Configuration Statements

```
service gprs ggsn
!
hostname GGSN2
!
ip dfp agent gprs
 port 1111
 password Password1 0
 inservice
!
ip domain-name gprs.com
!
interface loopback 1
 description LOOPBACK SAME AS IOS SLB VSERVER ADDRESS
 ip address 10.10.10.10 255.255.255.255
 no ip route-cache
 no ip mroute-cache
!
interface FastEthernet1/0
 description TO SLB
 ip address 10.1.1.202 255.255.255.0
 ip directed-broadcast
 no ip mroute-cache
 duplex half
!
```

```
interface Virtual-Template1
 description GTP VIRTUAL TEMPLATE
 ip address 192.168.2.2 255.255.255.0
 encapsulation gtp
 gprs access-point-list gprs1
!
ip route 10.111.111.111 255.255.255.255 FastEthernet1/0
!
gprs access-point-list gprs1
  access-point 1
   access-point-name gprs.company.com
   access-mode non-transparent
   ip-address-pool dhcp-proxy-client
   dhcp-server 10.100.0.5 10.100.0.6
   dhcp-gateway-address 10.27.3.1
   exit
!
gprs maximum-pdp-context-allowed 45000
gprs qos map canonical-qos
gprs gtp path-echo-interval 0
gprs dfp max-weight 32
gprs slb cef 10.10.10.10
```

GGSN3 Configuration Statements

```
service gprs ggsn
!
hostname GGSN3
!
ip dfp agent gprs
 port 1111
 password Password1 0
 inservice
!
ip domain-name gprs.com
!
interface loopback 1
 description LOOPBACK SAME AS IOS SLB VSERVER ADDRESS
 ip address 10.10.10.10 255.255.255.255
 no ip route-cache
 no ip mroute-cache
!
interface FastEthernet1/0
 description TO SLB
 ip address 10.1.1.203 255.255.255.0
 ip directed-broadcast
 no ip mroute-cache
 duplex half
!
interface Virtual-Template1
 description GTP VIRTUAL TEMPLATE
 ip address 192.168.3.3 255.255.255.0
 encapsulation gtp
 gprs access-point-list gprs1
!
ip route 10.111.111.111 255.255.255.255 FastEthernet1/0
!
```

```
gprs access-point-list gprs1
  access-point 1
   access-point-name gprs.company.com
   access-mode non-transparent
   ip-address-pool dhcp-proxy-client
   dhcp-server 10.100.0.5 10.100.0.6
   dhcp-gateway-address 10.27.3.1
   exit
!
gprs maximum-pdp-context-allowed 45000
gprs qos map canonical-qos
gprs gtp path-echo-interval 0
gprs dfp max-weight 32
gprs slb cef 10.10.10.10
```

IOS SLB with GPRS Load Balancing and NAT Example

The following example uses the same basic configuration as in the "IOS SLB with GPRS Load Balancing Example" section on page 110, including the network shown in Figure 22, but with the addition of NAT:

For more detailed GGSN configuration examples, refer to the *Cisco IOS Mobile Wireless Configuration Guide*, Release 12.2.

IOS SLB Configuration Statements

```
hostname GTP_SLB
!
ip domain-name gprs.com
!
ip slb serverfarm GPRS
 nat server
 real 192.168.1.1
  weight 1
  faildetect numconns 1 numclients 1
  inservice
!
 real 192.168.2.2
  weight 1
  faildetect numconns 1 numclients 1
  inservice
!
 real 192.168.3.3
  weight 1
  faildetect numconns 1 numclients 1
  inservice
!
ip slb vserver FOR_GPRS
 virtual 10.10.10.10 udp 3386 service gtp
 serverfarm GPRS
 inservice
!
```

```
ip slb dfp password Password1 0
 agent 10.1.1.201 1111 30 0 10
 agent 10.1.1.202 1111 30 0 10
 agent 10.1.1.203 1111 30 0 10
!
interface FastEthernet1/0
 description TO SERVERFARM GPRS
 ip address 10.1.1.100 255.255.255.0
 no ip redirects
 duplex half
!
interface FastEthernet3/0
 description TO SGSN
 ip address 10.2.1.100 255.255.255.0
 no ip mroute-cache
 duplex half
!
ip route 10.111.111.111 255.255.255.255 FastEthernet1/0
ip route 192.168.1.1 255.255.255.255 10.1.1.201
ip route 192.168.2.2 255.255.255.255 10.1.1.202
ip route 192.168.3.3 255.255.255.255 10.1.1.203
```

GGSN1 Configuration Statements

```
service gprs ggsn
!
hostname GGSN1
!
ip dfp agent gprs
 port 1111
 password Password1 0
 inservice
!
ip domain-name gprs.com
!
interface FastEthernet1/0
 description TO SLB
 ip address 10.1.1.201 255.255.255.0
 ip directed-broadcast
 no ip mroute-cache
 duplex half
!
interface Virtual-Template1
 description GTP VIRTUAL TEMPLATE
 ip address 192.168.1.1 255.255.255.0
 encapsulation gtp
 gprs access-point-list gprs1
!
ip route 10.111.111.111 255.255.255.255 FastEthernet1/0
!
gprs access-point-list gprs1
  access-point 1
   access-point-name gprs.company.com
   access-mode non-transparent
   ip-address-pool dhcp-proxy-client
   dhcp-server 10.100.0.5 10.100.0.6
   dhcp-gateway-address 10.27.3.1
   exit
!
```

```
gprs maximum-pdp-context-allowed 45000
gprs qos map canonical-qos
gprs gtp path-echo-interval 0
gprs dfp max-weight 32
```

GGSN2 Configuration Statements

```
service gprs ggsn
!
hostname GGSN2
!
ip dfp agent gprs
 port 1111
 password Password1 0
 inservice
!
ip domain-name gprs.com
!
interface FastEthernet1/0
 description TO SLB
 ip address 10.1.1.202 255.255.255.0
 ip directed-broadcast
 no ip mroute-cache
 duplex half
interface Virtual-Template1
 description GTP VIRTUAL TEMPLATE
 ip address 192.168.2.2 255.255.255.0
 encapsulation gtp
 gprs access-point-list gprs1
!
ip route 10.111.111.111 255.255.255.255 FastEthernet1/0
!
gprs access-point-list gprs1
  access-point 1
   access-point-name gprs.company.com
   access-mode non-transparent
   ip-address-pool dhcp-proxy-client
   dhcp-server 10.100.0.5 10.100.0.6
   dhcp-gateway-address 10.27.3.1
   exit
!
gprs maximum-pdp-context-allowed 45000
gprs qos map canonical-qos
gprs gtp path-echo-interval 0
gprs dfp max-weight 32
```

GGSN3 Configuration Statements

```
service gprs ggsn
!
hostname GGSN3
!
ip dfp agent gprs
 port 1111
 password Password1 0
 inservice
!
ip domain-name gprs.com
!
interface FastEthernet1/0
 description TO SLB
```

```
 ip address 10.1.1.203 255.255.255.0
 ip directed-broadcast
 no ip mroute-cache
 duplex half
!
interface Virtual-Template1
 description GTP VIRTUAL TEMPLATE
 ip address 192.168.3.3 255.255.255.0
 encapsulation gtp
 gprs access-point-list gprs1
!
ip route 10.111.111.111 255.255.255.255 FastEthernet1/0
!
gprs access-point-list gprs1
  access-point 1
   access-point-name gprs.company.com
   access-mode non-transparent
   ip-address-pool dhcp-proxy-client
   dhcp-server 10.100.0.5 10.100.0.6
   dhcp-gateway-address 10.27.3.1
   exit
!
gprs maximum-pdp-context-allowed 45000
gprs qos map canonical-qos
gprs gtp path-echo-interval 0
gprs dfp max-weight 32
```

IOS SLB with GPRS Load Balancing, NAT, and GTP Cause Code Inspection Example

The following example uses the same basic configuration as in the "IOS SLB with GPRS Load Balancing and NAT Example" section on page 114, including the network shown in Figure 22, but with the GTP cause code inspection enabled. In this configuration:

- The GSN idle timer is set to 20 seconds.
- The GTP request idle timer is set to 15 seconds.
- The virtual server accepts PDP context creates only from International Mobile Subscriber IDs (IMSIs) with carrier code **mcc 222 mnc 22**.

Following are the configuration statements for the configuration shown in Figure 22, with the addition of NAT and GTP cause code inspection support:

- IOS SLB Configuration Statements, page 118
- GGSN1 Configuration Statements, page 115 (no change for GTP cause code inspection)
- GGSN2 Configuration Statements, page 116 (no change for GTP cause code inspection)
- GGSN3 Configuration Statements, page 116 (no change for GTP cause code inspection)

For more detailed GGSN configuration examples, refer to the *Cisco IOS Mobile Wireless Configuration Guide*, Release 12.2.

IOS SLB Configuration Statements

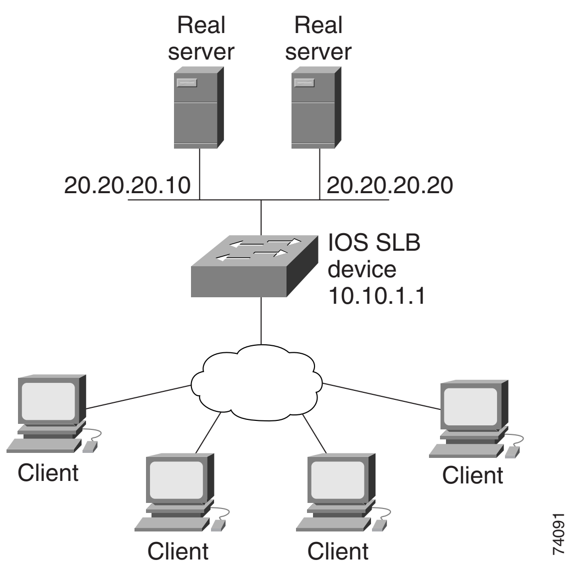
```
hostname GTP_SLB
!
ip domain-name gprs.com
!
ip slb timers gtp gsn 20
!
ip slb serverfarm GPRS
 nat server
 real 192.168.1.1
  weight 1
  faildetect numconns 1 numclients 1
  inservice
!
 real 192.168.2.2
  weight 1
  faildetect numconns 1 numclients 1
  inservice
!
 real 192.168.3.3
  weight 1
  faildetect numconns 1 numclients 1
  inservice
!
ip slb vserver FOR_GPRS
 virtual 10.10.10.10 udp 0 service gtp-inspect
 idle gtp request 15
 client gtp carrier-code mcc 222 mnc 22
 serverfarm GPRS
 inservice
!
ip slb dfp password Password1 0
 agent 10.1.1.201 1111 30 0 10
 agent 10.1.1.202 1111 30 0 10
 agent 10.1.1.203 1111 30 0 10
!
interface FastEthernet1/0
 description TO SERVERFARM GPRS
 ip address 10.1.1.100 255.255.255.0
 no ip redirects
 duplex half
!
interface FastEthernet3/0
 description TO SGSN
 ip address 10.2.1.100 255.255.255.0
 no ip mroute-cache
 duplex half
!
ip route 10.111.111.111 255.255.255.255 FastEthernet1/0
ip route 192.168.1.1 255.255.255.255 10.1.1.201
ip route 192.168.2.2 255.255.255.255 10.1.1.202
ip route 192.168.3.3 255.255.255.255 10.1.1.203
```

IOS SLB with VPN Server Load Balancing Example

Figure 23 shows a typical VPN server load-balancing configuration. In this configuration:

- VPN flows are balanced between real servers 20.20.20.10 and 20.20.20.20.
- Clients connect to 10.10.1.1, the IOS SLB virtual server address.
- There is a sticky connection between the ESP virtual server and the UDP virtual server.
- The cryptographic key exchange occurs via IKE (ISAKMP; port 500).

Figure 23 IOS SLB with VPN Server Load Balancing



Following are the IOS SLB configuration statements for the configuration shown in Figure 23:

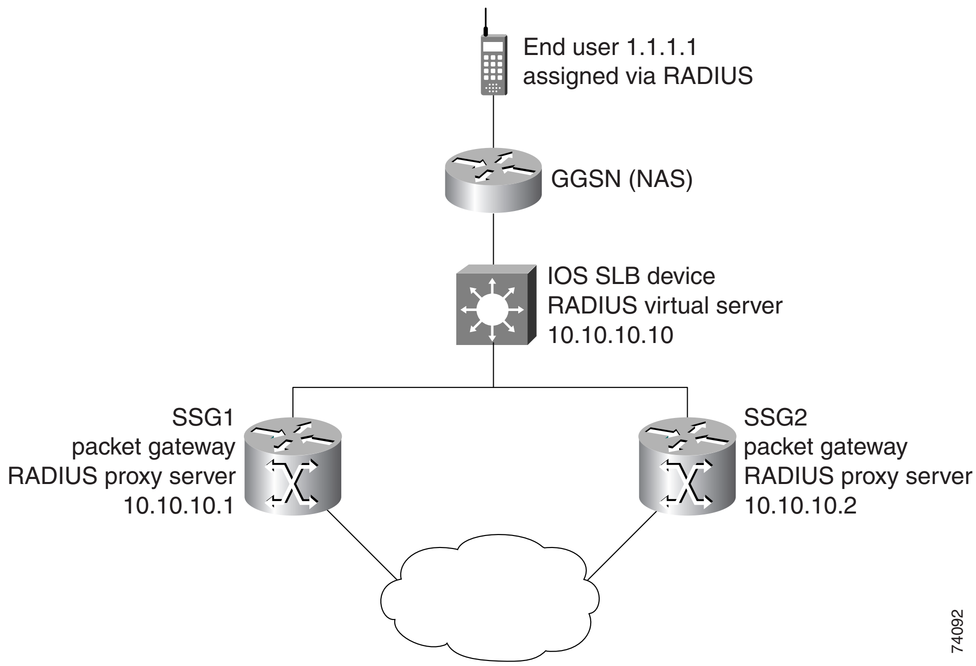
```
ip slb serverfarm VPN
 nat server
 real 20.20.20.10
  inservice
 real 20.20.20.20
  inservice
 failaction purge
!
ip slb vserver ESP
 virtual 10.10.1.1 ESP
 serverfarm VPN
 sticky 3600 group 69
 inservice
!
ip slb vserver UDP
 virtual 10.10.1.1 UDP isakmp
 serverfarm VPN
 sticky 3600 group 69
 inservice
```

IOS SLB with RADIUS Load Balancing for a GPRS Network Example

Figure 24 shows a typical IOS SLB RADIUS load-balancing configuration for a GPRS network. In this configuration:

- RADIUS requests are load-balanced between SSG RADIUS proxy servers 10.10.10.1 and 10.10.10.2.
- End-user data packets are routed to the IOS SLB device.
- End-user data packets from the 1.1.1.0 subnet are directed by IOS SLB to SSG1.
- End-user data packets from the 1.1.2.0 subnet are directed by IOS SLB to SSG2.

Figure 24 IOS SLB with RADIUS Load Balancing for a GPRS Network



Following are the IOS SLB configuration statements for the configuration shown in Figure 24:

```
ip slb route 1.1.0.0 255.255.0.0 framed-ip
!
ip slb serverfarm SSGFARM
 nat server
 real 10.10.10.1
  inservice
 real 10.10.10.2
  inservice
!
ip slb vserver RADIUS_ACCT
 virtual 10.10.10.10 udp 1812 service radius
 serverfarm SSGFARM
 idle radius request 20
 idle radius framed-ip 7200
 sticky radius framed-ip group 1
 inservice
!
```

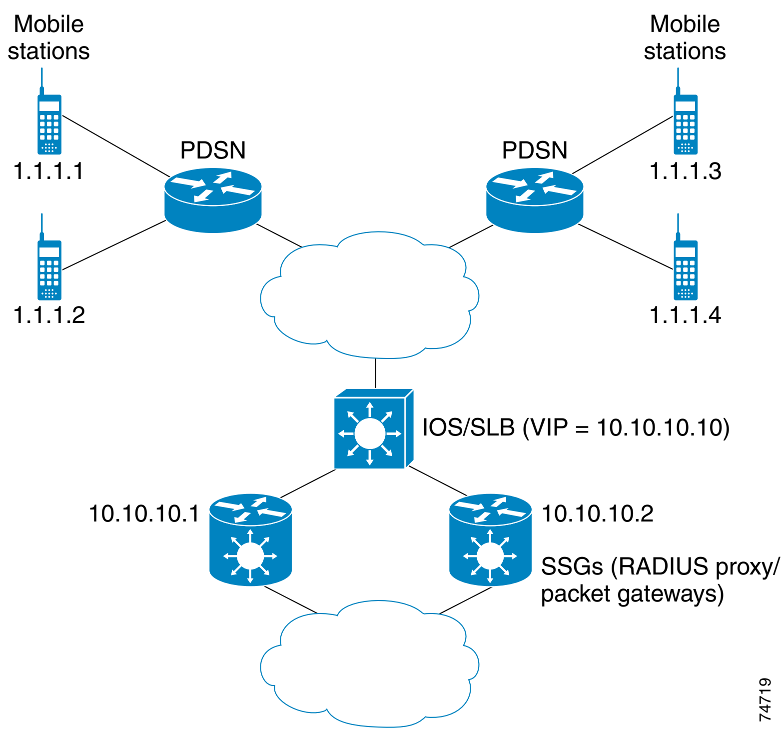
```
ip slb vserver RADIUS_AUTH
 virtual 10.10.10.10 udp 1813 service radius
 serverfarm SSGFARM
 idle radius request 20
 idle radius framed-ip 7200
 sticky radius framed-ip group 1
 inservice
```

IOS SLB with RADIUS Load Balancing for a Simple IP CDMA2000 Network Example

Figure 25 shows a typical IOS SLB RADIUS load-balancing configuration for a CDMA2000 network with simple IP service. In this configuration:

- The RADIUS virtual server IP address for the PDSNs is 10.10.10.10.
- RADIUS requests are load-balanced between SSG RADIUS proxy servers 10.10.10.1 and 10.10.10.2.
- End-user data packets are routed to the IOS SLB device.
- End-user data packets from the 1.1.0.0 network are routed to the SSGs.

Figure 25 IOS SLB with RADIUS Load Balancing for a Simple IP CDMA2000 Network



Following are the IOS SLB configuration statements for the configuration shown in Figure 25:

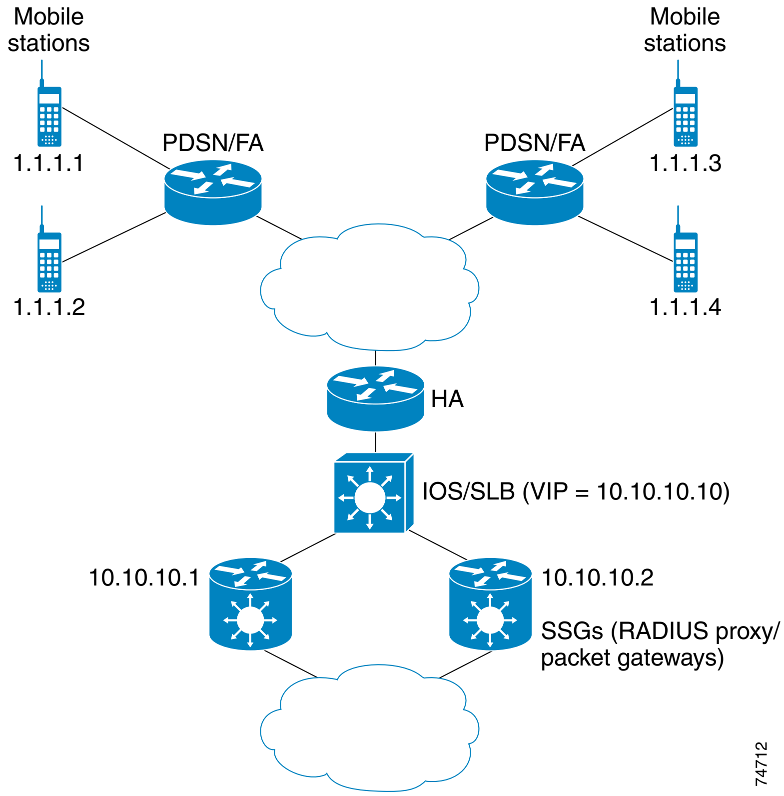
```
ip slb route 1.1.0.0 255.255.0.0 framed-ip
!
ip slb serverfarm SSGFARM
  nat server
  real 10.10.10.1
    inservice
  real 10.10.10.2
    inservice
!
ip slb vserver RADIUS_SIP
  virtual 10.10.10.10 udp 0 service radius
  serverfarm SSGFARM
  idle radius framed-ip 3600
  sticky radius username
  sticky radius framed-ip
  inservice
```

IOS SLB with RADIUS Load Balancing for a Mobile IP CDMA2000 Network Example

Figure 26 shows a typical IOS SLB RADIUS load-balancing configuration for a CDMA2000 network with Mobile IP service. In this configuration:

- The RADIUS virtual server IP address for the PDSNs and the HA is 10.10.10.10.
- RADIUS requests are load-balanced between SSG RADIUS proxy servers 10.10.10.1 and 10.10.10.2.
- End-user data packets are routed to the IOS SLB device.
- End-user data packets from the 1.1.0.0 network are routed to the SSGs.

Figure 26 IOS SLB with RADIUS Load Balancing for a Mobile IP CDMA2000 Network



Following are the IOS SLB configuration statements for the configuration shown in Figure 26:

```
ip slb route 1.1.0.0 255.255.0.0 framed-ip
!
ip slb serverfarm SSGFARM
  nat server
  real 10.10.10.1
    inservice
  real 10.10.10.2
    inservice
!
ip slb vserver RADIUS_SIP
  virtual 10.10.10.10 udp 0 service radius
  serverfarm SSGFARM
  idle radius framed-ip 3600
  sticky radius username
  sticky radius framed-ip
  inservice
```

IOS SLB with RADIUS Load Balancing for Multiple Service Gateway Farms Example

The following sample configuration enables IOS SLB to balance packet flows for a set of subscribers among multiple service gateway server farms (in this sample, a server farm of SSGs and a server farm of CSGs):

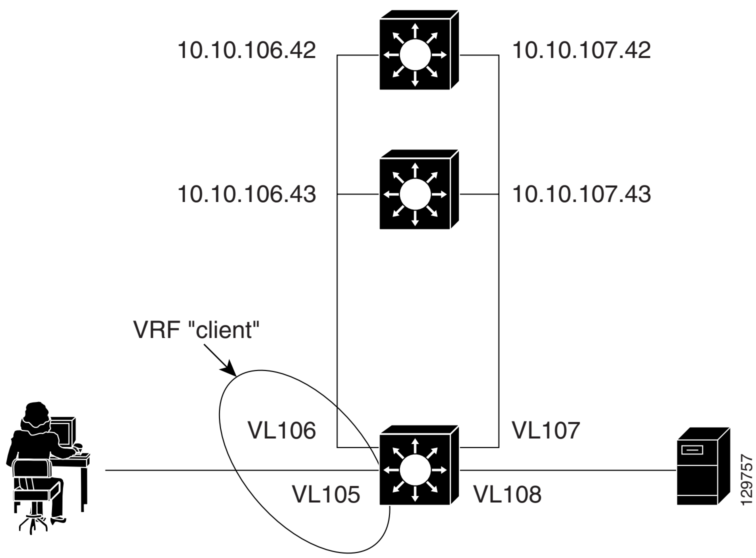
```
ip slb route 1.1.0.0 255.255.0.0 framed-ip
!
ip slb serverfarm SSGFARM
 nat server
 real 10.10.10.1
  inservice
 real 10.10.10.2
  inservice
!
ip slb serverfarm CSGFARM
 nat server
 real 20.20.20.1
  inservice
 real 20.20.20.2
  inservice
!
ip slb vserver SSG_AUTH
 virtual 10.10.10.10 udp 1812 service radius
 serverfarm SSGFARM
 idle radius request 20
 idle radius framed-ip 7200
 sticky radius framed-ip group 1
 access Vlan20 route framed-ip
 inservice
!
ip slb vserver SSG_ACCT
 virtual 10.10.10.10 udp 1813 service radius
 serverfarm SSGFARM
 idle radius request 20
 idle radius framed-ip 7200
 sticky radius framed-ip group 1
 access Vlan20 route framed-ip
 inservice
!
ip slb vserver CSG_ACCT
 virtual 20.20.20.20 udp 1813 service radius
 serverfarm CSGFARM
 idle radius request 25
 idle radius framed-ip 0
 sticky radius framed-ip
 access Vlan30 route framed-ip
 inservice
```

IOS SLB with RADIUS Load Balancing/Firewall Load Balancing “Sandwich” Example

Figure 27 shows a RADIUS load balancing/firewall load balancing “sandwich” on a single IOS SLB device. In this sample configuration:

- The RADIUS load balancing virtual IP address is 5.5.5.5.
- The subscriber framed-IP network is 1.0.0.0/255.0.0.0.
- VL105, VL106, VL107, and VL108 are VLANs.
- RADIUS requests arriving on VLAN VL105 are balanced to 10.10.106.42 and 10.10.106.43.
- User traffic is stickied based on framed-IP address assignments in the 1.0.0.0 subnet.
- Firewall load balancing on the other side (10.10.107.42/43) ensures that return path traffic to the subscriber is delivered to the correct gateway.

Figure 27 IOS SLB with RADIUS Load Balancing/Firewall Load Balancing “Sandwich”



Following are the IOS SLB configuration statements for the configuration shown in Figure 27:

```
ip vrf client
 rd 0:1
!
ip slb probe P742 ping
 address 10.10.107.42
 interval 120
!
ip slb probe P743 ping
 address 10.10.107.43
 interval 120
!
ip slb route 1.0.0.0 255.0.0.0 framed-ip
ip slb route framed-ip deny
!
ip slb firewallfarm SERVER
 access inbound Vlan108
 access outbound Vlan107
 inservice
```

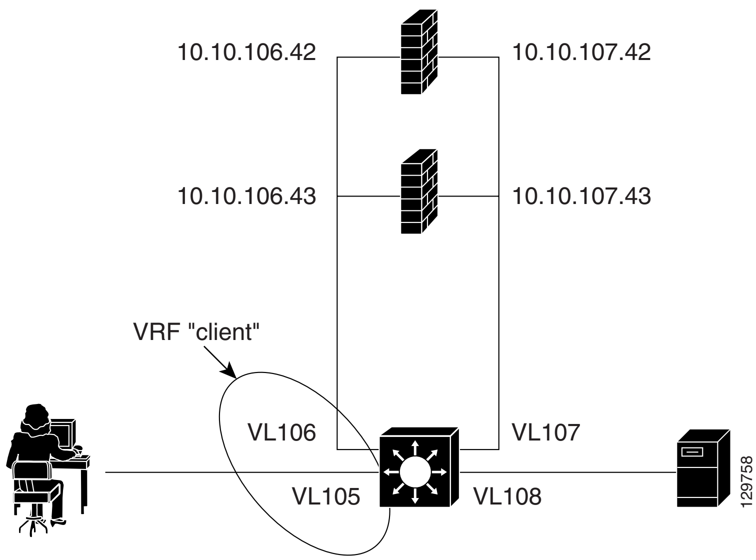
```
 real 10.10.107.42
  probe P742
  inservice
 real 10.10.107.43
  probe P743
  inservice
 protocol tcp
  sticky 180 destination
 protocol datagram
  sticky 180 destination
 predictor hash address port
!
ip slb serverfarm SF1
 nat server
 access Vlan106
!
 real 10.10.106.42
  inservice
 real 10.10.106.43
  inservice
!
ip slb vserver VS1
 virtual 5.5.5.5 udp 0 service radius
 serverfarm SF1
 sticky radius framed-ip
 access Vlan105 route framed-ip
 access Vlan105
 inservice
!
mls flow ip interface-full
!
!************************************************
!* Switchports, port channels and trunks         *
!* added to vlans 105-108 (left out for brevity) *
!************************************************
!
interface Vlan105
 ip vrf forwarding client
 ip address 10.10.105.2 255.255.255.0
!
interface Vlan106
 ip vrf forwarding client
 ip address 10.10.106.2 255.255.255.0
!
interface Vlan107
 ip address 10.10.107.2 255.255.255.0
!
interface Vlan108
 ip address 10.10.108.2 255.255.255.0
!
ip route 10.10.105.0 255.255.255.0 10.10.107.42
ip route vrf client 10.10.108.0 255.255.255.0 10.10.106.42
```

IOS SLB with Dual Firewall Load Balancing "Sandwich" Example

Figure 28 illustrates a basic dual firewall load balancing "sandwich" configuration hosted on a single IOS SLB device, including Virtual Private Network (VPN) routing and forwarding (VRF) and access interface configuration. VL105, VL106, VL107, and VL108 are VLANs.

Note The client and server in this configuration are directly connected; in a more typical deployment, additional routes would be needed inside and outside the VRF.

Figure 28 IOS SLB with Dual Firewall Load Balancing "Sandwich"



Following are the IOS SLB configuration statements for the configuration shown in Figure 28:

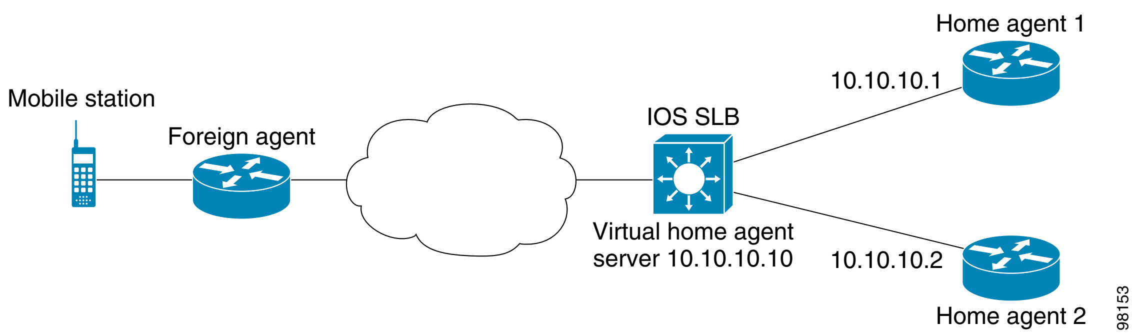
```
ip vrf client
 rd 0:1
!
ip slb probe P642 ping
 address 10.10.106.42
 interval 120
ip slb probe P643 ping
 address 10.10.106.43
 interval 120
ip slb probe P742 ping
 address 10.10.107.42
 interval 120
ip slb probe P743 ping
 address 10.10.107.43
 interval 120
!
ip slb firewallfarm CLIENT
 access inbound Vlan105
 access outbound Vlan106
 no inservice
!
 real 10.10.106.42
  probe P642
  inservice
 real 10.10.106.43
```

```
  probe P643
  inservice
 protocol tcp
  sticky 180 source
 protocol datagram
  sticky 180 source
 predictor hash address port
!
ip slb firewallfarm SERVER
 access inbound Vlan108
 access outbound Vlan107
 inservice
!
 real 10.10.107.42
  probe P742
  inservice
 real 10.10.107.43
  probe P743
  inservice
 protocol tcp
  sticky 180 destination
 protocol datagram
  sticky 180 destination
 predictor hash address port
!
mls flow ip interface-full
!
!*************************************************
!* Switchports, port channels and trunks         *
!* added to vlans 105-108 (left out for brevity) *
!*************************************************
!
interface Vlan105
 ip vrf forwarding client
 ip address 10.10.105.2 255.255.255.0
!
interface Vlan106
 ip vrf forwarding client
 ip address 10.10.106.2 255.255.255.0
!
interface Vlan107
 ip address 10.10.107.2 255.255.255.0
!
interface Vlan108
 ip address 10.10.108.2 255.255.255.0
!
ip route 10.10.105.0 255.255.255.0 10.10.107.42
ip route vrf client 10.10.108.0 255.255.255.0 10.10.106.42
```

IOS SLB with Home Agent Director Example

The following sample configuration enables IOS SLB to balance Mobile IP RRQs among multiple home agents.

Figure 29 IOS SLB with Home Agent Director



Following are the IOS SLB configuration statements for the configuration shown in Figure 29:

```
ip slb serverfarm HA_FARM
 nat server
 real 10.10.10.1
  inservice
 real 10.10.10.2
  inservice

ip slb vserver VIRTUAL_HA
 virtual 10.10.10.10 udp 434 service ipmobile
 serverfarm HA_FARM
 inservice
```

IOS SLB with Sticky Connections Example

The following sample configuration assigns all HTTP connections from a subnet to the same real server in server farm PUBLIC:

```
ip slb vserver http
  serverfarm PUBLIC
  sticky 30 group 1 netmask 255.255.255.248
  virtual 20.20.20.20 tcp 80
  inservice
```

The following sample configuration adds HTTPS connections to the above configuration, using the same sticky information but with a different virtual server:

```
ip slb vserver https
  serverfarm PUBLIC
  sticky 30 group 1 netmask 255.255.255.248
  virtual 20.20.20.20 tcp 443
  inservice
```

Now, all HTTP *and* HTTPS connections from the subnet are assigned to the same real server. For example, if a user connects to HTTP, then a second user connects to HTTPS, both connections are assigned to the same real server.

IOS SLB with GTP IMSI Sticky Database Example

The following sample configuration shows how to enable the IOS SLB GTP IMSI sticky database:

```
ip slb serverfarm GGSN_FARM
 failaction gtp purge
 real 10.20.10.1
  weight 1
  faildetect numconns 255 numclients 8
  inservice
!
 real 10.20.10.2
  weight 1
  faildetect numconns 255 numclients 8
  inservice
!
 real 10.20.10.3
  weight 1
  faildetect numconns 255 numclients 8
  inservice
!
ip slb vserver GGSN_SERVER1
 virtual 10.10.10.10 udp 3386 service gtp
 serverfarm GGSN_FARM backup GGSN_FARM
 idle gtp request 90
 idle gtp imsi 10000000
 sticky gtp imsi group 1
 gtp notification cac 3
 inservice
!
ip slb vserver GGSN_SERVER2
 virtual 10.10.10.10 udp 2123 service gtp
 serverfarm GGSN_FARM backup GGSN_FARM
 idle gtp request 90
 idle gtp imsi 10000000
 sticky gtp imsi group 1
 gtp notification cac 3
 inservice
```

IOS SLB with Transparent Web Cache Load Balancing Example

In the following sample configuration, virtual server WEBCACHE examines all web flows passing through the load-balancing device and dispatches them to server farm WEBCACHE-FARM. The **client exclude** statement ignores flows originating from subnet 80.80.7.0, enabling the real servers 80.80.7.188 and 80.80.7.189 to communicate with the Internet as needed.

```
ip slb serverfarm WEBCACHE-FARM
  real 80.80.7.188
   inservice
  real 80.80.7.189
   inservice
ip slb vserver WEBCACHE
  virtual 0.0.0.0 0.0.0.0 tcp www
  serverfarm WEBCACHE-FARM
  client 80.80.7.0 255.255.255.0 exclude
  inservice
```

Command Reference

This section documents only new and modified commands.

- idle (firewall farm TCP protocol)
- idle (virtual server)
- inservice (firewall farm real server)
- inservice (firewall farm)
- inservice (server farm real server)
- inservice (server farm virtual server)
- interval (custom UDP probe)
- interval (DNS probe)
- interval (HTTP probe)
- interval (ping probe)
- interval (TCP probe)
- interval (WSP probe)
- ip slb dfp
- ip slb entries
- ip slb firewallfarm
- ip slb maxbuffers frag
- ip slb natpool
- ip slb probe custom udp
- ip slb probe dns
- ip slb probe http
- ip slb probe ping
- ip slb probe tcp
- ip slb probe wsp
- ip slb replicate slave rate
- ip slb route
- ip slb serverfarm
- ip slb static
- ip slb timers gtp gsn
- ip slb vserver
- lookup
- maxclients
- maxconns (firewall farm datagram protocol)
- maxconns (firewall farm TCP protocol)
- maxconns (server farm)
- mls aging slb normal
- mls aging slb process
- mls ip slb search wildcard
- nat

- port (custom UDP probe)
- port (HTTP probe)
- port (TCP probe)
- predictor
- predictor hash address (firewall farm)
- probe (firewall farm real server)
- probe (server farm)
- protocol datagram
- protocol tcp
- purge radius framed-ip acct on-off (virtual server)
- purge radius framed-ip acct stop (virtual server)
- real (firewall farm)
- real (server farm)
- real (static NAT)
- reassign
- replicate casa (firewall farm)
- replicate casa (virtual server)
- replicate interval (firewall farm)
- replicate interval (virtual server)
- replicate slave (firewall farm)
- replicate slave (virtual server)
- request (custom UDP probe)
- request (HTTP probe)
- response
- retry (real server)
- serverfarm
- show fm slb counters
- show ip slb conns
- show ip slb dfp
- show ip slb firewallfarm
- show ip slb fragments
- show ip slb gtp
- show ip slb natpool
- show ip slb probe
- show ip slb reals
- show ip slb replicate
- show ip slb serverfarms
- show ip slb sessions

access (firewall farm)

To route specific flows to a firewall farm, use the **access** command in firewall farm configuration mode. To restore the default settings, use the **no** form of this command.

access [**source** *source-ip netmask* | **destination** *destination-ip netmask* | **inbound** {*inbound-interface* | **datagram connection**} | **outbound** *outbound-interface*]

no access [**source** *source-ip netmask* | **destination** *destination-ip netmask* | **inbound** {*inbound-interface* | **datagram connection**} | **outbound** *outbound-interface*]

Syntax Description

source	(Optional) Routes flows based on source IP address.
source-ip	(Optional) Source IP address. The default is 0.0.0.0 (all sources).
netmask	(Optional) Source IP network mask. The default is 0.0.0.0 (all source subnets).
destination	(Optional) Routes flows based on destination IP address.
destination-ip	(Optional) Destination IP address. The default is 0.0.0.0 (all destinations).
netmask	(Optional) Destination IP network mask. The default is 0.0.0.0 (all destination subnets).
inbound *inbound-interface*	(Optional) Indicates that the firewall farm is to accept inbound packets only on the specified inbound interface. You can specify a subinterface, such as Gigabitethernet7/3.100, for the *inbound-interface* argument.
inbound datagram connection	(Optional) Indicates that IOS SLB is to create connections for inbound traffic as well as outbound traffic.
outbound *outbound-interface*	(Optional) Indicates that the firewall farm is to accept outbound packets only on the specified outbound interface. You can specify a subinterface, such as Gigabitethernet7/3.100, for the *outbound-interface* argument.

Defaults

The default source IP address is 0.0.0.0 (routes flows from all sources to this firewall farm).
The default source IP network mask is 0.0.0.0 (routes flows from all source subnets to this firewall farm).
The default destination IP address is 0.0.0.0 (routes flows from all destinations to this firewall farm).
The default destination IP network mask is 0.0.0.0 (routes flows from all destination subnets to this firewall farm).
If you do not specify an inbound interface, the firewall farm accepts inbound packets on all inbound interfaces.
If you do not specify the **inbound datagram connection** option, IOS SLB creates connections only for outbound traffic.
If you do not specify an outbound interface, the firewall farm accepts outbound packets on all outbound interfaces.

Command Modes

Firewall farm configuration (config-slb-fw)

Command History

Release	Modification
12.1(7)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	The **inbound** and **outbound** keywords and *inbound-interface* and *outbound-interface* arguments were added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRE	This command was modified. The **datagram connection** keywords were added. The *inbound-interface* and *outbound-interface* arguments can be subinterfaces.

Usage Guidelines

You can specify more than one source or destination for each firewall farm. To do so, configure multiple **access** statements, making sure the network masks do not overlap each other.

You can specify up to two inbound interfaces and two outbound interfaces for each firewall farm. To do so, configure multiple **access** statements, keeping the following considerations in mind:

- All inbound and outbound interfaces must be in the same Virtual Private Network (VPN) routing and forwarding (VRF).
- All inbound and outbound interfaces must be different from each other.
- You cannot change inbound or outbound interfaces for a firewall farm while it is in service.

If you do not configure an access interface using this command, IOS SLB installs the wildcards for the firewall farm in all of the available interfaces of the device, including the VRF interfaces. If IOS SLB is not required on the VRF interfaces, use this command to limit wildcards to the specified interfaces only.

By default, IOS SLB firewall load balancing creates connections only for outbound traffic (that is, traffic that arrives through the real server). Inbound traffic uses those same connections to forward the traffic, which can impact the CPU. To enable IOS SLB to create connections for both inbound traffic and outbound traffic, reducing the impact on the CPU, use the **access inbound datagram connection** command.

Examples

The following example routes flows with a destination IP address of 10.1.6.0 to firewall farm FIRE1:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# access destination 10.1.6.0 255.255.255.0
```

Related Commands

Command	Description
show ip slb firewallfarm	Displays information about the firewall farm configuration.

access (server farm)

To configure an access interface for a server farm, use the **access** command in server farm configuration mode. To disable the access interface, use the **no** form of this command.

access *interface*

no access *interface*

Syntax Description

interface	Interface to be inspected. The server farm will handle outbound flows from real servers only on the specified interface. You can specify a subinterface, such as Gigabitethernet7/3.100, for the *interface* argument.

Defaults

The server farm handles outbound flows from real servers on all interfaces.

Command Modes

Server farm configuration (config-slb-sfarm)

Command History

Release	Modification
12.2(18)SXE	This command was introduced.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRE	This command was modified. The *interface* argument can be a subinterface.

Usage Guidelines

The virtual server and its associated server farm interfaces must be in the same Virtual Private Network (VPN) routing and forwarding (VRF).

You can specify up to two access interfaces for each server farm. To do so, configure two **access** statements, keeping the following considerations in mind:

- The two interfaces must be in the same VRF.
- The two interfaces must be different from each other.
- The access interfaces of primary and backup server farms must be the same.
- You cannot change the interfaces for a server farm while it is in service.

If you do not configure an access interface using this command, IOS SLB installs the wildcards for the server farm in all of the available interfaces of the device, including the VRF interfaces. If IOS SLB is not required on the VRF interfaces, use this command to limit wildcards to the specified interfaces only.

Examples

The following example limits the server farm to handling outbound flows from real servers only on access interface Vlan106:

```
Router(config)# ip slb serverfarm SF1
```

```
Router(config-slb-sfarm)# access Vlan106
```

Related Commands

Command	Description
show ip slb serverfarms	Displays information about the server farms.

access (virtual server)

To enable framed-IP routing to inspect the ingress interface, use the **access** command in virtual server configuration mode. To disable framed-IP routing, use the **no** form of this command.

access *interface* [**route framed-ip**]

no access *interface* [**route framed-ip**]

Syntax Description

interface	Interface to be inspected. You can specify a subinterface, such as Gigabitethernet7/3.100, for the *interface* argument.
route framed-ip	(Optional) Routes flows using framed-IP routing.

Defaults

Framed-IP routing cannot inspect the ingress interface.

Command Modes

Virtual server configuration (config-slb-vserver)

Command History

Release	Modification
12.1(12c)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	The command was modified to accept up to two framed-IP access interfaces (specified on separate commands).
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRE	This command was modified. The *interface* argument can be a subinterface.

Usage Guidelines

This command enables framed-IP routing to inspect the ingress interface when routing subscriber traffic. All framed-IP sticky database entries created as a result of RADIUS requests to this virtual server will include the interface in the entry. In addition to matching the source IP address of the traffic with the framed-IP address, the ingress interface must also match this interface when this command is configured.

You can use this command to allow subscriber data packets to be routed to multiple service gateway service farms.

The virtual server and its associated server farm interfaces must be in the same Virtual Private Network (VPN) routing and forwarding (VRF).

You can specify up to two framed-IP access interfaces for each virtual server. To do so, configure two **access** statements, keeping the following considerations in mind:

- The two interfaces must be in the same VRF.
- The two interfaces must be different from each other.
- You cannot change the interfaces for a virtual server while it is in service.

If you do not configure an access interface using this command, IOS SLB installs the wildcards for the virtual server in all of the available interfaces of the device, including the VRF interfaces. If IOS SLB is not required on the VRF interfaces, use this command to limit wildcards to the specified interfaces only.

Examples

The following example enables framed-IP routing to inspect ingress interface Vlan20:

```
Router(config)# ip slb vserver SSG_AUTH
Router(config-slb-vserver)# access Vlan20 route framed-ip
```

Related Commands

Command	Description
show ip slb vservers	Displays information about the virtual servers defined to IOS SLB.

address (custom UDP probe)

To configure an IP address to which to send custom User Datagram Protocol (UDP) probes, use the **address** command in custom UDP probe configuration mode. To restore the default settings, use the **no** form of this command.

address [*ip-address*] [**routed**]

no address [*ip-address*] [**routed**]

Syntax Description

ip-address	(Optional) Destination IP address that is to respond to the custom UDP probe.
routed	(Optional) Flags the probe as a routed probe, with the following considerations: • Only one instance of a routed probe per server farm can run at any given time. • Outbound packets for a routed probe are routed directly to *ip-address*.

Defaults

If the custom UDP probe is associated with a firewall farm, you must specify an IP address.
If the custom UDP probe is associated with a server farm, and you do not specify an IP address, the address is inherited from the server farm real servers.

Command Modes

Custom UDP probe configuration

Command History

Release	Modification
12.1(13)E3	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a custom UDP probe named PROBE6, enters custom UDP probe configuration mode, and configures the probe to receive responses from IP address 13.13.13.13:

```
Router(config)# ip slb probe PROBE6 custom udp
Router(config-slb-probe)# address 13.13.13.13
```

Related Commands

Command	Description
ip slb probe custom udp	Configures a custom User Datagram Protocol (UDP) probe name and enters custom UDP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

address (DNS probe)

To configure an IP address to which to send Domain Name System (DNS) probes, use the **address** command in DNS probe configuration mode. To restore the default settings, use the **no** form of this command.

address [*ip-address* [**routed**]]

no address [*ip-address* [**routed**]]

Syntax Description

ip-address	(Optional) Destination IP address that is to respond to the DNS probe.
routed	(Optional) Flags the probe as a routed probe, with the following considerations: • Only one instance of a routed probe per server farm can run at any given time. • Outbound packets for a routed probe are routed directly to the specified IP address.

Defaults

If the DNS probe is associated with a firewall farm, you must specify an IP address.
If the DNS probe is associated with a server farm, and you do not specify an IP address, the address is inherited from the server farm real servers.

Command Modes

DNS probe configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.1(12c)E	The **routed** keyword was added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a DNS probe named PROBE4, enters DNS probe configuration mode, and configures the probe to receive responses from IP address 13.13.13.13:

```
Router(config)# ip slb probe PROBE4 dns
Router(config-slb-probe)# address 13.13.13.13
```

Related Commands

Command	Description
ip slb probe dns	Configures a Domain Name System (DNS) probe name and enters DNS probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

address (HTTP probe)

To configure an IP address to which to send HTTP probes, use the **address** command in HTTP probe configuration mode. To restore the default settings, use the **no** form of this command.

address [*ip-address* [**routed**]]

no address [*ip-address* [**routed**]]

Syntax Description

ip-address	(Optional) Destination IP address that is to respond to the HTTP probe.
routed	(Optional) Flags the probe as a routed probe, with the following considerations: • Only one instance of a routed probe per server farm can run at any given time. • Outbound packets for a routed probe are routed directly to the specified IP address.

Defaults

If the HTTP probe is associated with a firewall farm, you must specify an IP address.
If the HTTP probe is associated with a server farm, and you do not specify an IP address, the address is inherited from the server farm real servers.

Command Modes

HTTP probe configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.1(12c)E	The **routed** keyword was added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures an HTTP probe named PROBE2, enters HTTP probe configuration mode, and configures the probe to receive responses from IP address 13.13.13.13:

```
Router(config)# ip slb probe PROBE2 http
Router(config-slb-probe)# address 13.13.13.13
```

Related Commands

Command	Description
ip slb probe http	Configures an HTTP probe name and enters HTTP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

address (ping probe)

To configure an IP address to which to send ping probes, use the **address** command in ping probe configuration mode. To restore the default settings, use the **no** form of this command.

address [*ip-address* [**routed**]]

no address [*ip-address* [**routed**]]

Syntax Description

ip-address	(Optional) Destination IP address that is to respond to the ping probe.
routed	(Optional) Flags the probe as a routed probe, with the following considerations: • Only one instance of a routed probe per server farm can run at any given time. • Outbound packets for a routed probe are routed directly to the specified IP address.

Defaults

If the ping probe is associated with a firewall farm, you must specify an IP address.
If the ping probe is associated with a server farm, and you do not specify an IP address, the address is inherited from the server farm real servers.

Command Modes

Ping probe configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.1(12c)E	The **routed** keyword was added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a ping probe named PROBE1, enters ping probe configuration mode, and configures the probe to receive responses from IP address 13.13.13.13:

```
Router(config)# ip slb probe PROBE1 ping
Router(config-slb-probe)# address 13.13.13.13
```

Related Commands

Command	Description
ip slb probe ping	Configures a ping probe name and enters ping probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

address (TCP probe)

To configure an IP address to which to send TCP probes, use the **address** command in TCP probe configuration mode. To restore the default settings, use the **no** form of this command.

address [*ip-address* [**routed**]]

no address [*ip-address* [**routed**]]

Syntax Description

ip-address	(Optional) Destination IP address that is to respond to the TCP probe.
routed	(Optional) Flags the probe as a routed probe, with the following considerations: • Only one instance of a routed probe per server farm can run at any given time. • Outbound packets for a routed probe are routed directly to the specified IP address.

Defaults

If the TCP probe is associated with a firewall farm, you must specify an IP address
If the TCP probe is associated with a server farm, and you do not specify an IP address, the address is inherited from the server farm real servers.

Command Modes

TCP probe configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.1(12c)E	The **routed** keyword was added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a TCP probe named PROBE5, enters TCP probe configuration mode, and configures the probe to receive responses from IP address 13.13.13.13:

```
Router(config)# ip slb probe PROBE5 tcp
Router(config-slb-probe)# address 13.13.13.13
```

Related Commands

Command	Description
ip slb probe tcp	Configures a TCP probe name and enters TCP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

address (WSP probe)

To configure an IP address to which to send Wireless Session Protocol (WSP) probes, use the **address** command in WSP probe configuration mode. To restore the default settings, use the **no** form of this command.

address [*ip-address* [**routed**]]

no address [*ip-address* [**routed**]]

Syntax Description

ip-address	(Optional) Destination IP address that is to respond to the WSP probe.
routed	(Optional) Flags the probe as a routed probe, with the following considerations: • Only one instance of a routed probe per server farm can run at any given time. • Outbound packets for a routed probe are routed directly to the specified IP address.

Defaults

If the WSP probe is associated with a firewall farm, you must specify an IP address.
If the WSP probe is associated with a server farm, and you do not specify an IP address, the address is inherited from the server farm real servers.
In dispatched mode, the *ip-address* argument value is the same as the virtual server IP address. In directed Network Address Translation (NAT) mode, an IP address is unnecessary.

Command Modes

WSP probe configuration

Command History

Release	Modification
12.1(5a)E	This command was introduced.
12.1(12c)E	The **routed** keyword was added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a WSP probe named PROBE3, enters WSP probe configuration mode, and configures the probe to receive responses from IP address 13.13.13.13:

```
Router(config)# ip slb probe PROBE3 wsp
Router(config-slb-probe)# address 13.13.13.13
```

Related Commands

Command	Description
ip slb probe wsp	Configures a Wireless Session Protocol (WSP) probe name and enters WSP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

advertise

To control the installation of a static route to the Null0 interface for a virtual server address, use the **advertise** command in SLB virtual server configuration mode. To prevent the installation of a static route for the virtual server IP address, use the **no** form of this command.

advertise [**active**]

no advertise [**active**]

Syntax Description

active	(Optional) Indicates that the host route is to be advertised only when the virtual IP address is available (that is, when there is at least one real server in OPERATIONAL, DFP_THROTTLED, or MAXCONNS state).

Defaults

The virtual server IP address is advertised. That is, a static route to the Null0 interface is installed for the virtual server IP addresses and it is added to the routing table.
If you do not specify the **active** keyword, the host route is advertised regardless of whether the virtual IP address is available.

Command Modes

SLB virtual server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(7)E	The **active** keyword was added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

Advertisement of a static route using the routing protocol requires that you configure redistribution of static routes for the routing protocol.

The **advertise** command does not affect virtual servers used for transparent web cache load balancing.

HTTP probes and route health injection require a route to the virtual server. The route is not used, but it must exist to enable the sockets code to verify that the destination can be reached, which in turn is essential for HTTP probes and route health injection to function correctly.

- For HTTP probes, the route can be either a host route (advertised by the virtual server) or a default route (specified using the **ip route 0.0.0.0 0.0.0.0** command, for example). If you specify either the **no advertise** or the **advertise active** command, you must specify a default route.
- For route health injection, the route must be a default route.

HTTP probes and route health injection can both use the same default route; you need not specify two unique default routes.

Examples

The following example prevents advertisement of the virtual server's IP address in routing protocol updates:

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# no advertise
```

Related Commands

Command	Description
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

agent

To identify a Dynamic Feedback Protocol (DFP) agent with which the IOS Server Load Balancing (IOS SLB) feature can initiate connections, use the **agent** command in SLB DFP configuration mode. To remove a DFP agent definition from the DFP configuration, use the **no** form of this command.

agent *ip-address port* [*timeout* [*retry-count* [*retry-interval*]]]

no agent *ip-address port*

Syntax Description

ip-address	Agent IP address.
port	Agent TCP or User Datagram Protocol (UDP) port number.
timeout	(Optional) Time period, in seconds, during which the DFP manager must receive an update from the DFP agent. The valid range is 0 to 65535 seconds. The default is 0 seconds, which means there is no timeout.
retry-count	(Optional) Number of times the DFP manager attempts to establish the TCP connection to the DFP agent. The valid range is 0 to 65535 times. The default is 0 retries, which means there are infinite retries.
retry-interval	(Optional) Interval, in seconds, between retries. The valid range is 1 to 65535 seconds. The default is 180 seconds.

Defaults

The default timeout is 0 seconds (no timeout).
The default retry count is 0 (infinite retries).
The default retry interval is 180 seconds.

Command Modes

SLB DFP configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

A DFP agent collects status information about the load capability of a server and reports that information to a load manager. The DFP agent may reside on the server, or it may be a separate device that collects and consolidates the information from several servers before reporting to the load manager.

The password specified in the **ip slb dfp** command for the DFP manager must match the password specified in the **password** command for the DFP agent.

You can configure up to 1024 agents.

Examples

The following example sets the DFP password to Password1 (to match the DFP agent's password), sets the timeout to 360 seconds, enters DFP configuration mode, and enables IOS SLB to connect to the DFP agent with IP address 10.1.1.1 and port number 2221:

```
Router(config)# ip slb dfp password Password1 360
Router(config-slb-dfp)# agent 10.1.1.1 2221 30 0 10
```

Related Commands

Command	Description
ip dfp agent	Identifies a Dynamic Feedback Protocol (DFP) agent subsystem and enters DFP agent configuration mode.
ip slb dfp	Configures Dynamic Feedback Protocol (DFP), supplies an optional password, and enters DFP configuration mode.

bindid

To configure a bind ID, use the **bindid** command in SLB server farm configuration mode. To remove a bind ID from the server farm configuration, use the **no** form of this command.

bindid [*bind-id*]

no bindid [*bind-id*]

Syntax Description

bind-id	(Optional) Bind ID number. The default bind ID is 0.

Defaults

The default bind ID is 0.

Command Modes

SLB server farm configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

You can configure one bind ID on each **bindid** command.

The bind ID allows a single physical server to be bound to multiple virtual servers, and to report a different weight for each one. Thus, the single real server is represented as multiple instances of itself, each having a different bind ID. Dynamic Feedback Protocol (DFP) uses the bind ID to identify for which instance of the real server a given weight is specified.

In general packet radio service (GPRS) load balancing, bind IDs are not supported. Therefore do not use the **bindid** command in a GPRS load-balancing environment.

Examples

The following example configures bind ID 309:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# bindid 309
```

Related Commands

Command	Description
ip slb dfp	Configures Dynamic Feedback Protocol (DFP), supplies an optional password, and enters DFP configuration mode.
show ip slb serverfarms	Displays information about the IOS Server Load Balancing (IOS SLB) server farms.

clear fm slb counters

To clear Feature Manager (FM) IOS Server Load Balancing (IOS SLB) counters, use the **clear fm slb counters** command in privileged EXEC mode.

clear fm slb {inband | purge} counters

Syntax Description

inband	Clears FM IOS SLB inband counters, which are tdb.
purge	Clears FM IOS SLB purge counters, which are tdb.

Defaults

FM IOS SLB counters are not cleared.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(18)SXF5	This command was introduced.

Examples

The following example clears the FM IOS SLB inband counters:

```
Router# clear fm slb inband counters
```

Related Commands

Command	Description
show fm slb counters	Displays information about the Feature Manager (FM) IOS Server Load Balancing (IOS SLB) counters.

clear ip slb connections

To clear IP IOS Server Load Balancing (IOS SLB) connections, use the **clear ip slb connections** command in privileged EXEC mode.

clear ip slb connections [**firewallfarm** *firewall-farm* | **serverfarm** *server-farm* | **vserver** *virtual-server*]

Syntax Description

firewallfarm *firewall-farm*	(Optional) Clears the IOS SLB connection database for the specified firewall farm.
serverfarm *server-farm*	(Optional) Clears the IOS SLB connection database for the specified server farm.
vserver *virtual-server*	(Optional) Clears the IOS SLB connection database for the specified virtual server.

Defaults

The IOS SLB connection database is cleared for all firewall farms, server farms, and virtual servers.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(1)E	This command was introduced as part of the **clear ip slb** command.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(11b)E	This command was separated from the **clear ip slb** command.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

In general packet radio service (GPRS) load balancing, the **clear ip slb connections** command clears connections, but does not clear sessions.

Examples

The following example clears the connection database of server farm FARM1:

```
Router# clear ip slb connections serverfarm FARM1
```

The following example clears the connection database of virtual server VSERVER1:

```
Router# clear ip slb connections vserver VSERVER1
```

Related Commands

Command	Description
show ip slb conns	Displays information about active IOS Server Load Balancing (IOS SLB) connections.
show ip slb firewallfarm	Displays information about the firewall farm configuration.
show ip slb serverfarms	Displays information about the IOS Server Load Balancing (IOS SLB) server farms.
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

clear ip slb counters

To clear the IP IOS Server Load Balancing (IOS SLB) counters, use the **clear ip slb counters** command in privileged EXEC mode.

clear ip slb counters [**kal-ap**]

Syntax Description

kal-ap	(Optional) clears only IP IOS SLB KeepAlive Application Protocol (KAL-AP) counters.

Defaults

IP IOS SLB counters are not cleared.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(1)E	This command was introduced as part of the **clear ip slb** command.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(11b)E	This command was separated from the **clear ip slb** command.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRC	The **kal-ap** keyword was added.

Examples

The following example clears the IP IOS SLB counters:

```
Router# clear ip slb counters
```

Related Commands

Command	Description
show ip slb stats	Displays IOS SLB statistics.

clear ip slb sessions

To clear the IP IOS Server Load Balancing (IOS SLB) sessions database, use the **clear ip slb sessions** command in privileged EXEC mode.

clear ip slb sessions [**firewallfarm** *firewall-farm* | **serverfarm** *server-farm* | **vserver** *virtual-server*]

Syntax Description

firewallfarm *firewall-farm*	(Optional) Clears the IOS SLB session database for the specified firewall farm.
serverfarm *server-farm*	(Optional) Clears the IOS SLB session database for the specified server farm.
vserver *virtual-server*	(Optional) Clears the IOS SLB session database for the specified virtual server.

Defaults

If no optional keywords or arguments are specified, the IOS SLB sessions database is cleared of all firewall farms, server farms, and virtual servers.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example clears the session database of server farm FARM1:

```
Router# clear ip slb sessions serverfarm FARM1
```

The following example clears the session database of virtual server VSERVER1:

```
Router# clear ip slb sessions vserver VSERVER1
```

Related Commands

Command	Description
show ip slb firewallfarm	Displays information about the IOS Server Load Balancing (IOS SLB) firewall farms.
show ip slb sessions	Displays information about sessions handled by IOS Server Load Balancing (IOS SLB).
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

clear ip slb sticky gtp imsi

To clear entries from an IOS Server Load Balancing (IOS SLB) general packet radio service (GPRS) Tunneling Protocol (GTP) International Mobile Subscriber ID (IMSI) sticky database, use the **clear ip slb sticky gtp imsi** command in privileged EXEC mode.

clear ip slb sticky gtp imsi [**id** *imsi*]

Syntax Description

id *imsi*	Clears only the entry associated with the specified IMSI from the IOS SLB GTP IMSI sticky database.

Defaults

If you enter this command without the optional IMSI ID, all entries are cleared from the IOS SLB GTP IMSI sticky database.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(18)SXE	This command was introduced.

Usage Guidelines

When you use this command to clear an entry from the IOS SLB GTP IMSI sticky database, the session is not cleared; it lingers until it times out. (The session timeout is configured by using the **idle** command in SLB virtual server configuration mode; the default timeout is 30 seconds.) If the same user tries to create a new Packet Data Protocol (PDP) context before the session times out, using the same Network Service Access Point Identifier (NSAPI) but a different access point name (APN), IOS SLB forwards the request to the old server farm, even though the new APN should lead to a different server farm. To avoid this problem, clear the session manually by using the **clear ip slb sessions** command in privileged EXEC mode.

Examples

The following example clears all entries from the IOS SLB GTP IMSI sticky database:

```
Router# clear ip slb sticky gtp imsi
```

Related Commands

Command	Description
show ip slb sticky	Displays information about the IOS Server Load Balancing (IOS SLB) sticky database.

clear ip slb sticky radius

To clear entries from a IOS Server Load Balancing (IOS SLB) RADIUS sticky database, use the **clear ip slb sticky radius** command in privileged EXEC mode.

clear ip slb sticky radius {**calling-station-id** [**id** *string*] | **framed-ip** [*framed-ip* [*netmask*]]}

Syntax Description

calling-station-id	Clears entries from the IOS SLB RADIUS calling-station-ID sticky database.
id *string*	(Optional) Calling station ID of the entry to be cleared.
framed-ip	Clears entries from the IOS SLB RADIUS framed-IP sticky database.
framed-ip	(Optional) Framed-IP address of entries to be cleared.
netmask	(Optional) Subnet mask specifying a range of entries to be cleared.

Defaults

If no optional arguments are specified, all entries are cleared from the IOS SLB RADIUS calling-station-ID sticky database or framed-IP sticky database.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(14)ZA5	The **calling-station-id** and **id** keywords and *string* argument were added.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

When you use this command to clear an entry from the IOS SLB RADIUS calling-station-ID sticky database, the session is not cleared; it lingers until it times out. (The session timeout is configured by using the **idle** command in SLB virtual server configuration mode; the default timeout is 30 seconds.) If the same user tries to create a new Packet Data Protocol (PDP) context before the session times out, using the same Network Service Access Point Identifier (NSAPI) but a different access point name (APN), IOS SLB forwards the request to the old server farm, even though the new APN should lead to a different server farm. To avoid this problem, clear the session manually by using the **clear ip slb sessions** command in privileged EXEC mode.

Examples

The following example clears all entries from the IOS SLB RADIUS framed-IP sticky database:

```
Router# clear ip slb sticky radius framed-ip
```

Related Commands

Command	Description
show ip slb sticky	Displays information about the IOS SLB sticky database.

client (virtual server)

To define which clients are allowed to use the virtual server, use the **client** command in Server Load Balancing (SLB) virtual server configuration mode. To remove a client definition from the SLB configuration, use the **no** form of this command.

client {*ip-address netmask* [**exclude**] | **gtp carrier-code** [*code*]}

no client {*ip-address netmask* [**exclude**] | **gtp carrier-code** [*code*]}

Syntax Description

ip-address	Client IP address. The default is 0.0.0.0 (all clients).
netmask	Client IP network mask. The default is 0.0.0.0 (all subnets).
exclude	(Optional) Ignores connections initiated by the client IP address from the load-balancing scheme.
gtp carrier-code	For general packet radio service (GPRS) Tunneling Protocol (GTP) cause code inspection, configures the virtual server to accept Packet Data Protocol (PDP) context creates only from the specified International Mobile Subscriber Identity (IMSI) carrier code.
code	(Optional) For GTP cause code inspection, identifies the IMSI carrier code from which this virtual server is to accept PDP context creates. The code has the format: **mcc** *mcc-code* **mnc** *mnc-code* where: • *mcc-code* is the Mobile Country Code (MCC) • *mnc-code* is the Mobile Network Code (MNC) If you do not specify a *code*, the virtual server accepts PDP context creates from any IMSI carrier code.

Defaults

The default client IP address is 0.0.0.0 (all clients).
The default client IP network mask is 0.0.0.0 (all subnets).
Taken together, the default is client 0.0.0.0 0.0.0.0 (allows all clients on all subnets to use the virtual server).
If you specify **gtp carrier-code** and you do not specify a code, the virtual server accepts PDP context creates from any IMSI carrier code.

Command Modes

SLB virtual server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(1)E	The **exclude** keyword was added.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.1(13)E3	The **gtp carrier-code** keyword and *code* argument were added.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

You can use more than one client command to define more than one client.

The *netmask* value is applied to the source IP address of incoming connections. The result must match the *ip-address* value for the client to be allowed to use the virtual server.

If you configure probes in your network, you must also do one of the following:

- Configure the **exclude** keyword on the **client** command on the virtual server to exclude connections initiated by the client IP address from the load-balancing scheme.
- Configure IP addresses on the IOS SLB device that are Layer 3-adjacent to the real servers used by the virtual server.

Configure separate **client** commands to specify the clients that can use the virtual server, and to specify the IMSI carrier code from which the virtual server is to accept PDP context creates.

Examples

The following example allows clients from only 10.4.4.0 access to the virtual server:

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# client 10.4.4.0 255.255.255.0
```

Related Commands

Command	Description
show ip slb vserver	Displays information about the virtual servers defined to IOS SLB.
virtual (virtual server)	Configures the virtual server attributes.

credentials (HTTP probe)

To configure basic authentication values for the HTTP IOS Server Load Balancing (IOS SLB) probe, use the **credentials** command in HTTP probe configuration mode. To remove a **credentials** configuration, use the **no** form of this command.

credentials *username* [*password*]

no credentials *username* [*password*]

Syntax Description

username	Authentication username of the HTTP probe header. The character string is limited to 15 characters.
password	(Optional) Authentication password of the HTTP probe header. The character string is limited to 15 characters.

Defaults

Basic authentication values for the HTTP IOS SLB probe are not configured.

Command Modes

HTTP probe configuration

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures an HTTP probe named PROBE2, enters HTTP probe configuration mode, sets the HTTP authentication to username Username1, and sets the password to develop:

```
Router(config)# ip slb probe PROBE2 http
Router(config-slb-probe)# credentials Username1 develop
```

Related Commands

Command	Description
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

debug gprs dfp

To display debugging messages for general packet radio service (GPRS) Dynamic Feedback Protocol (DFP) weight calculation, use the **debug gprs dfp** command in user EXEC or privileged EXEC mode. To disable debugging output, use the **no** form of this command.

debug gprs dfp

no debug gprs dfp

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

User EXEC or privileged EXEC

Command History

Release	Modification
12.1(9)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(4)MX	This command was incorporated in Cisco IOS Release 12.2(4)MX.
12.2(8)YD	This command was incorporated in Cisco IOS Release 12.2(8)YD.
12.2(8)B	This command was incorporated in Cisco IOS Release 12.2(8)B.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command displays debugging messages for GPRS DFP weight calculation. To display debugging messages for the DFP agent subsystem, use the **debug ip dfp agent** command.

See the following caution before using **debug** commands:

Caution Because debugging output is assigned high priority in the CPU process, it can render the system unusable. For this reason, use **debug** commands only to troubleshoot specific problems or during troubleshooting sessions with Cisco technical support staff. Moreover, it is best to use **debug** commands during periods of lower network flows and fewer users. Debugging during these periods reduces the effect these commands have on other users on the system.

Examples

The following example configures a debugging session to check all GPRS DFP weight calculation:

```
Router# debug gprs dfp
GPRS DFP debugging is on
Router#
```

The following example stops all debugging:

```
Router# no debug all
All possible debugging has been turned off
Router#
```

debug ip slb

To display debugging messages for the Cisco IOS Server Load Balancing (SLB) feature, use the **debug ip slb** command in user EXEC or privileged EXEC mode. To disable debugging output, use the **no** form of this command.

debug ip slb {**conns** [*acl-number*] | **dfp** | **firewallfarm** | **fragments** | **gtp** | **icmp** | **kal-ap** | **natpool** | **probe** | **reals** | **replication** | **route** | **sessions** [**gtp** | **ipmobile** | **radius**] | **sticky gtp imsi** | **vservers** | **all**}

no debug ip slb {**conns** [*acl-number*] | **dfp** | **firewallfarm** | **fragments** | **gtp** | **icmp** | **kal-ap** | **natpool** | **probe** | **reals** | **replication** | **route** | **sessions** [**gtp** | **ipmobile** | **radius**] | **sticky gtp imsi** | **vservers** | **all**}

Syntax Description

all	Displays all debugging messages for Cisco IOS SLB.
conns [*acl-number*]	Displays debugging messages for all connections being handled by IOS SLB, including Wireless Session Protocol (WSP) events and states. The optional *acl-number* argument references an IP access control list (ACL). This argument limits the information displayed based on the client IP address, real server IP address, or virtual server IP address: • For simple ACLs, IOS SLB checks the client IP address. • For extended ACLs, IOS SLB checks the client real and virtual IP addresses. For more information about ACLs, refer to the “Configuring IP Services” chapter of the *Cisco IOS IP Configuration Guide*, Release 12.2.
dfp	Displays debugging messages for Dynamic Feedback Protocol (DFP). • To display debugging messages for the DFP agent subsystem, use the **debug ip dfp agent** command. • To display debugging messages for the general packet radio service (GPRS) DFP weight calculation, use the **debug gprs dfp** command.
firewallfarm	Displays debugging messages related to firewall load balancing.
fragments	Displays debugging messages related to the IOS SLB fragment database.
gtp	Displays all GPRS Tunneling Protocol (GTP)-related packet handler, gateway GPRS support node (GGSN), serving GPRS support node (SGSN), and Network Service Access Point Identifier (NSAPI) debugging messages for IOS SLB.
icmp	Displays all Internet Control Message Protocol debugging messages for IOS SLB.
kal-ap	Displays all KeepAlive Application Protocol (KAL-AP) debugging messages for IOS SLB.

natpool	Displays debugging messages related to the IOS SLB client Network Address Translation (NAT) pool.
probe	Displays debugging messages related to probes.
reals	Displays debugging messages for all real servers defined to IOS SLB.
replication	Displays debugging messages related to IOS SLB stateful backup virtual server.
route	Displays debugging messages for all routing handled by the IOS SLB RADIUS framed-IP sticky database.
sessions [**gtp** | **ipmobile** | **radius**]	Displays debugging messages for all sessions being handled by IOS SLB. The optional **gtp** keyword enables users to limit the information displayed to only GTP sessions. The optional **ipmobile** keyword enables users to limit the information displayed to only Mobile IP sessions. The optional **radius** keyword enables users to limit the information displayed to only RADIUS sessions.
sticky gtp imsi	Displays all debugging messages related to the IOS SLB GTP International Mobile Subscriber ID (IMSI) sticky database.
vservers	Displays debugging messages for all virtual servers defined to IOS SLB.

Defaults

No default behavior or values.

Command Modes

User EXEC or privileged EXEC

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(2)E	The **natpool** and **replication** keywords were added.
12.1(3a)E	The **firewallfarm** keyword was added.
12.1(7)E	The **vservers** keyword was added.
12.1(9)E	The **sessions** keyword was added.
12.1(11b)E	The **route** keyword, the *acl-number* argument, and the **radius** option on the **sessions** keyword were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.1(13)E3	The **gtp** keyword and the **gtp** option on the **sessions** keyword were added.
12.2(14)ZA2	The **ipmobile** keyword was added.
12.2(18)SXE	The **sticky gtp imsi** keywords were added.

Release	Modification
12.2(33)SRC	The **kal-ap** keyword was added.

Usage Guidelines

This command displays debugging messages for IOS SLB.

See the following caution before using **debug** commands:

Caution Because debugging output is assigned high priority in the CPU process, it can render the system unusable. For this reason, use **debug** commands only to troubleshoot specific problems or during troubleshooting sessions with Cisco technical support staff. Moreover, it is best to use **debug** commands during periods of lower network flows and fewer users. Debugging during these periods reduces the effect these commands have on other users on the system.

Examples

The following example configures a debugging session to check all IP IOS SLB parameters:

```
Router# debug ip slb all

SLB All debugging is on
Router#
```

The following example stops all debugging:

```
Router# no debug all

All possible debugging has been turned off
Router#
```

The following example configures debugging to check IP IOS SLB replication used with stateful backup and displays the output from the send or transmit virtual server:

```
Router# debug ip slb replication
*Mar  2 08:02:38.019:  SLB Replicate: (send) update vs: VS1 update_count 42
```

The following example shows Cisco IOS SLB DFP debug output:

```
Router# debug ip slb dfp

SLB DFP debugging is on
router#
022048 SLB DFP Queue to main queue - type 2 for Agent 161.44.2.3458229
022048 SLB DFP              select_rc = -1   readset = 0
022048 SLB DFP       Sleeping ...
022049 SLB DFP              readset = 0
022049 SLB DFP              select_rc = -1   readset = 0
022049 SLB DFP Processing Q event for Agent 161.44.2.3458229 - OPEN
022049 SLB DFP Queue to conn_proc_q - type 2 for Agent 161.44.2.3458229
022049 SLB DFP              readset = 0
022049 SLB DFP Set SLB_DFP_SIDE_QUEUE
022049 SLB DFP Processing Conn Q event for Agent 161.44.2.3458229 - OPEN
022049 SLB DFP Open to Agent 161.44.2.3458229 succeeded, socket = 0
022049 SLB DFP Agent 161.44.2.3458229 start connect
022049 SLB DFP Connect to Agent 161.44.2.3458229 successful - socket 0

022049 SLB DFP Queue to main queue - type 6 for Agent 161.44.2.3458229
022049 SLB DFP Processing Conn Q unknown MAJOR 80
022049 SLB DFP Reset SLB_DFP_SIDE_QUEUE
022049 SLB DFP              select_rc = -1   readset = 0
```

```
022049 SLB DFP       Sleeping ...
022050 SLB DFP              readset = 1
022050 SLB DFP              select_rc = 1   readset = 1
022050 SLB DFP Agent 161.44.2.3458229 fd = 0 readset = 1
022050 SLB DFP Message length 44 from Agent 161.44.2.3458229
022050 SLB DFP Agent 161.44.2.3458229 setting Host 17.17.17.17, Bind ID 1 Weight 1
022050 SLB DFP Agent 161.44.2.3458229 setting Host 34.34.34.34, Bind ID 2 Weight 2
022050 SLB DFP Agent 161.44.2.3458229 setting Host 51.51.51.51, Bind ID 3 Weight 3
022050 SLB DFP Processing Q event for Agent 161.44.2.3458229 - WAKEUP

022050 SLB DFP              readset = 1
022050 SLB DFP              select_rc = 1   readset = 1
022050 SLB DFP Agent 161.44.2.3458229 fd = 0 readset = 1
022050 SLB DFP Message length 64 from Agent 161.44.2.3458229
022050 SLB DFP Agent 161.44.2.3458229 setting Host 17.17.17.17, Bind ID 1 Weight 1
022050 SLB DFP Agent 161.44.2.3458229 setting Host 68.68.68.68, Bind ID 4 Weight 4
022050 SLB DFP Agent 161.44.2.3458229 setting Host 85.85.85.85, Bind ID 5 Weight 5
022050 SLB DFP Agent 161.44.2.3458229 setting Host 17.17.17.17, Bind ID 111 Weight 111
022050 SLB DFP              readset = 1

022115 SLB DFP Queue to main queue - type 5 for Agent 161.44.2.3458229
022115 SLB DFP              select_rc = -1   readset = 0
022115 SLB DFP       Sleeping ...
022116 SLB DFP              readset = 1
022116 SLB DFP              select_rc = -1   readset = 0
022116 SLB DFP Processing Q event for Agent 161.44.2.3458229 - DELETE

022116 SLB DFP Queue to conn_proc_q - type 5 for Agent 161.44.2.3458229
022116 SLB DFP              readset = 1
022116 SLB DFP Set SLB_DFP_SIDE_QUEUE
022116 SLB DFP Processing Conn Q event for Agent 161.44.2.3458229 - DELETE
022116 SLB DFP Connection to Agent 161.44.2.3458229 closed
022116 SLB DFP Agent 161.44.2.3458229 deleted
022116 SLB DFP Processing Conn Q unknown MAJOR 80
022116 SLB DFP Reset SLB_DFP_SIDE_QUEUE
022116 SLB DFP Set SLB_DFP_SIDE_QUEUE
022116 SLB DFP Reset SLB_DFP_SIDE_QUEUE
```

delay (firewall farm TCP protocol)

To change the amount of time IOS Server Load Balancing (IOS SLB) maintains TCP connection context after a connection has terminated, use the **delay** command in firewall farm TCP protocol configuration mode. To restore the default delay timer, use the **no** form of this command.

delay *duration*

no delay

Syntax Description

duration	Delay timer duration in seconds. The valid range is 1 to 600 seconds. The default value is 10 seconds.

Defaults

The default duration is 10 seconds.

Command Modes

Firewall farm TCP protocol configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The delay timer allows out-of-sequence packets and final acknowledgments (ACKs) to be delivered after a TCP connection ends. Do not set this value to zero (0).

If you are configuring a delay timer for HTTP flows, choose a low number such as 5 seconds as a starting point.

Examples

The following example specifies that IOS SLB maintains TCP connection context for 30 seconds after a connection has terminated:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# protocol tcp
Router(config-slb-fw-tcp)# delay 30
```

Related Commands

Command	Description
protocol tcp	Enters firewall farm TCP protocol configuration mode.
show ip slb firewallfarm	Displays information about the firewall farm configuration.

delay (virtual server)

To change the amount of time IOS Server Load Balancing (IOS SLB) maintains TCP connection context after a connection has terminated, use the **delay** command in SLB virtual server configuration mode. To restore the default delay timer, use the **no** form of this command.

delay {*duration* | **radius framed-ip** *duration*}

no delay {*duration* | **radius framed-ip** *duration*}

Syntax Description

duration	Delay timer duration for TCP connection context, in seconds. The valid range is 1 to 600 seconds. The default value is 10 seconds.
radius framed-ip *duration*	Delay timer for RADIUS framed-ip sticky database, in seconds. The valid range is 1 to 600 seconds. The default value is 10 seconds.

Defaults

The default duration for the TCP connection context is 10 seconds.
The default duration for the RADIUS framed-ip sticky database is 10 seconds.

Command Modes

SLB virtual server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.1(18)E	The **radius** and **framed-ip** keywords and the *duration* argument were added.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

The TCP connection context delay timer allows out-of-sequence packets and final acknowledgments (ACKs) to be delivered after a TCP connection ends. Do not set this value to zero (0).

If you are configuring a TCP connection context delay timer for HTTP flows, choose a low number such as 5 seconds as a starting point.

For the Home Agent Director, the **delay** command has no meaning and is not supported.

Examples

The following example specifies that IOS SLB maintains TCP connection context for 30 seconds after a connection has terminated:

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# delay 30
```

Related Commands

Command	Description
show ip slb vservers	Displays information about the virtual servers defined to IOS SLB.
virtual	Configures the virtual server attributes.

expect

To configure a status code or regular expression to expect information from the HTTP probe, use the **expect** command in HTTP probe configuration mode. To restore the default settings, use the **no** form of this command.

expect [**status** *status-code*] [**regex** *expression*]

no expect [**status** *status-code*] [**regex** *expression*]

Syntax Description

status *status-code*	(Optional) Configures the expected HTTP status code. The valid range is 100 to 599. The default expected status code is 200.
regex *expression*	(Optional) Configures the regular expression expected in the HTTP response.

Defaults

The default expected status code is 200.
There is no default expected regular expression.

Command Modes

HTTP probe configuration

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.1(3a)E	The **regex** keyword and *expression* argument were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The **expect** command configures the expected status code or regular expression to be received from the servers. A real server is considered to have failed and is taken out of service if any of the following events occurs:

- A status number other than the expected one is received.
- The expected regular expression is not received in the first 2920 bytes of probe output. (IOS SLB searches only the first 2920 bytes for the expected status code or regular expression.)
- The server fails to respond.

For IOS SLB firewall load balancing, configure the HTTP probe to expect status code 40l.

Examples

The following example configures an HTTP probe named PROBE2, enters HTTP configuration mode, and configures the HTTP probe to expect the status code 40l and the regular expression Copyright:

```
Router(config)# ip slb probe PROBE2 http
Router(config-slb-probe)# expect status 401 regex Copyright
```

Related Commands

Command	Description
ip slb probe http	Configures an HTTP probe name and enters HTTP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

failaction (firewall farm)

To configure IOS Server Load Balancing (IOS SLB)'s behavior when a firewall fails, use the **failaction** command in firewall farm configuration mode.

failaction purge

Syntax Description

purge	Enables IOS SLB to automatically remove connections to failed firewalls from the connection database even if the idle timers have not expired.

Defaults

If you do not specify the **failaction** command, IOS SLB does not automatically remove connections to failed firewalls.

Command Modes

Firewall farm configuration

Command History

Release	Modification
12.1(9)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command is useful for applications that do not rotate the source port (such as Internet Key Exchange [IKE]), and for protocols that do not have ports to differentiate flows (such as Encapsulation Security Payload [ESP]).

Examples

In the following example, IOS SLB removes all connections to failed firewalls in firewall farm FIRE1:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# failaction purge
```

failaction (server farm)

To configure IOS Server Load Balancing (IOS SLB)'s behavior when a real server fails, use the **failaction** command in server farm configuration mode. To restore the default settings, use the **no** form of this command.

failaction {**purge** | **gtp purge** | **radius reassign**}

no failaction {**purge** | **gtp purge** | **radius reassign**}

Syntax Description

purge	Enables IOS SLB to automatically remove connections to failed real servers from the connection database even if the idle timers have not expired.
gtp purge	Enables IOS SLB to automatically remove objects associated with failed real servers from the general packet radio service (GPRS) Tunneling Protocol (GTP) International Mobile Subscriber ID (IMSI) sticky database, even if the idle timers have not expired.
radius reassign	Enables IOS SLB to automatically reassign to a new real server RADIUS sticky objects that are destined for a failed real server.

Defaults

If you do not specify the **failaction** command, IOS SLB does not automatically remove connections to failed real servers, nor objects associated with failed real servers, nor does it reassign RADIUS sticky objects.

Command Modes

Server farm configuration

Command History

Release	Modification
12.1(9)E	This command was introduced.
12.1(11b)E	The **radius reassign** keywords were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	The **gtp purge** keywords were added.

Usage Guidelines

This command is useful for applications that do not rotate the source port (such as Internet Key Exchange [IKE]), and for protocols that do not have ports to differentiate flows (such as Encapsulation Security Payload [ESP]).

You can specify **no failaction purge**, but it has no effect on the connection database.

If you specify **failaction radius reassign**, IOS SLB reassigns RADIUS sticky objects without seeing any new RADIUS messages. The assumption is that, in the event of a failure, the RADIUS proxy gateways can handle user flows without seeing the RADIUS messages. If the RADIUS proxy gateways cannot do so, do not specify the **failaction radius reassign** command.

Examples

In the following example, IOS SLB removes all connections to failed real servers in server farm PUBLIC:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# failaction purge
```

faildetect (DNS probe)

To specify the conditions that indicate a server failure, use the **faildetect** command in DNS probe configuration mode. To restore the default values that indicate a server failure, use the **no** form of this command.

faildetect *number-of-probes*

no faildetect

Syntax Description

number-of-probes	Number of consecutive unacknowledged Domain Name System (DNS) probes allowed before a real server is considered to have failed. Valid range is 1 to 65535. The default value is three (3) unacknowledged DNS probes.

Defaults

The default value is three (3) unacknowledged DNS probes.

Command Modes

DNS probe configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

In the following example the unacknowledged DNS probe threshold is set to 16:

```
Router(config)# ip slb probe PROBE4 dns
Router(config-slb-probe)# faildetect 16
```

Related Commands

Command	Description
ip slb probe dns	Configures a Domain Name System (DNS) probe name and enters DNS probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

faildetect (ping probe)

To specify the conditions that indicate a server failure, use the **faildetect** command in ping probe configuration mode. To restore the default values that indicate a server failure, use the **no** form of this command.

faildetect *number-of-pings*

no faildetect

Syntax Description

number-of-pings	Number of consecutive unacknowledged pings allowed before a real server is considered to have failed. Valid range is 1 to 65535. The default is ten (10) unacknowledged pings.

Defaults

The default value is ten (10) unacknowledged pings.

Command Modes

Ping probe configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

In the following example the unacknowledged ping threshold is set to 16:

```
Router(config)# ip slb probe PROBE1 ping
Router(config-slb-probe)# faildetect 16
```

Related Commands

Command	Description
ip slb probe ping	Configures a ping probe name and enters ping probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

faildetect inband (real server)

To enable automatic server failure detection, use the **faildetect inband** command in real server configuration mode. To disable automatic server failure detection, use the **no** form of this command.

faildetect inband

no faildetect inband

Syntax Description

This command has no arguments or keywords.

Defaults

Automatic server failure detection is enabled.

Command Modes

Real server configuration

Command History

Release	Modification
12.2(14)ZA4	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

If you have configured all-port virtual servers (that is, virtual servers that accept flows destined for all ports except GTP ports), flows can be passed to servers for which no application port exists. When the servers reject these flows, IOS SLB might fail the servers and remove them from load balancing. This situation can also occur in slow-to-respond AAA servers in RADIUS load-balancing environments. To prevent this situation, you can disable automatic server failure detection using the **no faildetect inband** command.

Note If you disable automatic server failure detection using the **no faildetect inband** command, Cisco strongly recommends that you configure one or more probes.

If you specify the **no faildetect inband** command, the **faildetect numconns** command is ignored, if specified.

Examples

In the following example, automatic server failure detection is disabled:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# real 10.10.1.1
Router(config-slb-real)# no faildetect inband
```

Related Commands

Command	Description
faildetect numconns (real server)	Specifies the conditions that indicate a real server failure.
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
shoq ip slb reals	Displays information about the real servers.
show ip slb serverfarms	Displays information about the server farm configuration.

faildetect numconns (real server)

To specify the conditions that indicate a real server failure, use the **faildetect numconns** command in SLB real server configuration mode. To restore the default values that indicate a server failure, use the **no** form of this command.

faildetect numconns *number-of-conns* [**numclients** *number-of-clients*]

no faildetect numconns *number-of-conns* [**numclients** *number-of-clients*]

Syntax Description

number-of-conns	Number of consecutive connection failures allowed before IOS Server Load Balancing (IOS SLB) fails the real server. The valid range is 1 to 255. The default value is 8.
numclients *number-of-clients*	(Optional) Number of unique client IP addresses that can experience connection failures before IOS SLB fails the real server. The valid range is 1 to 8. The default value is 2. If there is only one client in your network (for example, one serving GPRS support node [SGSN] in a general packet radio service [GPRS] load-balancing environment), then you must specify **numclients 1**. In RADIUS load balancing, for automatic session-based failure detection, specify **numclients 1**.

Defaults

If you do not specify the **faildetect numconns** command, the default value of the connection failure threshold is 8.
If you specify the **faildetect numconns** command but do not specify the **numclients** keyword, the default value of the client connection failure threshold is 2.

Command Modes

SLB real server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(9)E	This command was modified to support GPRS load balancing.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

If you specify the **no faildetect inband** command, the **faildetect numconns** command is ignored, if specified.

IOS SLB does not fail the real server until both of the following conditions are met:

- There have been *number-of-conns* consecutive connection failures.

- There have been *number-of-clients* unique client connection failures.

That is, there can be many consecutive connection failures, but until there have also been *number-of-clients* unique client connection failures, IOS SLB does not fail the real server.

Similarly, there can be many unique client connection failures, but until there have also been *number-of-conns* consecutive connection failures, IOS SLB does not fail the real server.

GPRS load balancing has the following features:

- The **numconns** keyword specifies the number of consecutive Create Packet Data Protocol (PDP) requests allowed before IOS SLB fails the gateway GPRS support node (GGSN).
- The **numclients** keyword specifies the number of unique client Create PDP request failures allowed before IOS SLB fails the GGSN.

Examples

In the following example, the **numconns** keyword is set to 10 and the **numclients** keyword is set to 3:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# real 10.10.1.1
Router(config-slb-real)# faildetect numconns 10 numclients 3
```

With those settings, IOS SLB will not fail the real server until there have been ten (10) consecutive connection failures and there have been three (3) unique client connection failures.

Related Commands

Command	Description
faildetect inband (real server)	Enables automatic server failure detection.
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
show ip slb reals	Displays information about the real servers.
show ip slb serverfarms	Displays information about the server farm configuration.

gtp notification cac

To limit the number of times IOS SLB can reassign a session to a new real server for GGSN-IOS SLB messaging, use the **gtp notification cac** command in virtual server configuration mode. To restore the default limit, use the **no** form of this command.

gtp notification cac [*reassign-count*]

no gtp notification cac

Syntax Description

reassign-count	(Optional) Number of times IOS SLB can reassign a session to a new real server. That is, the number of times that IOS SLB can reassign a rejected Create PDP Context to a new real GGSN. The valid range is 1 to 20 reassignments. The default setting is 2 reassignments (that is, the initial real server assignment and 2 additional reassignments).

Defaults

The default is 2 reassignments (that is, the initial real server assignment and 2 additional reassignments).

Command Modes

Virtual server configuration

Command History

Release	Modification
12.2(17d)SXB1	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example specifies that IOS SLB can reassign a session up to 5 times:

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# gtp notification cac 5
```

Related Commands

Command	Description
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).
virtual	Configures the virtual server attributes.

hand-off radius

To change the amount of time IOS Server Load Balancing (IOS SLB) waits for an ACCT-START message from a new Mobile IP foreign agent in the event of a foreign agent hand-off, use the **hand-off radius** command in virtual server configuration mode. To restore the default hand-off timer, use the **no** form of this command.

hand-off radius *duration*

no hand-off radius

Syntax Description

duration	Hand-off timer duration in seconds. The valid range is 1 to 43200 seconds.

Defaults

No default behavior or values

Command Modes

Virtual server configuration

Command History

Release	Modification
12.2(14)ZA2	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The hand-off radius timer is valid only for RADIUS virtual servers that have the **service radius** keywords specified on the **virtual** command.

Examples

The following example specifies that IOS SLB waits for 30 seconds after a foreign agent hand-off:

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# hand-off radius 30
```

Related Commands

Command	Description
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).
virtual	Configures the virtual server attributes.

header

To configure the basic authentication values for the HTTP probe, use the **header** command in HTTP probe configuration mode. To remove a **header** HTTP probe configuration, use the **no** form of this command.

header *field-name* [*field-value*]

no header *field-name* [*field-value*]

Syntax Description

field-name	Configures the name of the HTTP probe header. The character string is limited to 15 characters.
field-value	(Optional) Configures the value of the HTTP probe header.

Defaults

The following headers are inserted in the request by default:

Accept: */*
Connection: close
User-Agent: cisco-slb-probe/1.0
Host: *virtual IP address*

Command Modes

HTTP probe configuration

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The **header** command in HTTP probe configuration mode configures the name and value parameters of the header.

Note The colon (:) separating the field name and field value is automatically inserted if not provided. Multiple headers with the same name are not supported.

Examples

The following example configures an HTTP probe named PROBE2, enters HTTP configuration mode, and configures the HTTP probe header name as HeaderName and value as HeaderValue:

```
Router(config)# ip slb probe PROBE2 http
Router(config-slb-probe)# header HeaderName HeaderValue
```

Related Commands

Command	Description
ip slb probe http	Configures an HTTP probe name and enters HTTP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

idle (firewall farm datagram protocol)

To specify the minimum time IOS Server Load Balancing (IOS SLB) maintains connection information in the absence of packet activity, use the **idle** command in firewall farm datagram protocol configuration mode. To restore the default idle duration value, use the **no** form of this command.

idle *duration*

no idle

Syntax Description

duration	Idle connection timer duration in seconds. Valid values range from 10 to 65535 seconds. The default is 3600 seconds (1 hour).

Defaults

The default idle duration is 3600 seconds.

Command Modes

Firewall farm datagram protocol configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example instructs IOS SLB to maintain connection information for an idle connection for 120 seconds:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# protocol datagram
Router(config-slb-fw-udp)# idle 120
```

Related Commands

Command	Description
protocol datagram	Enters firewall farm datagram protocol configuration mode.
show ip slb firewallfarm	Displays information about the firewall farm configuration.

idle (firewall farm TCP protocol)

To specify the minimum time IOS Server Load Balancing (IOS SLB) maintains connection information in the absence of packet activity, use the **idle** command in firewall farm TCP protocol configuration mode. To restore the default idle duration value, use the **no** form of this command.

idle *duration*

no idle

Syntax Description

duration	Idle connection timer duration in seconds. Valid values range from 10 to 65535 seconds. The default is 3600 seconds (1 hour).

Defaults

The default idle duration is 3600 seconds.

Command Modes

Firewall farm TCP protocol configuration (config-slb-fw-tcp)

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

If a client sends a TCP packet that is not a sequence number (SYN) or reset (RST) packet, and IOS SLB does not have a TCP connection object in its table (possibly due to expiration of the idle timer), IOS SLB sends a TCP RST to the client.

If you are configuring an idle timer for HTTP flows, choose a low number such as 120 seconds as a starting point. A low number ensures that the IOS SLB connection database maintains a manageable size if problems at the server, client, or network result in a large number of connections. However, do not choose a value under 60 seconds; such a low value can reduce the efficiency of IOS SLB.

Examples

The following example instructs IOS SLB to maintain connection information for an idle connection for 120 seconds:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# protocol tcp
Router(config-slb-fw-tcp)# idle 120
```

Related Commands

Command	Description
protocol tcp	Enters firewall farm TCP protocol configuration mode.
show ip slb firewallfarm	Displays information about the firewall farm configuration.

idle (virtual server)

To specify the minimum time the IOS Server Load Balancing (IOS SLB) maintains connection information in the absence of packet activity, use the **idle** command in SLB virtual server configuration mode. To restore the default idle duration value, use the **no** form of this command.

idle [**asn request** *duration* | **asn msid** *msid* | **gtp imsi** *duration* [**query** [*max-queries*]] | **gtp request** *duration* | **ipmobile request** *duration* | **radius** {**request** | **framed-ip**} *duration*]

no idle [**asn request** *duration* | **asn msid** *msid* | **gtp imsi** *duration* [**query** [*max-queries*]] | **gtp request** *duration* | **ipmobile request** *duration* | **radius** {**request** | **framed-ip**} *duration*]

Syntax Description

asn request	(Optional) For load balancing across a set of Access Service Network (ASN) gateways, configures the duration for which IOS SLB keeps the session object. If a Mobile Station (MS) Pre-Attachment Ack is received before the timer expires, IOS SLB resets the timer.
duration	Idle connection timer duration in seconds. Valid values range from 4 to 65535 seconds. For GTP IMSI, you can specify 0 to disable the timer and prevent GTP IMSI sticky database objects from timing out. The default values are: • 60 seconds in ASN load balancing. • 60 seconds for objects in the ASN MSID sticky database. • 0 seconds for objects in the GTP IMSI sticky database. • 10 seconds in the Home Agent Director. • 30 seconds in GPRS load balancing. • 30 seconds for RADIUS entries in the IOS SLB session database. • 7200 seconds for entries in the IOS SLB RADIUS framed-IP sticky database. • 3600 seconds (1 hour) in all other environments.
asn msid	(Optional) For load balancing across a set of ASN gateways, configures the duration for objects in the ASN Mobile Station ID (MSID) sticky database.
gtp imsi	(Optional) For general packet radio service (GPRS) Tunneling Protocol (GTP) cause code inspection, configures the duration for objects in the GTP International Mobile Subscriber ID (IMSI) sticky database.
query	(Optional) Query the Cisco gateway GPRS support node (GGSN) before deleting any GTP IMSI sticky objects. The default is not to query the GGSN.
max-queries	(Optional) Maximum number of queries to send when there is no response from the GGSN. Valid range is 1 to 10 queries. The default value is 5 queries.

gtp request	(Optional) For general packet radio service (GPRS) Tunneling Protocol (GTP) cause code inspection, configures the duration for Packet Data Protocol (PDP) context create, update, or delete request messages to a real gateway GPRS support node (GGSN) to go unanswered, before IOS SLB cleans up the session object.
ipmobile request	(Optional) For Home Agent Director, configures the duration for IOS SLB to wait for a Mobile IP Registration Request (RRQ), before IOS SLB cleans up the session object.
radius request	(Optional) Configures the duration for RADIUS entries in the IOS SLB session database.
radius framed-ip	(Optional) Configures the duration for entries in the IOS SLB RADIUS framed-IP sticky database.

Defaults

The default idle duration is:

- 60 seconds in ASN load balancing.
- 60 seconds for objects in the ASN MSID sticky database.
- 0 seconds for objects in the GTP IMSI sticky database.
- 10 seconds in the Home Agent Director
- 30 seconds in GPRS load balancing
- 30 seconds for RADIUS entries in the IOS SLB session database
- 7200 seconds for entries in the IOS SLB RADIUS framed-IP sticky database
- 3600 seconds (1 hour) in all other environments

The default setting for the **query** keyword is no queries.

The default setting for the *max-queries* argument is 5 queries.

Command Modes

SLB virtual server configuration (config-slb-vserver)

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(9)E	This command was modified to support GPRS load balancing.
12.1(11b)E	This command was modified to support RADIUS load balancing.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.1(13)E3	The **gtp request** keywords were added.
12.2(14)ZA2	The **ipmobile request** keywords were added.
12.2(18)SXE	The **gtp imsi** keywords were added.
12.2(18)SXF	The **query** keyword and *max-queries* argument were added.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRC1	The **asn request** option was added.

Release	Modification
12.2(33)SRE	The **asn msid** option was added.

Usage Guidelines

If a client sends a TCP packet that is not a sequence number (SYN) or reset (RST) packet, and IOS SLB does not have a TCP connection object in its table (possibly due to expiration of the idle timer), IOS SLB sends a TCP RST to the client.

If you are configuring an idle timer for HTTP flows, choose a low number such as 120 seconds as a starting point. A low number ensures that the IOS SLB connection database maintains a manageable size if problems at the server, client, or network result in a large number of connections. However, do not choose a value under 60 seconds (except in GPRS load balancing); such a low value can reduce the efficiency of the IOS SLB feature.

In most environments, the idle timer times out data paths. However, in GPRS load balancing, it times out the session context for signaling paths (not data paths).

In GPRS load balancing without GTP cause code inspection enabled, you must specify an idle timer greater than the longest possible interval between PDP context requests on the serving GPRS support node (SGSN). The longest interval can be expressed using the following algorithm:

Longest interval = T3 x 2(N3-2)

where T3 is the SGSN’s T3-RESPONSE counter value and N3 is the SGSN’s N3-REQUESTS counter value.

For example, if the T3-RESPONSE counter value is 3 and the N3-REQUESTS counter value is 6, then:

Longest interval = 3 x 2(6-2) = 3 x 2(4) = 3 x 16 = 48 seconds

Given those values, you must specify an idle timer of at least 49 seconds.

Examples

The following example instructs IOS SLB to maintain sticky objects in the GTP IMSI sticky database for 120 seconds:

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# idle gtp imsi 120
```

Related Commands

Command	Description
show ip slb vservers	Displays information about the virtual servers defined to IOS SLB.
virtual	Configures the virtual server attributes.

inservice (firewall farm real server)

To enable the firewall for use by IOS Server Load Balancing (IOS SLB), use the **inservice** command in firewall farm real server configuration mode. To remove the firewall from service, use the **no** form of this command.

inservice

no inservice

Syntax Description

This command has no arguments or keywords.

Defaults

The firewall is defined to IOS SLB but is not used.

Command Modes

Firewall farm real server configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

IOS SLB firewall load balancing uses probes to detect failures. Therefore, if you have not configured a probe, the firewall is not placed in service.

When you use the **no** form of this command to remove a firewall from service, the firewall acquiesces gracefully. No new connections are assigned, and existing connections are allowed to complete.

Examples

In the following example, the firewall is enabled for use by the IOS SLB feature:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# real 10.10.1.1
Router(config-slb-fw-real)# inservice
```

Related Commands

Command	Description
real (firewall farm)	Identifies a firewall by IP address as a member of a firewall farm and enters real server configuration mode.
show ip slb firewallfarm	Displays information about the firewall farm configuration.
show ip slb reals	Displays information about the real servers.

inservice (firewall farm)

To enable the firewall farm for use by IOS Server Load Balancing (IOS SLB), use the **inservice** command in firewall farm configuration mode. To remove the firewall farm from service, use the **no** form of this command.

inservice [**standby** *group-name*]

no inservice [**standby** *group-name*]

Syntax Description

standby	(Optional) Configures the Hot Standby Router Protocol (HSRP) standby firewall farm for use with stateless and stateful backup.
group-name	(Optional) HSRP group name with which the IOS SLB firewall farm is associated.

Defaults

The firewall farm is defined to IOS SLB but is not used.

Command Modes

Firewall farm configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

When you use the **no** form of this command to remove a firewall farm from service, the firewall farm acquiesces gracefully. No new connections are assigned, and existing connections are allowed to complete.

Examples

In the following example, the firewall farm is enabled for use by the IOS SLB feature:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# inservice
```

Related Commands

Command	Description
ip slb firewallfarm	Identifies a firewall by IP address farm and enters firewall farm configuration mode.
show ip slb firewallfarm	Displays information about the firewall farm configuration.

inservice (server farm real server)

To enable the real server for use by IOS Server Load Balancing (IOS SLB), use the **inservice** command in SLB server farm real server configuration mode. To remove the real server from service, use the **no** form of this command.

inservice

no inservice

Syntax Description

This command has no arguments or keywords.

Defaults

The real server is defined to IOS SLB but is not used.

Command Modes

SLB server farm real server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

In the following example, the real server is enabled for use by the IOS SLB feature:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# real 10.10.1.1
Router(config-slb-sfarm-real)# inservice
```

Related Commands

Command	Description
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
show ip slb reals	Displays information about the real servers.
show ip slb serverfarms	Displays information about the server farm configuration.

inservice (server farm virtual server)

To enable the virtual server for use by IOS Server Load Balancing (IOS SLB), use the **inservice** command in SLB server farm virtual server configuration mode. To remove the virtual server from service, use the **no** form of this command.

inservice [**standby** *group-name*]

no inservice [**standby** *group-name*]

Syntax Description

standby	(Optional) Configures the Hot Standby Router Protocol (HSRP) standby virtual server for use with stateless and stateful backup.
group-name	(Optional) HSRP group name with which the IOS SLB virtual server is associated.

Defaults

The virtual server is defined to IOS SLB but is not used.

Command Modes

SLB server farm virtual server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(1)E	The **standby** keyword and *group-name* argument were added.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

When you use the **no** form of this command to remove a virtual server from service, the virtual server acquiesces gracefully. No new connections are assigned, and existing connections are allowed to complete.

Examples

In the following example, the virtual server is enabled for use by the IOS SLB feature:

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# inservice
```

Related Commands

Command	Description
show ip slb vservers	Displays information about the virtual servers.
virtual	Configures the virtual server attributes.

interval (custom UDP probe)

To configure a custom User Datagram Protocol (UDP) probe interval, use the **interval** command in custom UDP probe configuration mode. To remove a custom UDP probe **interval** configuration, use the **no** form of this command.

interval *seconds*

no interval *seconds*

Syntax Description

seconds	Number of seconds to wait before reattempting the probe. Valid values range from 1 to 65535 seconds. The default interval is 10 seconds.

Defaults

The default custom UDP probe interval value is 10 seconds.

Command Modes

Custom UDP probe configuration

Command History

Release	Modification
12.1(13)E3	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a custom UDP probe named PROBE6, enters custom UDP configuration mode, and configures the custom UDP probe timer interval to send every 11 seconds:

```
Router(config)# ip slb probe PROBE6 custom udp
Router(config-slb-probe)# interval 11
```

Related Commands

Command	Description
ip slb probe custom udp	Configures a custom User Datagram Protocol (UDP) probe name and enters custom UDP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

interval (DNS probe)

To configure a DNS probe interval, use the **interval** command in Domain Name System (DNS) probe configuration mode. To remove a DNS probe **interval** configuration, use the **no** form of this command.

interval *seconds*

no interval *seconds*

Syntax Description

seconds	Number of seconds to wait before reattempting the probe. Valid values range from 1 to 65535 seconds. The default interval is 10 seconds.

Defaults

The default DNS probe interval value is 10 seconds.

Command Modes

DNS probe configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a DNS probe named PROBE4, enters DNS configuration mode, and configures the DNS probe timer interval to send every 11 seconds:

```
Router(config)# ip slb probe PROBE4 dns
Router(config-slb-probe)# interval 11
```

Related Commands

Command	Description
ip slb probe dns	Configures a Domain Name System (DNS) probe name and enters DNS probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

interval (HTTP probe)

To configure an HTTP probe interval, use the **interval** command in HTTP probe configuration mode. To remove an HTTP probe **interval** configuration, use the **no** form of this command.

interval *seconds*

no interval *seconds*

Syntax Description

seconds	Number of seconds to wait before reattempting the probe. Valid values range from 1 to 65535 seconds. The default interval is 8 seconds.

Defaults

The default HTTP probe interval value is 8 seconds.

Command Modes

HTTP probe configuration

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures an HTTP probe named PROBE2, enters HTTP configuration mode, and configures the HTTP probe timer interval to send every 11 seconds:

```
Router(config)# ip slb probe PROBE2 http
Router(config-slb-probe)# interval 11
```

Related Commands

Command	Description
ip slb probe http	Configures an HTTP probe name and enters HTTP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

interval (ping probe)

To configure a ping probe interval, use the **interval** command in ping probe configuration mode. To remove a ping probe **interval** configuration, use the **no** form of this command.

interval *seconds*

no interval *seconds*

Syntax Description

seconds	Number of seconds to wait before reattempting the probe. Valid values range from 1 to 65535 seconds. The default interval is 1 second.

Defaults

The default ping probe interval value is 1 second.

Command Modes

Ping probe configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a ping probe named PROBE1, enters ping configuration mode, and configures the ping probe timer interval to send every 11 seconds:

```
Router(config)# ip slb probe PROBE1 ping
Router(config-slb-probe)# interval 11
```

Related Commands

Command	Description
ip slb probe ping	Configures a ping probe name and enters ping probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

interval (TCP probe)

To configure a TCP probe interval, use the **interval** command in TCP probe configuration mode. To remove a TCP probe **interval** configuration, use the **no** form of this command.

interval *seconds*

no interval *seconds*

Syntax Description

seconds	Number of seconds to wait before reattempting the probe. Valid values range from 1 to 65535 seconds. The default interval is 10 seconds.

Defaults

The default TCP probe interval value is 10 seconds.

Command Modes

TCP probe configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a TCP probe named PROBE5, enters TCP configuration mode, and configures the TCP probe timer interval to send every 11 seconds:

```
Router(config)# ip slb probe PROBE5 tcp
Router(config-slb-probe)# interval 11
```

Related Commands

Command	Description
ip slb probe tcp	Configures a TCP probe name and enters TCP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

interval (WSP probe)

To configure a Wireless Session Protocol (WSP) probe interval, use the **interval** command in WSP probe configuration mode. To remove a WSP probe **interval** configuration, use the **no** form of this command.

interval *seconds*

no interval *seconds*

Syntax Description

seconds	Number of seconds to wait before reattempting the probe. Valid values range from 1 to 65535 seconds. The default interval is 8 seconds.

Defaults

The default WSP probe interval value is 8 seconds.

Command Modes

WSP probe configuration

Command History

Release	Modification
12.1(5a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a ping probe named PROBE3, enters WSP probe configuration mode, and configures the WSP probe timer interval to send every 11 seconds:

```
Router(config)# ip slb probe PROBE3 wsp
Router(config-slb-probe)# interval 11
```

Related Commands

Command	Description
ip slb probe wsp	Configures a Wireless Session Protocol (WSP) probe name and enters WSP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

ip slb dfp

To configure Dynamic Feedback Protocol (DFP), supply an optional password, and enter DFP configuration mode, use the **ip slb dfp** command in global configuration mode. To remove the DFP configuration, use the **no** form of this command.

ip slb dfp [**password** [*encrypt*] *secret-string* [*timeout*]]

no ip slb dfp

Syntax Description

password	(Optional) Password for Message Digest Algorithm Version 5 (MD5) authentication.
encrypt	(Optional) Indicates how the *secret-string* is represented when the configuration is displayed (for example, **show run**), or how it is written to nonvolatile memory (for example, **write memory**). The possible values are **0** and **7**: • **0**—The *secret-string* is stored in plain text. This is the default setting. • **7**—The *secret-string* is encrypted before it is displayed or written to nonvolatile memory. **Note** If your router is configured to encrypt all passwords, then the password is represented as 7 followed by the encrypted text. See the Cisco IOS **service** command for more details.
secret-string	(Optional) 1- to 64-character clear password value for MD5 authentication. All characters are valid; case is significant. This password must match the password configured on the host agent. The *secret-string* is always sent in plain text when the configuration is downloaded. The *secret-string* must match the secret that is specified on the RADIUS client (for example, the gateway general packet radio service [GPRS] support node [GGSN]).
timeout	(Optional) Delay period, in seconds, during which both the old password and the new password are accepted. The valid range is 0 to 65535 seconds. The default value is 180 seconds, if a password is specified.

Defaults

The default password encryption is 0 (unencrypted).
The default password timeout is 180 seconds, if a password is specified.

Command Modes

Global configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.

Release	Modification
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(3a)E	The **0** and **7** keywords were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The password specified in the **ip slb dfp** command for the DFP manager must match the password specified in the **password** command for the DFP agent.

The timeout option allows you to change the password without stopping messages between the DFP agent and its manager. The default value is 180 seconds.

During the timeout, the agent sends packets with the old password (or null, if there is no old password), and receives packets with either the old or new password. After the timeout expires, the agent sends and receives packets only with the new password; received packets that use the old password are discarded.

If you are changing the password for an entire load-balanced environment, set a longer timeout to allow enough time for you to update the password on all agents and servers before the timeout expires. Setting a longer timeout also prevents mismatches between agents and servers that have begun running the new password and agents, and servers on which you have not yet changed the old password.

If you are running IOS SLB as a DFP manager, and you specify a password on the **ip slb dfp** command, the password must match the one specified on the **password** command in DFP agent configuration mode in the DFP agent.

Examples

The following example configures DFP, sets the DFP password to Password1 and the timeout to 360 seconds, and enters DFP configuration mode:

```
Router(config)# ip slb dfp password Password1 360
Router(config-slb-dfp)#
```

Related Commands

Command	Description
agent	Identifies a Dynamic Feedback Protocol (DFP) agent to which IOS Server Load Balancing (IOS SLB) can connect.
ip dfp agent	Identifies a Dynamic Feedback Protocol (DFP) agent subsystem and enters DFP agent configuration mode.

ip slb entries

To configure an initial allocation and a maximum value for IOS Server Load Balancing (IOS SLB) database entries, use the **ip slb entries** command in global configuration mode. To restore the default values, use the **no** form of this command.

ip slb entries [**conn** [*init-conn* [*max-conn*]] | **frag** [*init-frag* [*max-frag*] | **lifetime** *timeout*] | **gtp** {**gsn** *init-gsn* [*max-gsn*] | **nsapi** *init-nsapi* [*max-nsapi*]} | **sticky** [*init-sticky* [*max-sticky*]]]

no ip slb entries [**conn** | **frag** [**lifetime**] | **gtp** {**gsn** | **nsapi**} | **sticky**]

Syntax Description

conn	(Optional) Configures an initial allocation and a maximum value for IOS SLB connection database entries.
init-conn	(Optional) Initial allocation of connection database entries. When the number of available entries is reduced to less than half of the *init-conn* argument, IOS SLB begins allocating additional entries. The number of entries can grow dynamically up to the number specified by the *max-conn* argument. Valid range is 1 to 1000000 connection database entries. The default is 8000 connection database entries. **Note** Be careful when setting the *init-conn* argument to a very high value, such as 1000000, because IOS SLB immediately allocates those entries, which can cause the router or switch to pause indefinitely. Start with a lower value, such as 125000.
max-conn	(Optional) Maximum number of connection database entries that can be allocated. Valid range is 1 to 8000000 connection database entries. The default is 8000000 connection database entries.
frag	(Optional) Configures an initial allocation and a maximum value for IOS SLB fragment database entries.
init-frag	(Optional) Initial allocation of routing entries in the fragment database. When the number of available entries is reduced to less than half of the *init-frag* argument, IOS SLB begins allocating additional entries. The number of entries can grow dynamically up to the number specified by the *max-frag* argument. Valid range is 1 to 1000000 connection database entries. The default is 2000 connection database entries. **Note** Be careful when setting the *init-frag* argument to a very high value, such as 1000000, because IOS SLB immediately allocates those entries, which can cause the router or switch to pause indefinitely. Start with a lower value, such as 125000.
max-frag	(Optional) Maximum number of fragment database entries that can be allocated. Valid range is 1 to 8000000 fragment database entries. The default is 32000 fragment database entries.

lifetime *timeout*	(Optional) Lifetime of an entry in the IOS SLB fragment database, in seconds. Valid range is 1 to 255 seconds. The default value is 10 seconds.
gtp	(Optional) Configures an initial allocation and a maximum value for IOS SLB general packet radio service (GPRS) Tunneling Protocol (GTP) database entries.
gsn	(Optional) Configures an initial allocation and a maximum value for IOS SLB GPRS support node (GSN) database entries.
init-gsn	(Optional) Initial allocation of GSN database entries. When the number of available entries is reduced to less than half of the *init-gsn* argument, IOS SLB begins allocating additional entries. The number of entries can grow dynamically up to the number specified by the *max-gsn* argument. Valid range is 1 to 5000 GSN database entries. The default is 200 GSN database entries. **Note** Be careful when setting the *init-gsn* argument to a very high value, such as 5000, because IOS SLB immediately allocates those entries, which can cause the router or switch to pause indefinitely. Start with a lower value, such as 500.
max-gsn	(Optional) Maximum number of GSN database entries that can be allocated. Valid range is 1 to 20000 GSN database entries. The default is 20000 GSN database entries.
nsapi	(Optional) Configures an initial allocation and a maximum value for IOS SLB Network Service Access Point Identifier (NSAPI) database entries.
init-nsapi	(Optional) Initial allocation of NSAPI database entries. When the number of available entries is reduced to less than half of the *init-nsapi* argument, IOS SLB begins allocating additional entries. The number of entries can grow dynamically up to the number specified by the *max-nsapi* argument. Valid range is 1 to 1000000 NSAPI database entries. The default is 8000 NSAPI database entries. **Note** Be careful when setting the *init-nsapi* argument to a very high value, such as 1000000, because IOS SLB immediately allocates those entries, which can cause the router or switch to pause indefinitely. Start with a lower value, such as 125000.
max-nsapi	(Optional) Maximum number of NSAPI database entries that can be allocated. Valid range is 1 to 8000000 NSAPI database entries. The default is 8000000 NSAPI database entries.
sticky	(Optional) Configures an initial allocation and a maximum value for IOS SLB sticky connection database entries.

init-sticky	(Optional) Initial allocation of sticky database entries. When the number of available entries is reduced to less than half of the *init-sticky* argument, IOS SLB begins allocating additional entries. The number of entries can grow dynamically up to the number specified by the *max-sticky* argument. Valid range is 1 to 1000000 sticky database entries. The default is 4000 sticky database entries. **Note** Be careful when setting the *init-sticky* argument to a very high value, such as 1000000, because IOS SLB immediately allocates those entries, which can cause the router or switch to pause indefinitely. Start with a lower value, such as 125000.
max-sticky	(Optional) Maximum number of sticky database entries that can be allocated. Valid range is 1 to 8000000 sticky database entries. The default is 8000000 sticky database entries.

Defaults

For the connection database, the default initial allocation is 8000 connections, and the default maximum is 8000000 connections.
For the fragment database, the default initial allocation is 2000 fragments, and the default maximum is 8000000 fragments. The default lifetime is 10 seconds.
For the GSN database, the default initial allocation is 200 GSNs, and the default maximum is 20000 GSNs.
For the NSAPI database, the default initial allocation is 8000 NSAPIs, and the default maximum is 8000000 NSAPIs.
For the sticky connection database, the default initial allocation is 4000 sticky connections, and the default maximum is 3200 sticky connections.

Command Modes

Global configuration

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.1(11b)E	The **lifetime** keyword and *timeout* argument were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.1(13)E3	The **gsn**, **gtp**, and **nsapi** keywords and *init-gsn*, *init-nsapi*, *max-gsn*, and *max-nsapi* arguments were added.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

If you configure an initial allocation value that exceeds the amount of available memory, memory might not be available for other features. In extreme cases, the router or switch might not boot properly. Therefore, be careful when you configure initial allocation values.

Examples

The following example configures an initial allocation of 128,000 connections, which can grow dynamically to a limit of 512,000 connections:

```
Router(config)# ip slb entries conn 128000 512000
```

Related Commands

Command	Description
show ip slb conns	Displays all connections handled by IOS SLB, or, optionally, only those connections associated with a particular virtual server or client.

ip slb firewallfarm

To identify a firewall farm and enter firewall farm configuration mode, use the **ip slb firewallfarm** command in global configuration mode. To remove the firewall farm from the IOS Server Load Balancing (IOS SLB) configuration, use the **no** form of this command.

ip slb firewallfarm *firewall-farm*

no ip slb firewallfarm *firewall-farm*

Syntax Description

firewall-farm	Character string used to identify the firewall farm. The character string is limited to 15 characters.

Defaults

No default behavior or values

Command Modes

Global configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

Grouping real servers into firewall farms is an essential part of IOS SLB firewall load balancing. Using firewall farms enables IOS SLB to assign new connections to the real servers based on their weighted capacities, and on the load-balancing algorithms used.

Examples

The following example identifies a firewall farm named FIRE1:

```
Router(config)# ip slb firewallfarm FIRE1
```

Related Commands

Command	Description
real (firewall farm)	Identifies a firewall by IP address as a member of a firewall farm and enters real server configuration mode.

ip slb maxbuffers frag

To configure the maximum number of buffers for the IOS Server Load Balancing (IOS SLB) fragment database, use the **ip slb maxbuffers frag** command in global configuration mode. To restore the default setting, use the **no** form of this command.

ip slb maxbuffers frag *buffers*

no ip slb maxbuffers frag

Syntax Description

buffers	Maximum number of out-of-order trailing fragments to be buffered simultaneously in the IOS SLB fragment database, waiting for the leader fragment. This value can help prevent IOS SLB memory from being overrun in the event of a fragment attack. Valid range is 0 to 65535 buffers. The default value is 100 buffers.

Defaults

The default maximum is 100 buffers.

Command Modes

Global configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example sets the maximum number of buffers for the IOS SLB fragment buffer to 300:

```
Router(config)# ip slb maxbuffers frag 300
```

ip slb natpool

To configure an IOS Server Load Balancing (IOS SLB) Network Address Translation (NAT) to create at least one client address pool, use the **ip slb natpool** command in global configuration mode. To remove an **ip slb natpool** configuration, use the **no** form of this command.

ip slb natpool *pool start-ip end-ip* [**netmask** *netmask* | **prefix-length** *leading-1-bits*] [**entries** *init-address* [*max-address*]]

no ip slb natpool *pool*

Syntax Description

pool	Character string used to identify this client address pool. The character string is limited to 15 characters.
start-ip	Starting IP address that defines the range of addresses in the address pool.
end-ip	Ending IP address that defines the range of addresses in the address pool.
netmask *netmask*	(Optional) Configures the mask for the associated IP subnet. Specifies the netmask of the network to which the pool addresses belong.
prefix-length *leading-1-bits*	(Optional) Specifies how many bits of the netmask are ones (that is, how many bits of the address indicate the network).
entries	(Optional) Configures an initial allocation and optional maximum value for IOS SLB client NAT address entries for the *pool* argument.
init-address	(Optional) Initial allocation of client NAT address entries. The number of client NAT address entries can grow dynamically: When the number of available client NAT address entries is less than half of the *init-address* argument, IOS SLB allocates additional client NAT address entries. Valid range is 1 to 1000000 client NAT address entries. The default is 8000 client NAT address entries.
max-address	(Optional) Maximum number of client NAT address entries that can be allocated. Valid range is 1 to 8000000 client NAT address entries. The default is the maximum number of ports that can be allocated within the IP address range specified for *pool*. For example, the following command: **ip slb natpool 3.3.3.1 3.3.3.5 prefix-length 24 entries 8000** has a default *max-address* of (3.3.3.1-3.3.3.5)*54535, or 4*54535, or 218140.

Defaults

The default initial allocation is 8000 client NAT address entries.
The default maximum number of client NAT address entries that can be allocated is the maximum number of ports that can be allocated within the IP address range.

Command Modes

Global configuration

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

If you want to use client NAT, you must create at least one client address pool.

The range of IP addresses in the address pool, configured with the *start-ip* and *end-ip* arguments, must not overlap the IP address for a VLAN as specified on the **ip address** interface configuration command.

Examples

The following example configures an IOS SLB NAT server farm pool of addresses with the name web-clients, the IP address range from 128.3.0.1 to 128.3.0.254, and a subnet mask of 255.255.0.0:

```
Router(config)# ip slb natpool web-clients 128.3.0.1 128.3.0.254 netmask
255.255.0.0
```

Related Commands

Command	Description
show ip slb natpool	Displays information about the IOS Server Load Balancing (IOS SLB) Network Address Translation (NAT) configuration.
show ip slb serverfarms	Displays information about the server farm configuration.

ip slb probe custom udp

To configure a custom User Datagram Protocol (UDP) probe name and enter custom UDP probe configuration mode, use the **ip slb probe custom udp** command in global configuration mode. To remove an **ip slb probe custom udp** configuration, use the **no** form of this command.

ip slb probe *probe* **custom udp**

no ip slb probe *probe*

Syntax Description

probe	Name of the custom UDP probe. The character string is limited to 15 characters.

Defaults

No custom UDP probe is configured.

Command Modes

Global configuration

Command History

Release	Modification
12.1(13)E3	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command configures the custom UDP probe name and application protocol and enters custom UDP configuration mode.

The custom UDP probe cannot be unconfigured while it is being used by the server farm or firewall farm.

You can configure more than one probe, in any combination of supported types, for each server farm or for each firewall in a firewall farm.

Examples

The following example configures an IOS Server Load Balancing (IOS SLB) probe named PROBE6, then enters custom UDP probe configuration mode:

```
Router(config)# ip slb probe PROBE6 custom udp
```

Related Commands

Command	Description
address (custom UDP probe)	Configures an IP address to which to send custom User Datagram Protocol (UDP) probes.
interval (custom UDP probe)	Configures a custom User Datagram Protocol (UDP) probe interval.
port (custom UDP probe)	Specifies the port to which a custom User Datagram Protocol (UDP) probe is to connect.
request (custom UDP probe)	Defines the payload of the User Datagram Protocol (UDP) request packet to be sent by a custom UDP probe.
response	Defines the data string to match against custom User Datagram Protocol (UDP) probe response packets.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

ip slb probe dns

To configure a Domain Name System (DNS) probe name and enter DNS probe configuration mode, use the **ip slb probe dns** command in global configuration mode. To remove an **ip slb probe dns** configuration, use the **no** form of this command.

ip slb probe *probe* **dns**

no ip slb probe *probe*

Syntax Description

probe	Name of the DNS probe. The character string is limited to 15 characters.

Defaults

No DNS probe is configured.

Command Modes

Global configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

DNS probes send domain name resolve requests to real servers and verify the returned IP addresses.

This command configures the DNS probe name and application protocol and enters DNS configuration mode.

The DNS probe cannot be unconfigured while it is being used by the server farm or firewall farm.

You can configure more than one probe, in any combination of supported types, for each server farm or for each firewall in a firewall farm.

Examples

The following example configures an IOS Server Load Balancing (IOS SLB) probe named PROBE4, then enters DNS probe configuration mode:

```
Router(config)# ip slb probe PROBE4 dns
```

Related Commands

Command	Description
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

ip slb probe http

To configure an HTTP probe name and enter HTTP probe configuration mode, use the **ip slb probe http** command in global configuration mode. To remove an **ip slb probe http** configuration, use the **no** form of this command.

ip slb probe *probe* **http**

no ip slb probe *probe*

Syntax Description

probe	Name of the HTTP probe. The character string is limited to 15 characters.

Defaults

No HTTP probe is configured.

Command Modes

Global configuration

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command configures the HTTP probe name and application protocol and enters HTTP configuration mode.

The HTTP probe cannot be unconfigured while it is being used by the server farm or firewall farm.

You can configure more than one probe, in any combination of supported types, for each server farm or for each firewall in a firewall farm.

Note HTTP probes require a route to the virtual server. The route is not used, but it must exist to enable the sockets code to verify that the destination can be reached, which in turn is essential for HTTP probes to function correctly. The route can be either a host route (advertised by the virtual server) or a default route (specified using the **ip route 0.0.0.0 0.0.0.0** command, for example).

Examples

The following example configures an IOS Server Load Balancing (IOS SLB) probe named PROBE2, then enters HTTP probe configuration mode:

```
Router(config)# ip slb probe PROBE2 http
```

Related Commands

Command	Description
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

ip slb probe ping

To configure a ping probe name and enter ping probe configuration mode, use the **ip slb probe ping** command in global configuration mode. To remove an **ip slb probe ping** configuration, use the **no** form of this command.

ip slb probe *probe* **ping**

no ip slb probe *probe*

Syntax Description

probe	Name of the ping probe. The character string is limited to 15 characters.

Defaults

No ping probe is configured.

Command Modes

Global configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command configures the ping probe name and application protocol and enters ping configuration mode.

The ping probe cannot be unconfigured while it is being used by the server farm or firewall farm.

You can configure more than one probe, in any combination of supported types, for each server farm or for each firewall in a firewall farm.

Examples

The following example configures an IOS Server Load Balancing (IOS SLB) probe named PROBE1, then enters ping probe configuration mode:

```
Router(config)# ip slb probe PROBE1 ping
```

Related Commands

Command	Description
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

ip slb probe tcp

To configure a TCP probe name and enter TCP probe configuration mode, use the **ip slb probe tcp** command in global configuration mode. To remove an **ip slb probe tcp** configuration, use the **no** form of this command.

ip slb probe *probe* **tcp**

no ip slb probe *probe*

Syntax Description

probe	Name of the TCP probe. The character string is limited to 15 characters.

Defaults

No TCP probe is configured.

Command Modes

Global configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command configures the TCP probe name and application protocol and enters TCP configuration mode.

The TCP probe cannot be unconfigured while it is being used by the server farm or firewall farm.

You can configure more than one probe, in any combination of supported types, for each server farm or for each firewall in a firewall farm.

Examples

The following example configures an IOS Server Load Balancing (IOS SLB) probe named PROBE5, then enters TCP probe configuration mode:

```
Router(config)# ip slb probe PROBE5 tcp
```

Related Commands

Command	Description
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

ip slb probe wsp

To configure a Wireless Session Protocol (WSP) probe name and enter WSP probe configuration mode, use the **ip slb probe wsp** command in global configuration mode. To remove an **ip slb probe wsp** configuration, use the **no** form of this command.

ip slb probe *probe* **wsp**

no ip slb probe *probe*

Syntax Description

probe	Name of the WSP probe. The character string is limited to 15 characters.

Defaults

No WSP probe is configured.

Command Modes

Global configuration

Command History

Release	Modification
12.1(5a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command configures the WSP probe name and application protocol and enters WSP probe configuration mode.

The WSP probe cannot be unconfigured while it is being used by the server farm or firewall farm.

You can configure more than one probe, in any combination of supported types, for each server farm or for each firewall in a firewall farm.

Examples

The following example configures an IOS Server Load Balancing (IOS SLB) probe named PROBE3, then enters WSP probe configuration mode:

```
Router(config)# ip slb probe PROBE3 wsp
```

Related Commands

Command	Description
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

ip slb replicate slave rate

To set the replication message rate for IOS Server Load Balancing (IOS SLB) slave replication, use the **replicate slave** command in global configuration mode. To restore the default rate, use the **no** form of this command.

ip slb replicate slave rate *rate*

no ip slb replicate slave rate *rate*

Syntax Description

rate	Replication message rate for IOS SLB slave replication, in messages per second. The valid range is 50 messages per second to 1000 messages per second. The default setting is 400 messages per second.

Defaults

The default rate is 400 messages per second.

Command Modes

Global configuration

Command History

Release	Modification
12.2(14)ZA5	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command enables you to manage Interprocess Communication Channel (IPC) resources between two route processors. If there is congestion between the two route processors, use this command to set a lower rate.

If the replication rate is exceeded, IOS SLB issues an appropriate error message.

General packet radio service (GPRS) load balancing without GPRS Tunneling Protocol (GTP) cause code inspection enabled does not support the **ip slb replicate slave rate** command in global configuration mode.

The Home Agent Director does not support the **ip slb replicate slave rate** command in global configuration mode.

Examples

The following example sets the replication message rate to 500 messages per second:

```
Router(config)# ip slb replicate slave rate 500
```

Related Commands

Command	Description
replicate casa (firewall farm)	Configures a stateful backup of IOS Server Load Balancing (IOS SLB) decision tables to a backup switch
replicate interval (firewall farm)	Sets the replication delivery interval for an IOS Server Load Balancing (IOS SLB) firewall farm.
replicate slave (firewall farm)	Enables stateful backup of redundant route processors for an IOS Server Load Balancing (IOS SLB) firewall farm.
show ip slb replicate	Displays the configuration of IOS Server Load Balancing (IOS SLB) IP replication.
show ip slb virtuals	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

ip slb route

To enable IOS Server Load Balancing (IOS SLB) to route packets using the RADIUS framed-IP sticky database, or to route packets from one firewall real server back through another firewall real server, use the **ip slb route** command in global configuration mode. To route packets normally, use the **no** form of this command.

ip slb route {**framed-ip deny** | *ip-address netmask* **framed-ip** | **inter-firewall**}

no ip slb route {**framed-ip deny** | *ip-address netmask* **framed-ip** | **inter-firewall**}

Syntax Description

framed-ip deny	(Optional) Packets that do not match entries in the IOS SLB RADIUS framed-ip sticky database are not routed.
ip-address	(Optional) IP address of packets to be inspected.
netmask	(Optional) Subnet mask specifying a range of packets to be inspected.
framed-ip	(Optional) Packets are to be routed using the IOS SLB RADIUS framed-IP sticky database.
inter-firewall	(Optional) Enables IOS SLB to route packets from one firewall real server back through another firewall real server, if the flows to the destination IP would otherwise have been firewall load-balanced. This can be done within the same firewall farm or across different firewall farms.

Defaults

Cisco IOS SLB cannot route packets using the RADIUS framed-IP sticky database, nor can it route packets from one firewall real server back through another firewall real server.

Command Modes

Global configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.1(13)E3	The **inter-firewall** keyword was added.
12.2 (14)ZA6	The **framed-ip deny** keyword was added.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

This command enables IOS SLB to inspect packets whose source IP addresses match the specified IP address and subnet mask. IOS SLB then searches for the packet's source IP address in the RADIUS framed-IP sticky database. If the database contains a matching entry, IOS SLB routes the packet to the associated real server. If the database does not contain a matching entry, IOS SLB routes the packet normally.

The **inter-firewall** keyword is useful when traffic is arriving from an address behind a firewall, is destined for an address behind a firewall, and has a sticky entry to be routed via the routing table.

Examples

The following example enables IOS SLB to inspect packets with the source IP address 10.10.10.1:

```
Router(config)# ip slb route 10.10.10.1 255.255.255.255 framed-ip
```

Related Commands

Command	Description
show ip slb sticky	Displays the IOS SLB sticky database.

ip slb serverfarm

To identify a server farm and enter SLB server farm configuration mode, use the **ip slb serverfarm** command in global configuration mode. To remove the server farm from the IOS Server Load Balancing (IOS SLB) configuration, use the **no** form of this command.

ip slb serverfarm *server-farm*

no ip slb serverfarm *server-farm*

Syntax Description

server-farm	Character string used to identify the server farm. The character string is limited to 15 characters.

Defaults

No server farm is identified.

Command Modes

Global configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

Grouping real servers into server farms is an essential part of IOS SLB. Using server farms enables IOS SLB to assign new connections to the real servers based on their weighted capacities, and on the load-balancing algorithms used.

Examples

The following example identifies a server farm named PUBLIC:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)#?
```

Related Commands

Command	Description
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.

ip slb static

To configure a real server's Network Address Translation (NAT) behavior and enter static NAT configuration mode, use the **ip slb static** command in global configuration mode. To restore the real server's default NAT behavior, use the **no** form of this command.

ip slb static {**drop** | **nat** {**virtual** | *virtual-ip* [**per-packet** | **sticky**]}}

no ip slb static {**drop** | **nat** {**virtual** | *virtual-ip* [**per-packet** | **sticky**]}}

Syntax Description

drop	Indicates that IOS Server Load Balancing (IOS SLB) is to drop packets from this real server if the packets do not correspond to existing connections. This option is usually used in conjunction with the subnet mask or port number option on the **real** command in static NAT configuration mode, such that IOS SLB builds connections to the specified subnet or port, and drops all other connections from the real server.
nat virtual	Configures the real server to use server NAT, and to use the virtual IP address that is configured on the **real** command in static NAT configuration mode when translating addresses.
nat *virtual-ip*	Configures the real server to use server NAT, and to use the specified virtual IP address when translating addresses.
per-packet	(Optional) IOS SLB is *not* to maintain connection state for packets originating from the real server. That is, IOS SLB is to use server NAT to redirect packets originating from the real server.
sticky	(Optional) Indicates that IOS SLB is *not* to maintain connection state for packets originating from the real server, *unless* those packets match a sticky object. That is, if IOS SLB can find a matching sticky object, it builds the connection. Otherwise, IOS SLB does not build the connection.

Defaults

If you do not specify either the **per-packet** or **sticky** keyword, IOS SLB maintains connection state for packets originating from the real server.

Command Modes

Global configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

If you specify the *virtual-ip* argument and you do not specify the **per-packet** option, IOS SLB uses server port translation to distinguish between connection requests initiated by different real servers.

Examples

The following example specifies that the real server is to use server NAT and to use virtual IP address 13.13.13.13 when translating addresses, and that IOS SLB is not to maintain connection state for any packets originating from the real server:

```
Router(config)# ip slb static nat 13.13.13.13 per-packet
```

Related Commands

Command	Description
show ip slb static	Displays information about the static Network Address Translation (NAT) configuration.

ip slb timers gtp gsn

To change the amount of time IOS Server Load Balancing (IOS SLB) maintains sessions to and from an idle gateway general packet radio service (GPRS) support node (GGSN) or serving GPRS support node (SGSN), use the **ip slb timers gtp gsn** command in global configuration mode. To restore the default GPRS support node (GSN) idle timer, use the **no** form of this command.

ip slb timers gtp gsn *duration*

no ip slb timers gtp gsn *duration*

Syntax Description

duration	GSN idle timer duration in seconds, which defines how long IOS SLB is to allow a GGSN or SGSN to be idle (that is, to go without echoing or signaling through IOS SLB). When the timer expires, IOS SLB cleans up all sessions that are using the idle GGSN or SGSN. The valid range is 1 to 65535 seconds. The default value is 90 seconds.

Defaults

The default duration is 90 seconds.

Command Modes

Global configuration

Command History

Release	Modification
12.1(13)E3	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command sets the GSN idle timer for all IOS SLB virtual servers that are configured for GPRS Tunneling Protocol (GTP) cause code inspection. When the GSN idle timer expires, IOS SLB destroys all sessions to and from the idle GGSN or SGSN.

Examples

The following example specifies that IOS SLB maintains sessions for 45 seconds after a GGSN or SGSN becomes idle:

```
Router(config)# ip slb timers gtp gsn 45
```

Related Commands

Command	Description
virtual	Configures the virtual server attributes.

ip slb vserver

To identify a virtual server and enter SLB virtual server configuration mode, use the **ip slb vserver** command in global configuration mode. To remove a virtual server from the IOS Server Load Balancing (IOS SLB) configuration, use the **no** form of this command.

ip slb vserver *virtual-server*

no ip slb vserver *virtual-server*

Syntax Description

virtual-server	Character string used to identify the virtual server. The character string is limited to 15 characters.

Defaults

No virtual server is identified.

Command Modes

Global configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example identifies a virtual server named PUBLIC_HTTP:

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)#
```

Related Commands

Command	Description
serverfarm	Associates a real server farm with a virtual server, and optionally configures a backup server farm and specifies that sticky connections are to be used in the backup server farm.
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

lookup

To configure an IP address of a real server that a Domain Name System (DNS) server should supply in response to a domain name resolve request, use the **lookup** command in DNS probe configuration mode. To remove an IP address from the expected list, use the **no** form of this command.

lookup *ip-address*

no lookup *ip-address*

Syntax Description

ip-address	IP address of a real server that a DNS server should supply in response to a domain name resolve request.

Defaults

No lookup IP address is configured.

Command Modes

DNS probe configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a DNS probe named PROBE4, enters DNS probe configuration mode, and specifies 13.13.13.13 as the IP address to resolve:

```
Router(config)# ip slb probe PROBE4 dns
Router(config-slb-probe)# lookup 13.13.13.13
```

Related Commands

Command	Description
ip slb probe dns	Configures a Domain Name System (DNS) probe name and enters DNS probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

maxclients

To specify the maximum number of IOS Server Load Balancing (IOS SLB) RADIUS and GTP sticky subscribers that can be assigned to an individual virtual server, use the **maxclients** command in real server configuration mode. To remove the limit, use the **no** form of this command.

maxclients *maximum-number*

no maxclients

Syntax Description

maximum-number	Maximum number of IOS SLB RADIUS and GTP sticky subscribers that can be assigned to an individual virtual server: • If the **radius calling-station-id** keyword is specified in the **sticky** command for the virtual server (that is, if the virtual server is configured to create the IOS SLB RADIUS calling-station-ID sticky database), a sticky subscriber is an entry in the IOS SLB RADIUS calling-station-ID sticky database. • If the **radius framed-ip** keyword is specified in the **sticky** command for the virtual server (that is, if the virtual server is configured to create the IOS SLB RADIUS framed-IP sticky database), a sticky subscriber is an entry in the IOS SLB RADIUS framed-IP sticky database. • If the **radius username** keyword is specified in the **sticky** command for the virtual server (that is, if the virtual server is configured to create the IOS SLB RADIUS username sticky database), a sticky subscriber is an entry in the IOS SLB RADIUS username sticky database. • If both the **radius framed-ip** and **radius calling-station-id** keywords are specified in the **sticky** command for the virtual server, a sticky subscriber is an entry in the IOS SLB RADIUS calling-station-ID sticky database. • If both the **radius framed-ip** and **radius username** keywords are specified in the **sticky** command for the virtual server, a sticky subscriber is an entry in the IOS SLB RADIUS username sticky database. By default, there is no limit on the number of IOS SLB RADIUS and GTP sticky subscribers that can be assigned to an individual virtual server.

Defaults

There is no limit on the number of IOS SLB RADIUS and GTP sticky subscribers that can be assigned to an individual virtual server.

Command Modes

Real server configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.1(12c)E	This command was modified to support RADIUS load balancing for CDMA2000, a third-generation (3-G) version of Code Division Multiple Access (CDMA).
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example specifies that up to 10 IOS SLB RADIUS sticky subscribers can be assigned to an individual real server:

```
Router(config-slb-real)# maxclients 10
```

Related Commands

Command	Description
ip slb route	Enables IOS Server Load Balancing (IOS SLB) to inspect packets for RADIUS framed-IP sticky routing.
show ip slb sticky	Displays the IOS Server Load Balancing (IOS SLB) sticky database.

maxconns (firewall farm datagram protocol)

To limit the number of active datagram connections to the firewall farm, use the **maxconns** command in firewall farm datagram protocol configuration mode. To restore the default of 4294967295, use the **no** form of this command.

maxconns *maximum-number*

no maxconns

Syntax Description

maximum-number	Maximum number of simultaneous active datagram connections using the firewall farm. Valid values range from 1 to 4294967295. The default is 4294967295.

Defaults

The default maximum number of simultaneous active datagram connections using the firewall farm is 4294967295.

Command Modes

Firewall farm datagram protocol configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example limits the real server to a maximum of 1000 simultaneous active connections:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# protocol datagram
Router(config-slb-fw-udp)# maxconns 1000
```

Related Commands

Command	Description
protocol datagram	Enters firewall farm datagram protocol configuration mode.
show ip slb firewallfarm	Displays information about the firewall farm configuration.
show ip slb reals	Displays information about the real servers.

maxconns (firewall farm TCP protocol)

To limit the number of active TCP connections to the firewall farm, use the **maxconns** command in firewall farm TCP protocol configuration mode. To restore the default of 4294967295, use the **no** form of this command.

maxconns *maximum-number*

no maxconns

Syntax Description

maximum-number	Maximum number of simultaneous active TCP connections using the firewall farm. Valid values range from 1 to 4294967295. The default is 4294967295.

Defaults

The default maximum number of simultaneous active TCP connections using the firewall farm is 4294967295.

Command Modes

Firewall farm TCP protocol configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example limits the real server to a maximum of 1000 simultaneous active connections:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# protocol tcp
Router(config-slb-fw-tcp)# maxconns 1000
```

Related Commands

Command	Description
protocol tcp	Enters firewall farm TCP protocol configuration mode.
show ip slb firewallfarm	Displays information about the firewall farm configuration.
show ip slb reals	Displays information about the real servers.

maxconns (server farm)

To limit the number of active connections to the real server, use the **maxconns** command in SLB server farm configuration mode. To restore the default of 4294967295, use the **no** form of this command.

maxconns *maximum-number* [**sticky-override**]

no maxconns

Syntax Description

maximum-number	Maximum number of simultaneous active connections on the real server. Valid values range from 1 to 4294967295. The default is 4294967295.
sticky-override	(Optional) Allow sticky load balancing to exceed *maximum-number* for this real server.

Defaults

The default maximum number of simultaneous active connections on the real server is 4294967295.

Command Modes

SLB server farm configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.1(18)E	The **sticky-override** keyword was added.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Examples

The following example limits the real server to a maximum of 1000 simultaneous active connections:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# real 10.10.1.1
Router(config-slb-real)# maxconns 1000
```

Related Commands

Command	Description
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
show ip slb reals	Displays information about the real servers.
show ip slb severfarms	Displays information about the server farm configuration.

mls aging slb normal

To configure the aging time for flows, use the **mls aging slb normal** global configuration command. To restore the default setting, use the **no** form of this command.

mls aging slb normal *time*

no mls aging slb normal *time*

Syntax Description

time	Idle time, in milliseconds, before a flow is aged. The valid range is 1 milliseconds to 10000 milliseconds. The default setting is 2000 milliseconds. **Note** Heavier-than-normal loads can age flows more aggressively than this time.

Defaults

The default aging idle time is 2000 milliseconds.

Command Modes

Global configuration

Command History

Release	Modification
12.1(8)E	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command is supported for Catalyst 6000 family switches only.

Examples

The following example sets the idle time to 4000 milliseconds:

```
Router(config)# mls aging slb normal 4000
```

Related Commands

Command	Description
ip slb firewallfarm	Identifies a firewall farm and initiates firewall farm configuration mode.
ip slb serverfarm	Associates a real server farm with a virtual server.
ip slb vserver	Identifies a virtual server.
mls aging slb process	Controls how often the aging process runs.

mls aging slb process

To control how often the aging process runs, use the **mls aging slb process** global configuration command. To restore the default setting, use the **no** form of this command.

mls aging slb process *time*

no mls aging slb process *time*

Syntax Description

time	Aging process interval, in milliseconds. The valid range is 1 millisecond to 10000 milliseconds. The default setting is 2000 seconds.

Defaults

The default aging process interval is 2000 milliseconds.

Command Modes

Global configuration

Command History

Release	Modification
12.1(8)E	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command is supported for Catalyst 6000 family switches only.

Examples

The following example sets the aging process interval to 4000 milliseconds:

```
Router(config)# mls aging slb process 4000
```

Related Commands

Command	Description
ip slb firewallfarm	Identifies a firewall farm and initiates firewall farm configuration mode.
ip slb serverfarm	Associates a real server farm with a virtual server.
ip slb vserver	Identifies a virtual server.
mls aging slb normal	Configures the aging time for flows.

mls ip slb search wildcard

To specify the behavior of IOS Server Load Balancing (IOS SLB) wildcard searches, use the **mls ip slb search wildcard** command in global configuration mode. To restore the default setting, use the **no** form of this command.

mls ip slb search {**wildcard** [**pfc** | **rp**] | **icmp**}

no mls ip slb search {**wildcard** [**pfc** | **rp**] | **icmp**}

Syntax Description

wildcard	IOS SLB wildcard searches are to be performed by the Policy Feature Card (PFC). This value is the default setting.
pfc	(Optional) IOS SLB wildcard searches are to be performed by the Policy Feature Card (PFC). This value is the default setting.
rp	(Optional) IOS SLB wildcard searches are to be performed by the route processor.
icmp	Disables ICMP handling by IOS SLB. (Pings to IOS SLB virtual IP addresses are still answered.) Use this command to reduce CPU usage when IOS SLB is configured in locations with a high volume of ICMP flows, such as in the network core. **Note** Use of the **icmp** keyword can result in minor ICMP errors, such as flows returned to the client with no Network Address Translation (NAT).

Defaults

The default setting is for the PFC to perform IOS SLB wildcard searches.

Command Modes

Global configuration

Command History

Release	Modification
12.1(7)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

This command is supported for Catalyst 6500 family switches only.

If you configure IOS SLB and either input ACLs or firewall load balancing on the same Catalyst 6500 Family Switch, you can exceed the capacity of the TCAM on the PFC. To correct the problem, use the **mls ip slb search wildcard rp** command to reduce the amount of TCAM space used by IOS SLB. However, be aware that this command can result in a slight increase in route processor utilization.

Examples

The following example limits wildcard searches to the route processor:

```
Router(config)# mls ip slb search wildcard rp
```

Related Commands

Command	Description
ip slb firewallfarm	Identifies a firewall by IP address farm and enters firewall farm configuration mode.
ip slb serverfarm	Associates a real server farm with a virtual server.
ip slb vserver	Identifies a virtual server.

nat

To configure IOS Server Load Balancing (IOS SLB) Network Address Translation (NAT) and specify a NAT mode, use the **nat** command in SLB server farm configuration mode. To remove a NAT configuration, use the **no** form of this command.

nat {**client** *pool* | **server**}

no nat {**client** | **server**}

Syntax Description

client *pool*	Configures the client address in load-balanced packets using addresses from the client address pool. The pool name must match the *pool* argument from a previous **ip slb natpool** command. This mode is commonly referred to as *directed client NAT*, or simply client NAT.
server	Configures the destination address in load-balanced packets sent to the real server as the address of the real server chosen by the server farm load-balancing algorithm. This mode is commonly referred to as *directed server NAT*, or simply server NAT.

Defaults

No IOS SLB NAT is configured.

Command Modes

SLB server farm configuration

Command History

Release	Modification
12.1(1)E	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(2)E	The **client** keyword and *pool* argument were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The **no nat** command is allowed only if the virtual server was removed from service with the **no inservice** command.

Examples

The following example enters server farm configuration mode and configures NAT mode as server address translation on server farm FARM2:

```
Router# ip slb serverfarm FARM2
```

```
Router(config-slb-sfarm)# nat server
```

The following example configures the NAT mode on server farm FARM2 to client translation mode and, using the **real** command in server farm configuration mode, configures the real server IP address as 10.3.1.1:

```
Router(config-slb-sfarm)# nat client web-clients
Router(config-slb-sfarm)# real 10.3.1.1
```

Related Commands

Command	Description
ip slb serverfarm	Associates a real server farm with a virtual server.
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
show ip slb serverfarms	Displays information about the server farm configuration.

port (custom UDP probe)

To specify the port to which a custom User Datagram Protocol (UDP) probe is to connect, use the **port** command in custom UDP probe configuration mode. To restore the default settings, use the **no** form of this command.

port *port*

no port *port*

Syntax Description

port	UDP port number to which the custom UDP probe is to connect.

Defaults

In dispatched mode, the port number is inherited from the virtual server.
If port translation is configured for the real server, that port number is used. See the **real (server farm)** command for more details.

Command Modes

Custom UDP probe configuration

Command History

Release	Modification
12.1(13)E3	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a custom UDP probe named PROBE6, enters custom UDP probe configuration mode, and configures the probe to connect to port number 8:

```
Router(config)# ip slb probe PROBE6 custom UDP
Router(config-slb-probe)# port 8
```

Related Commands

Command	Description
ip slb probe custom udp	Configures a custom User Datagram Protocol (UDP) probe name and enters custom UDP probe configuration mode.
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

port (HTTP probe)

To specify the port to which an HTTP probe is to connect, use the **port** command in HTTP probe configuration mode. To restore the default settings, use the **no** form of this command.

port *port*

no port *port*

Syntax Description

port	TCP or User Datagram Protocol (UDP) port number to which the HTTP probe is to connect.

Defaults

In dispatched mode, the port number is inherited from the virtual server.
If port translation is configured for the real server, that port number is used. See the **real (server farm)** command for more details.

Command Modes

HTTP probe configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures an HTTP probe named PROBE2, enters HTTP probe configuration mode, and configures the probe to connect to port number 8:

```
Router(config)# ip slb probe PROBE2 http
Router(config-slb-probe)# port 8
```

Related Commands

Command	Description
ip slb probe http	Configures an HTTP probe name and enters HTTP probe configuration mode.
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

port (TCP probe)

To specify the port to which a TCP probe is to connect, use the **port** command in TCP probe configuration mode. To restore the default settings, use the **no** form of this command.

port *port*

no port *port*

Syntax Description

port	TCP port number to which the TCP probe is to connect.

Defaults

In dispatched mode, the port number is inherited from the virtual server.
If port translation is configured for the real server, that port number is used. See the **real (server farm)** command for more details.

Command Modes

TCP probe configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a TCP probe named PROBE5, enters TCP probe configuration mode, and configures the probe to connect to port number 8:

```
Router(config)# ip slb probe PROBE5 tcp
Router(config-slb-probe)# port 8
```

Related Commands

Command	Description
ip slb probe tcp	Configures a TCP probe name and enters TCP probe configuration mode.
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

predictor

To specify the load-balancing algorithm for selecting a real server in the server farm, use the **predictor** command in SLB server farm configuration mode. To restore the default load-balancing algorithm of weighted round robin, use the **no** form of this command.

predictor [**roundrobin** | **leastconns**]

no predictor

Syntax Description

roundrobin	(Optional—IOS SLB feature only) Uses the weighted round robin algorithm for selecting the real server to handle the next new connection for the server farm. See the "Weighted Round Robin" section for a detailed description of this algorithm. This algorithm is the default value. RADIUS load balancing requires the weighted round robin algorithm. General packet radio service (GPRS) load balancing without GPRS Tunneling Protocol (GTP) cause code inspection enabled requires the weighted round robin algorithm. The Home Agent Director requires the weighted round robin algorithm.
leastconns	(Optional—IOS SLB feature only) Uses the weighted least connections algorithm for selecting the real server to handle the next new connection for this server farm. See the "Weighted Round Robin" section for a detailed description of this algorithm.

Defaults

If you do not enter a **predictor** command, or if you enter the **predictor** command without specifying a load-balancing algorithm, the weighted round robin algorithm is used.

Command Modes

SLB server farm configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

RADIUS load balancing requires the weighted round robin algorithm.

GPRS load balancing without GTP cause code inspection enabled requires the weighted round robin algorithm. A server farm that uses weighted least connections can be bound to a virtual server providing GPRS load balancing without GTP cause code inspection enabled, but you cannot place the virtual server INSERVICE. If you try to do so, IOS Server Load Balancing (IOS SLB) issues an error message.

The Home Agent Director requires the weighted round robin algorithm. A server farm that uses weighted least connections can be bound to a Home Agent Director virtual server, but you cannot place the virtual server INSERVICE. If you try to do so, IOS Server Load Balancing (IOS SLB) issues an error message.

Examples

The following example specifies the weighted least connections algorithm:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# predictor leastconns
```

Related Commands

Command	Description
show ip slb serverfarms	Displays information about the server farm configuration.
weight (server farm)	Specifies the real server's capacity, relative to other real servers in the server farm.

predictor hash address (firewall farm)

To specify the load-balancing algorithm for selecting a firewall in the firewall farm, use the **predictor hash address** command in firewall farm configuration mode. To restore the default load-balancing algorithm, use the **no** form of this command.

predictor hash address [**port**]

no predictor

Syntax Description

port	(Optional) Uses the source and destination TCP or User Datagram Protocol (UDP) port numbers, in addition to the source and destination IP addresses, when selecting a firewall.

Defaults

IOS Server Load Balancing (IOS SLB) uses the source and destination IP addresses when selecting a firewall.

Command Modes

Firewall farm configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example specifies that source and destination IP addresses are to be used when selecting a firewall:

```
Router(config)# ip slb firewall FIRE1
Router(config-slb-fw)# predictor hash address
```

Related Commands

Command	Description
show ip slb firewallfarm	Displays information about the firewall farm configuration.
weight (firewall farm real server)	Specifies the firewall's capacity, relative to other firewalls in the firewall farm.

probe (firewall farm real server)

To associate a probe with a firewall farm, use the **probe** command in firewall farm real server configuration mode. To remove the association, use the **no** form of this command.

probe *probe*

no probe *probe*

Syntax Description

probe	Name of the probe to associate with this firewall farm.

Defaults

No probe is associated with a firewall farm.

Command Modes

Firewall farm real server configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

You can configure more than one probe for each firewall in a firewall farm.

If you configure probes in your network, you must also do one of the following:

- Configure the **exclude** keyword on the **client** command on the virtual server, to exclude connections initiated by the client IP address from the load-balancing scheme.
- Configure IP addresses on the IOS Server Load Balancing (IOS SLB) device that are Layer 3-adjacent to the real servers used by the virtual server.

Examples

The following example associates probe FireProbe with server farm FIRE1:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw-real)# probe FireProbe
```

Related Commands

Command	Description
show ip slb firewallfarm	Displays information about the server farm configuration.

probe (server farm)

To associate a probe with a server farm, use the **probe** command in server farm configuration mode. To remove the association, use the **no** form of this command.

probe *probe*

no probe *probe*

Syntax Description

probe	Name of the probe to associate with this server farm.

Defaults

No probe is associated with a server farm.

Command Modes

Server farm configuration

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

You can configure more than one probe for each server farm.

If you configure probes in your network, you must also do one of the following:

- Configure the **exclude** keyword on the **client** command on the virtual server, to exclude connections initiated by the client IP address from the load-balancing scheme.
- Configure IP addresses on the IOS Server Load Balancing (IOS SLB) device that are Layer 3-adjacent to the real servers used by the virtual server.

Examples

The following example associates probe PROBE1 with server farm PUBLIC:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# probe PROBE1
```

Related Commands

Command	Description
show ip slb serverfarms	Displays information about the server farm configuration.

protocol datagram

To enter firewall farm datagram protocol configuration mode, use the **protocol datagram** command in firewall farm configuration mode.

protocol datagram

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values

Command Modes

Firewall farm configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced, replacing the **udp** command.
12.1(12c)E	This command was integrated into Cisco IOS Release 12.1(12c)E, replacing the **protocol udp** command.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

Firewall farm datagram protocol configuration applies to the Encapsulation Security Payload (ESP), Generic Routing Encapsulation (GRE), IP in IP encapsulation, and User Datagram Protocol (UDP) protocols.

Examples

The following example enters firewall farm datagram protocol configuration mode:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# protocol datagram
```

Related Commands

Command	Description
show ip slb firewallfarm	Displays information about the firewall farm configuration.

protocol tcp

To enter firewall farm TCP protocol configuration mode, use the **protocol tcp** command in firewall farm configuration mode.

protocol tcp

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values

Command Modes

Firewall farm configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced, replacing the **tcp** command.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example enters firewall farm TCP protocol configuration mode:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# protocol tcp
```

Related Commands

Command	Description
show ip slb firewallfarm	Displays information about the firewall farm configuration.

purge radius framed-ip acct on-off (virtual server)

To enable IOS SLB to purge entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting ON or OFF message, use the **purge radius framed-ip acct on-off** virtual server configuration command. To disable this behavior, use the **no** form of this command.

purge radius framed-ip acct on-off

no purge radius framed-ip acct on-off

Syntax Description

This command has no arguments or keywords.

Defaults

IOS SLB purges entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting ON or OFF message.

Command Modes

Virtual server configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example prevents IOS SLB from purging entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting ON or OFF message:

```
Router(config)# ip slb vserver VS1
Router(config-slb-vserver)# no purge radius framed-ip acct on-off
```

Related Commands

Command	Description
sticky (virtual server)	Assigns all connections from a client to the same real server.

purge radius framed-ip acct stop (virtual server)

To enable IOS SLB to purge entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting-Stop message, use the **purge radius framed-ip acct stop** virtual server configuration command. To disable this behavior, use the **no** form of this command.

purge radius framed-ip acct stop {*attribute-number* | {**26** | *vsa*} {*vendor-ID* | **3gpp** | **3gpp2**} *sub-attribute-number*}

no purge radius framed-ip acct stop {*attribute-number* | {**26** | *vsa*} {*vendor-ID* | **3gpp** | **3gpp2**} *sub-attribute-number*}

Syntax Description

attribute-number	RADIUS attribute number.
26	RADIUS attribute number 26.
vsa	Vendor-specific attribute number.
vendor-ID	Vendor ID.
3gpp	Third Generation Partnership Project (3GPP) vendor ID.
3gpp2	Third Generation Partnership Project 2 (3GPP2) vendor ID.
sub-attribute-number	Sub-attribute number.

Defaults

IOS SLB purges entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting-Stop message.

Command Modes

Virtual server configuration

Command History

Release	Modification
12.2(14)ZA5	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example prevents IOS SLB from purging entries in the IOS SLB RADIUS framed-ip sticky database upon receipt of an Accounting-Stop message:

```
Router(config)# ip slb vserver VS1
Router(config-slb-vserver)# no purge radius framed-ip acct stop 44
```

Related Commands

Command	Description
sticky (virtual server)	Assigns all connections from a client to the same real server.

real (firewall farm)

To identify a firewall as a member of a firewall farm and enter real server configuration mode, use the **real** command in firewall farm configuration mode. To remove the firewall from the IOS Server Load Balancing (IOS SLB) configuration, use the **no** form of this command.

real *ip-address*

no real *ip-address*

Syntax Description

ip-address	Real server IP address.

Defaults

No firewall is identified as a member of a firewall farm.

Command Modes

Firewall farm configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

A firewall farm comprises a number of firewalls. The firewalls are the physical devices that provide the firewall load-balanced services.

Examples

The following example identifies a firewall as a member of firewall farm FIRE1:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# real 10.1.1.1
```

Related Commands

Command	Description
inservice (firewall farm real server)	Enables the firewall for use by IOS Server Load Balancing (IOS SLB).
show ip slb firewallfarm	Displays information about the firewall farm configuration.
show ip slb reals	Displays information about the real servers.

real (server farm)

To identify a real server as a member of a server farm and enter real server configuration mode, use the **real** command in SLB server farm configuration mode. To remove the real server from the IOS Server Load Balancing (IOS SLB) configuration, use the **no** form of this command.

real *ip-address* [*port*]

no real *ip-address* [*port*]

Syntax Description

ip-address	Real server IP address.
port	(Optional) Port translation for the server. Valid values range from 1 to 65535.

Defaults

No real server is identified as a member of a server farm.

Command Modes

SLB server farm configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(2)E	The *port* argument was added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

A server farm comprises a number of real servers. The real servers are the physical devices that provide the load-balanced services.

In general packet radio service (GPRS) load balancing, this command identifies a gateway GPRS support node (GGSN) that is a member of the server farm. Also, remember that the Cisco GGSN IP addresses are virtual template IP addresses, not real interface IP addresses.

In Virtual Private Network (VPN) server load balancing, this command identifies a real server acting as a VPN terminator.

Examples

The following example identifies a real server as a member of the server farm:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# real 10.1.1.1
```

Related Commands

Command	Description
inservice (server farm real server)	Enables the real server for use by IOS Server Load Balancing (IOS SLB).
show ip slb reals	Displays information about the real servers.
show ip slb serverfarms	Displays information about the server farm configuration.

real (static NAT)

To configure one or more real servers to use static Network Address Translation (NAT), use the **real** command in static NAT configuration mode. To restore the default behavior, use the **no** form of this command.

real *ip-address* [*port*]

no real *ip-address* [*port*]

Syntax Description

ip-address	IP address of the real server that is to use static NAT.
port	(Optional) Layer 4 source port number, used by IOS Server Load Balancing (IOS SLB) to differentiate between User Datagram Protocol (UDP) responses from the real server and connections initiated by the real server.

Defaults

No real server is configured to use static NAT.

Command Modes

Static NAT configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

If no port number is specified, IOS SLB uses static NAT for all packets outbound from the real server.

Examples

The following example configures real server 10.0.0.0 to use static NAT:

```
Router(config)# ip slb static nat
Router(config-slb-static)# real 10.0.0.0
```

Related Commands

Command	Description
ip slb static	Configures a real server's Network Address Translation (NAT) behavior and enters static NAT configuration mode.
show ip slb reals	Displays information about the real servers.
show ip slb static	Displays information about the static Network Address Translation (NAT) configuration.

reassign

To specify the threshold of consecutive unacknowledged SYNchronize sequence numbers (SYNs) or Create Packet Data Protocol (PDP) requests that, if exceeded, result in an attempted connection to a different real server, use the **reassign** command in SLB real server configuration mode. To restore the default reassignment threshold, use the **no** form of this command.

reassign *threshold*

no reassign

Syntax Description

threshold	Number of unacknowledged TCP SYNs (or Create PDP requests, in general packet radio service [GPRS] load balancing) that are directed to a real server before the connection is reassigned to a different real server. An unacknowledged SYN is one for which no SYN or ACKnowledgment (ACK) is detected before the next SYN arrives from the client. IOS Server Load Balancing (IOS SLB) allows 30 seconds for the connection to be established or for a new SYN to be received. If neither of these occurs within that time, the connection is removed from the IOS SLB database. The 30-second timer is restarted for each SYN as long as the number of connection reassignments specified in the **faildetect numconns (real server)** command is not exceeded. See the **faildetect numconns (real server)** command for more information. Valid threshold values range from one (1) to four (4) SYNs. The default value is three (3).

Defaults

The default threshold is three (3) SYNs.

Command Modes

SLB real server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(9)E	This command was modified to support general packet radio service (GPRS) load balancing.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

IOS SLB does not reassign sticky connections if either of the following conditions is true:

- The real server is not OPERATIONAL or MAXCONNS_THROTTLED.
- The connection is the first for this sticky connection.

In GPRS load balancing, this command specifies the number of consecutive unacknowledged Create PDP requests (not TCP SYNs) that are directed to a gateway GPRS support node (GGSN) before the connection is reassigned to a different GGSN. You must specify a reassign threshold less than the serving GPRS support node (SGSN)'s N3-REQUESTS counter value:

threshold < n3-requests

Examples

The following example sets the threshold of unacknowledged SYNs to 2:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# real 10.10.1.1
Router(config-slb-real)# reassign 2
```

Related Commands

Command	Description
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
show ip slb reals	Displays information about the real servers.
show ip slb serverfarms	Displays information about the server farm configuration.

replicate casa (firewall farm)

To configure a stateful backup of IOS Server Load Balancing (IOS SLB) decision tables to a backup switch, use the **replicate casa** command in firewall farm configuration mode. To remove a **replicate casa** configuration, use the **no** form of this command.

replicate casa *listen-ip remote-ip port* [*interval*] [**password** [*encrypt*] *secret-string* [*timeout*]]

no replicate casa *listen-ip remote-ip port*

Syntax Description

listen-ip	Listening IP address for state exchange messages that are advertised.
remote-ip	Destination IP address for all state exchange signals.
port	TCP or User Datagram Protocol (UDP) port number or port name for all state exchange signals.
interval	(Optional) Maximum replication delivery interval from 1 to 300 seconds. The default value is 10 seconds. **Note** While IOS SLB does accept the *interval* argument, the **replicate interval** command is the preferred means for setting the replication delivery interval. In fact, if you set the replication delivery interval using the *interval* argument, IOS SLB writes it into the configuration as a **replicate interval** command.
password	(Optional) Specifies the password for Message Digest Algorithm Version 5 (MD5) authentication.
encrypt	(Optional) Indicates how the *secret-string* is represented when the configuration is displayed (for example, **show run**), or how it is written to nonvolatile memory (for example, **write memory**). The possible values are **0** and **7**: • **0**—The *secret-string* is stored in plain text. This is the default setting. • **7**—The *secret-string* is encrypted before it is displayed or written to nonvolatile memory. **Note** If your router is configured to encrypt all passwords, then the password is represented as 7 followed by the encrypted text. See the Cisco IOS **service** command for more details.
secret-string	(Optional) 1- to 64-character clear password value for MD5 authentication. All characters are valid; case is significant. This password must match the password configured on the host agent. The *secret-string* is always sent in plain text when the configuration is downloaded. The *secret-string* must match the secret that is specified on the RADIUS client (for example, the gateway general packet radio service [GPRS] support node [GGSN]).
timeout	(Optional) Delay period, in seconds, during which both the old password and the new password are accepted. The default value is 180 seconds.

Defaults

The default interval is 10 seconds.
The default password encryption is 0 (unencrypted).
The default password timeout is 180 seconds.

Command Modes

Firewall farm configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The *timeout* option allows you to change the password without stopping messages between the backup and primary Layer 3 switches. The default value is 180 seconds.

During the timeout, the backup sends packets with the old password (or null, if there is no old password), and receives packets with either the old or new password. After the timeout expires, the backup sends and receives packets only with the new password.

When setting a new password timeout, remember the following considerations:

- If you are configuring a new backup, set the timeout to 0 (send packets with the new password immediately). This configuration prevents password mismatches between the new backup and its primary.
- If you are changing the password for an existing backup, set a longer timeout to allow enough time for you to update the password on the primary before the timeout expires. Setting a longer timeout also prevents mismatches between the backup and primary.

If you configure this command but you do not specify the **7** keyword, the secret-string is stored in the plain text.

Examples

The following example configures a stateful backup Layer-3 switch with a listening IP address of 10.10.10.11 and a remote IP address of 10.10.11.12 over HTTP port 4231:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# replicate casa 10.10.10.11 10.10.11.12 4231
```

Related Commands

Command	Description
show ip slb firewallfarm	Displays information about the firewall farm configuration.
show ip slb replicate	Displays the configuration of IOS Server Load Balancing (IOS SLB) IP replication.

replicate casa (virtual server)

To configure a stateful backup of IOS Server Load Balancing (IOS SLB) decision tables to a backup switch, use the **replicate casa** command in virtual server configuration mode. To remove a **replicate casa** configuration, use the **no** form of this command.

replicate casa *listen-ip remote-ip port* [*interval*] [**password** [*encrypt*] *secret-string* [*timeout*]]

no replicate casa *listen-ip remote-ip port*

Syntax Description

listen-ip	Listening IP address for state exchange messages that are advertised.
remote-ip	Destination IP address for all state exchange signals.
port	TCP or User Datagram Protocol (UDP) port number or port name for all state exchange signals.
interval	(Optional) Maximum replication delivery interval from 1 to 300 seconds. The default value is 10 seconds. **Note** While IOS SLB does accept the *interval* argument, the **replicate interval** command is the preferred means for setting the replication delivery interval. In fact, if you set the replication delivery interval using the *interval* argument, IOS SLB writes it into the configuration as a **replicate interval** command.
password	(Optional) Specifies the password for Message Digest Algorithm Version 5 (MD5) authentication.
encrypt	(Optional) Indicates how the *secret-string* is represented when the configuration is displayed (for example, **show run**), or how it is written to nonvolatile memory (for example, **write memory**). The possible values are **0** and **7**: • **0**—The *secret-string* is stored in plain text. This is the default setting. • **7**—The *secret-string* is encrypted before it is displayed or written to nonvolatile memory. **Note** If your router is configured to encrypt all passwords, then the password is represented as 7 followed by the encrypted text. See the Cisco IOS **service** command for more details.
secret-string	(Optional) 1- to 64-character clear password value for MD5 authentication. All characters are valid; case is significant. This password must match the password configured on the host agent. The *secret-string* is always sent in plain text when the configuration is downloaded. The *secret-string* must match the secret that is specified on the RADIUS client (for example, the gateway general packet radio service [GPRS] support node [GGSN]).
timeout	(Optional) Delay period, in seconds, during which both the old password and the new password are accepted. The default value is 180 seconds.

Defaults

The default interval is 10 seconds.
The default password encryption is 0 (unencrypted).
The default password timeout is 180 seconds.

Command Modes

Virtual server configuration

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.1(3a)E	The **0** and **7** keywords were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The *timeout* option allows you to change the password without stopping messages between the backup and primary Layer 3 switches. The default value is 180 seconds.

During the timeout, the backup sends packets with the old password (or null, if there is no old password), and receives packets with either the old or new password. After the timeout expires, the backup sends and receives packets only with the new password.

When setting a new password timeout, remember the following considerations:

- If you are configuring a new backup, set the timeout to 0 (send packets with the new password immediately). This configuration prevents password mismatches between the new backup and its primary.
- If you are changing the password for an existing backup, set a longer timeout to allow enough time for you to update the password on the primary before the timeout expires. Setting a longer timeout also prevents mismatches between the backup and primary.

General packet radio service (GPRS) load balancing without GPRS Tunneling Protocol (GTP) cause code inspection enabled does not support the **replicate casa** command in virtual server configuration mode.

The Home Agent Director does not support the **replicate casa** command in virtual server configuration mode.

If you configure this command but you do not specify the **7** keyword, the secret-string is stored in the plain text.

Examples

The following example configures a stateful backup Layer-3 switch with a listening IP address of 10.10.10.11 and a remote IP address of 10.10.11.12 over HTTP port 4231:

```
Router(config)# ip slb vserver VS1
Router(config-slb-vserver)# replicate casa 10.10.10.11 10.10.11.12 4231
```

Related Commands

Command	Description
show ip slb replicate	Displays the configuration of IOS Server Load Balancing (IOS SLB) IP replication.
show ip slb vserver	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

replicate interval (firewall farm)

To set the replication delivery interval for an IOS Server Load Balancing (IOS SLB) firewall farm, use the **replicate interval** command in firewall farm configuration mode. To restore the default interval, use the **no** form of this command.

replicate interval *interval*

no replicate interval

Syntax Description

interval	Maximum replication delivery interval, in seconds. Replication updates are sent to the peer device (CASA or slave) when the interval expires, or when the send buffer (1500 bytes) is full. The valid range is 1 to 300 seconds. The default value is 10 seconds.

Defaults

The default interval is 10 seconds.

Command Modes

Firewall farm configuration

Command History

Release	Modification
12.2(14)ZA5	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

General packet radio service (GPRS) load balancing without GPRS Tunneling Protocol (GTP) cause code inspection enabled does not support the **replicate interval** command in firewall farm configuration mode.

The Home Agent Director does not support the **replicate interval** command in firewall farm configuration mode.

Examples

The following example configures a replication interval of 20 seconds:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# replicate interval 20
```

Related Commands

Command	Description
ip slb replicate slave rate	Sets the replication message rate for IOS Server Load Balancing (IOS SLB) slave replication.
replicate casa (firewall farm)	Configures a stateful backup of IOS Server Load Balancing (IOS SLB) decision tables to a backup switch
replicate slave (firewall farm)	Enables stateful backup of redundant route processors for an IOS Server Load Balancing (IOS SLB) firewall farm.
show ip slb replicate	Displays the configuration of IOS Server Load Balancing (IOS SLB) IP replication.
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

replicate interval (virtual server)

To set the replication delivery interval for an IOS Server Load Balancing (IOS SLB) virtual server, use the **replicate interval** command in virtual server configuration mode. To restore the default interval, use the **no** form of this command.

replicate interval *interval*

no replicate interval

Syntax Description

interval	Maximum replication delivery interval, in seconds. Replication updates are sent to the peer device (CASA or slave) when the interval expires, or when the send buffer (1500 bytes) is full. The valid range is 1 to 300 seconds. The default value is 10 seconds.

Defaults

The default interval is 10 seconds.

Command Modes

Virtual server configuration

Command History

Release	Modification
12.2(14)ZA5	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

General packet radio service (GPRS) load balancing without GPRS Tunneling Protocol (GTP) cause code inspection enabled does not support the **replicate interval** command in virtual server configuration mode.

The Home Agent Director does not support the **replicate interval** command in virtual server configuration mode.

Examples

The following example configures a replication interval of 20 seconds:

```
Router(config)# ip slb vserver VS1
Router(config-slb-vserver)# replicate interval 20
```

Related Commands

Command	Description
ip slb replicate slave rate	Sets the replication message rate for IOS Server Load Balancing (IOS SLB) slave replication.
replicate casa (virtual server)	Configures a stateful backup of IOS Server Load Balancing (IOS SLB) decision tables to a backup switch
replicate slave (virtual server)	Enables stateful backup of redundant route processors for an IOS Server Load Balancing (IOS SLB) virtual server.
show ip slb replicate	Displays the configuration of IOS Server Load Balancing (IOS SLB) IP replication.
show ip slb vserver	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

replicate slave (firewall farm)

To enable stateful backup of redundant route processors for an IOS Server Load Balancing (IOS SLB) firewall farm, if the slave device is present, use the **replicate slave** command in firewall farm configuration mode. To disable stateful backup of redundant route processors, use the **no** form of this command.

replicate slave

no replicate slave

Syntax Description

This command has no arguments or keywords.

Defaults

Stateful backup of redundant route processors is disabled.

Command Modes

Firewall farm configuration

Command History

Release	Modification
12.2(14)ZA5	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

General packet radio service (GPRS) load balancing without GPRS Tunneling Protocol (GTP) cause code inspection enabled does not support the **replicate slave** command in firewall farm configuration mode.

The Home Agent Director does not support the **replicate slave** command in firewall farm configuration mode.

Examples

The following example enables stateful backup of redundant route processors:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# replicate slave
```

Related Commands

Command	Description
ip slb replicate slave rate	Sets the replication message rate for IOS Server Load Balancing (IOS SLB) slave replication.
replicate casa (firewall farm)	Configures a stateful backup of IOS Server Load Balancing (IOS SLB) decision tables to a backup switch
replicate interval (firewall farm)	Sets the replication delivery interval for an IOS Server Load Balancing (IOS SLB) firewall farm.
show ip slb replicate	Displays the configuration of IOS Server Load Balancing (IOS SLB) IP replication.
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

replicate slave (virtual server)

To enable stateful backup of redundant route processors for an IOS Server Load Balancing (IOS SLB) virtual server, if the slave device is present, use the **replicate slave** command in virtual server configuration mode. To disable stateful backup of redundant route processors, use the **no** form of this command.

replicate slave

no replicate slave

Syntax Description

This command has no arguments or keywords.

Defaults

Stateful backup of redundant route processors is disabled.

Command Modes

Virtual server configuration

Command History

Release	Modification
12.2(14)ZA5	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

General packet radio service (GPRS) load balancing without GPRS Tunneling Protocol (GTP) cause code inspection enabled does not support the **replicate slave** command in virtual server configuration mode.

The Home Agent Director does not support the **replicate slave** command in virtual server configuration mode.

Examples

The following example enables stateful backup of redundant route processors:

```
Router(config)# ip slb vserver VS1
Router(config-slb-vserver)# replicate slave
```

Related Commands

Command	Description
ip slb replicate slave rate	Sets the replication message rate for IOS Server Load Balancing (IOS SLB) slave replication.
replicate casa (virtual server)	Configures a stateful backup of IOS Server Load Balancing (IOS SLB) decision tables to a backup switch
replicate interval (virtual server)	Sets the replication delivery interval for an IOS Server Load Balancing (IOS SLB) virtual server.
show ip slb replicate	Displays the configuration of IOS Server Load Balancing (IOS SLB) IP replication.
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

request (custom UDP probe)

To define the payload of the User Datagram Protocol (UDP) request packet to be sent by a custom UDP probe, use the **request** command in custom UDP probe configuration mode.

request data {*start-byte* | **continue**} *hex-data-string*

Syntax Description

data *start-byte*	Identifies the payload offset at which the *hex-data-string* is to be placed into the packet.
data continue	String of characters represented by the *hex-data-string* argument is to be placed after the last defined byte in the request packet.
hex-data-string	Payload of the UDP request packet, up to 100 bytes of data in hexadecimal format.

Defaults

The payload of the UDP request packet is not defined.

Command Modes

Custom UDP probe configuration

Command History

Release	Modification
12.1(13)E3	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

You can enter more than one **request** command, to specify the entire UDP payload.

Examples

The following example generates custom UDP probe PROBE6, with the specified 119-byte UDP payload.

```
Router(config)# ip slb probe PROBE6 custom UDP
Router(config-slb-probe)# request data 0 05 04 00 77 18 2A D6 CD 0A AD 53 4D F1 29 29 CF
C1 96 59 CB
Router(config-slb-probe)# request data 20 01 07 63 68 72 69 73 28 06 00 00 00 01 2C 0A 30
30 30 30 30
Router(config-slb-probe)# request data 40 30 30 42 07 06 00 00 00 07 1E 10 63 75 66 66 2E
63 69 73 63
Router(config-slb-probe)# request data 60 6F 2E 63 6F 6D 1F 0C 39 31 39 33 39 32 39 31 36
39 08 06 0A
Router(config-slb-probe)# request data 80 0A 01 01 2D 06 00 00 00 01 3D 06 00 00 00 05 05
06 00 00 00
Router(config-slb-probe)# request data 100 00 06 06 00 00 00 02 04 06 0A 0A 18 0A 29 06 00
00 00 00
```

Related Commands

Command	Description
ip slb probe custom udp	Configures the IOS Server Load Balancing (IOS SLB) IP probe name.
response	Defines the data string to match against custom User Datagram Protocol (UDP) probe response packets.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

request (HTTP probe)

To configure an HTTP probe to check the status of the real servers, use the **request** command in HTTP probe configuration mode. To remove a **request** configuration, use the **no** form of this command.

request [**method** {**get** | **post** | **head** | **name** *name*}] [**url** *path*]

no request [**method** {**get** | **post** | **head** | **name** *name*}] [**url** *path*]

Syntax Description

method	(Optional) Configures the way the data is requested from the server.
get	(Optional) Configures the Get method to request data from the server.
post	(Optional) Configures the Post method to request data from the server.
head	(Optional) Configures the header data type to request data from the server.
name *name*	(Optional) Configures the name string of the data to send to the servers to request data. The character string is limited to 15 characters.
url *path*	(Optional) Configures the path from the server.

Defaults

No HTTP probe is configured to check the status of the real servers.

Command Modes

HTTP probe configuration

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The **request** command configures the IOS Server Load Balancing (IOS SLB) HTTP probe method used to receive data from the server. Only one IOS SLB HTTP probe can be configured for each server farm.

If no values are configured following the **method** keyword, the default is Get.

If no URL path is set to the server, the default is /.

Examples

The following example configures an IOS SLB HTTP probe named PROBE2, enters HTTP probe configuration mode, and configures HTTP requests to use the post method and the URL /probe.cgi?all:

```
Router(config)# ip slb probe PROBE2 http
Router(config-slb-probe)# request method post url /probe.cgi?all
```

Related Commands

Command	Description
ip slb probe http	Configures the IOS Server Load Balancing (IOS SLB) IP probe name.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

response

To define the data string to match against custom User Datagram Protocol (UDP) probe response packets, use the **response** command in custom UDP probe configuration mode.

response *clause-number* **data** *start-byte hex-data-string*

Syntax Description

clause-number	Identifies the response clause that is being modified. Up to 8 response clauses can be specified, on individual **response** commands.
data *start-byte*	Byte in the UDP response packet at which the *hex-data-string* is to be matched.
hex-data-string	Up to 100 bytes of data, in hexadecimal format, that is to be matched against the UDP response packet payload. If the data does not match, the probe fails.

Defaults

The data string to match against custom UDP probe response packets is not defined.

Command Modes

Custom UDP probe configuration

Command History

Release	Modification
12.1(13)E3	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

You can enter up to 8 individual response commands, to parse up to 8 non-contiguous bytes of data.

Examples

In the following example, if the 26th and 27th bytes of the response from *PROBE6* are not *FF FF*, and the 44th and 45th bytes are not *DD DD*, the probe fails.

```
Router(config)# ip slb probe PROBE6 custom UDP
Router(config-slb-probe)# response 1 data 26 FF FF
Router(config-slb-probe)# response 2 data 44 DD DD
```

Related Commands

Command	Description
ip slb probe custom udp	Configures the IOS Server Load Balancing (IOS SLB) IP probe name.
request (custom UDP probe)	Defines the payload of the User Datagram Protocol (UDP) request packet to be sent by a custom UDP probe.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

retry (real server)

To specify how long to wait before a new connection is attempted to a failed server, use the **retry** command in SLB real server configuration mode. To restore the default retry value, use the **no** form of this command.

retry *retry-value*

no retry

Syntax Description

retry-value	Time, in seconds, to wait after the detection of a server failure before a new connection to the server is attempted. If the new connection attempt succeeds, the real server is placed in OPERATIONAL state. If the connection attempt fails, the timer is reset, the connection is reassigned, and the process repeats until it is successful or until the server is placed in the OUTOFSERVICE state by the network administrator. Valid values range from 1 to 3600. The default value is 60 seconds. A value of 0 means do not attempt a new connection to the server when it fails.

Defaults

The default retry-value is 60 seconds.

Command Modes

SLB real server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example specifies that 120 seconds must elapse after the detection of a server failure before a new connection is attempted:

```
Router(config)# ip slb serverfarm PUBLIC
Router(config-slb-sfarm)# real 10.10.1.1
Router(config-slb-real)# retry 120
```

Related Commands

Command	Description
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
show ip slb reals	Displays information about the real servers.
show ip slb serverfarms	Displays information about the server farm configuration.

serverfarm

To associate a real server farm with a virtual server, and optionally configure a backup server farm and specify that sticky connections are to be used in the backup server farm, use the **serverfarm** command in SLB virtual server configuration mode. To remove the server farm association from the virtual server configuration, use the **no** form of this command.

serverfarm *primary-farm* [**backup** *backup-farm* [**sticky**]] [**map** *map-id* **priority** *priority*]

no serverfarm *primary-farm* [**backup** *backup-farm* [**sticky**]] [**map** *map-id* **priority** *priority*]

Syntax Description

primary-farm	Name of a server farm that has already been defined using the **ip slb serverfarm** command.
backup *backup-farm*	(Optional) Specifies the name of a backup server farm that has already been defined using the **ip slb serverfarm** command.
sticky	(Optional) Specifies that sticky connections are to be used in the backup server farm.
map *map-id* **priority** *priority*	(Optional) Associates an IOS SLB GPRS Tunneling Protocol (GTP) or RADIUS map with the server farm for general packet radio service (GPRS) or RADIUS load balancing. The map ID identifies a specific map that has already been defined using the **ip slb map** command. The priority specifies the order of preference of the specified map. A lower number indicates a higher priority. The range of priorities is 1 to 255. Priorities for different maps do not have to be contiguous. That is, you can have three maps with priorities 1, 5, and 10, respectively. When IOS SLB searches for a match, it does so on the basis of both the map ID and the map priority. Each map ID and each map priority must be unique across all server farms associated with the virtual server. That is, you cannot configure more than one map with the same ID or priority.

Command Default

No real server farm is associated with a virtual server.

Command Modes

SLB virtual server configuration (config-slb-vserver)

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(8a)E	The **backup** and **sticky** keywords and the *backup-farm* argument were added.

Release	Modification
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(33)SRB	The **map** and **priority** keywords and the *map-id* and *priority* arguments were added.

Usage Guidelines

General packet radio service (GPRS) load balancing, RADIUS load balancing, and the Home Agent Director do not support the **sticky** keyword.

If **backup** *backup-farm* is not specified, no backup server farm is configured.

If a backup server farm is configured but the **sticky** keyword is not specified, sticky connections are not used in the backup server farm.

You can associate more than one server farm with a given virtual server by configuring more than one **serverfarm** command, each with a unique map ID and a unique priority. (That is, each map ID and each map priority must be unique across all server farms associated with the virtual server.)

For GPRS load balancing, if a real server is defined in two or more server farms, each server farm must be associated with a different virtual server.

If you associate a primary server farm with a backup server farm, then all of the server farm maps that use that primary server farm must also be configured to use that same backup serverfarm. You cannot configure a server farm map that uses that primary server farm and no backup server farm. For example, if you configure primary server farm SF1 with backup server farm SF2, then all of the server farm maps that are configured with SF1 as the primary serverfarm must also be configured with SF2 as the backup serverfarm, as follows:

```
ip slb vserver RADIUS
 virtual 2.2.2.2 udp 0 service radius
 serverfarm SF1 backup SF2 map 1 priority 1
 serverfarm SF1 backup SF2
 inservice
```

You cannot configure a server farm map to use SF1 as the primary server farm and no backup server farm. That is, the following is not allowed:

```
ip slb vserver RADIUS
 virtual 2.2.2.2 udp 0 service radius
 serverfarm SF1 map 1 priority 1
 serverfarm SF1 backup SF2
 inservice
```

The backup server farm associated with an IOS SLB protocol map cannot be associated as a backup server farm with any other map in a given virtual server.

Examples

The following example shows how the **ip slb vserver**, **virtual**, and **serverfarm** commands are used to associate the real server farm named PUBLIC with the virtual server named PUBLIC_HTTP.

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# virtual 10.0.0.1 tcp www
Router(config-slb-vserver)# serverfarm PUBLIC
```

Related Commands

Command	Description
ip slb serverfarm	Identifies a server farm and enters server farm configuration mode.
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).
virtual	Configures the virtual server attributes.

show fm slb counters

To display information about the Feature Manager (FM) IOS Server Load Balancing (IOS SLB) counters, use the **show fm slb counters** command in privileged EXEC mode.

show fm slb counters

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.2(18)SXF5	This command was introduced.

Examples

The following sample output from the **show fm slb counters** command shows counter information for virtual server 10.11.11.11:

```
Router# show fm slb counters
FM SLB Purge Counters:
Global Purges:    0
TCP Purges:       0
UDP Purges:       0
Virtual Purges:   0
Flow Purges:      0

FM SLB Netflow Install Counters
[Slot 6 ] Install Request Sent          3
```

Table 9 describes the fields shown in the display.

Table 2 show fm slb counters Field Descriptions

Field	Description
Global Purges	Number of global purges sent by FM IOS SLB.
TCP Purges	Number of TCP purges sent by FM IOS SLB.
UDP Purges	Number of UDP purges sent by FM IOS SLB.
Virtual Purges	Number of virtual purges sent by FM IOS SLB.
Flow Purges	Number of flow purges sent by FM IOS SLB.
Install Request Sent	Number of install requests sent by IOS SLB.

Related Commands

Command	Description
clear fm slb counters	Clears Feature Manager (FM) IOS Server Load Balancing (IOS SLB) counters.

show ip slb conns

To display the active IOS Server Load Balancing (IOS SLB) connections (or sessions, in GPRS load balancing and the Home Agent Director), use the **show ip slb conns** command in privileged EXEC mode.

show ip slb conns [**vserver** *virtual-server* | **client** *ip-address* | **firewall** *firewall-farm*] [**detail**]

Syntax Description

vserver *virtual-server*	(Optional) Displays only those connections (or sessions, in GPRS load balancing and the Home Agent Director) associated with the specified virtual server.
client *ip-address*	(Optional) Displays only those connections (or sessions, in GPRS load balancing and the Home Agent Director) associated with the specified client IP address.
firewall *firewall-farm*	(Optional) Displays only those connections (or sessions, in GPRS load balancing and the Home Agent Director) associated with the specified firewall farm.
detail	(Optional) Displays detailed information information about the connection (or session, in GPRS load balancing and the Home Agent Director).

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(7)E	The **firewall** keyword and *firewall-farm* argument were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

If no options are specified, the command displays output for all active IOS SLB connections (or sessions, in GPRS load balancing and the Home Agent Director).

Examples

The following is sample output from the **show ip slb conns** command:

```
Router# show ip slb conns

vserver           prot   client               real                 state
-------------------------------------------------------------------------------
TEST              TCP    7.150.72.183:328     80.80.90.25:80       INIT
TEST              TCP    7.250.167.226:423    80.80.90.26:80       INIT
TEST              TCP    7.234.60.239:317     80.80.90.26:80       ESTAB
TEST              TCP    7.110.233.96:747     80.80.90.26:80       ESTAB
```

```
TEST             TCP    7.162.0.201:770      80.80.90.30:80       CLOSING
TEST             TCP    7.22.225.219:995     80.80.90.26:80       CLOSING
TEST             TCP    7.2.170.148:169      80.80.90.30:80       ZOMBIE
```

Table 29 describes the fields shown in the display.

Table 3 show ip slb conns Field Descriptions

Field	Description
vserver	Name of the virtual server associated with the connection (or session, in GPRS load balancing and the Home Agent Director).
prot	Protocol being used by the connection (or session, in GPRS load balancing and the Home Agent Director).
client	Client IP address associated with the connection (or session, in GPRS load balancing and the Home Agent Director).
real	Real server IP address associated with the connection (or session, in GPRS load balancing and the Home Agent Director).
state	Current state of the connection (or session, in GPRS load balancing and the Home Agent Director). • CLOSING—The connection is closing. • ESTAB—The connection has been established and is operational. • INIT—The connection is being initialized. • ZOMBIE—The connection is currently pending destruction (awaiting a timeout or some other condition to be met).

show ip slb dfp

To display Dynamic Feedback Protocol (DFP) manager and agent information, such as passwords, timeouts, retry counts, and weights, use the **show ip slb dfp** command in privileged EXEC mode.

show ip slb dfp [**agent** *agent-ip port* | **manager** *manager-ip* | **detail** | **weights**]

Syntax Description

agent	(Optional) Displays information about an agent.
agent-ip	(Optional) Agent IP address.
port	(Optional) Agent TCP or User Datagram Protocol (UDP) port number.
manager	(Optional) Displays information about the specified manager.
manager-ip	(Optional) Manager IP address.
detail	(Optional) Displays all data available.
weights	(Optional) Displays information about weights assigned to real servers for load balancing.

Defaults

If no options are specified, the command displays summary information.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(5a)E	The **manager** keyword and *manager-ip* argument were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

If no options are specified, the command displays summary information.

Examples

The following sample output from the **show ip slb dfp** command displays high-level information about all DFP agents and managers:

```
Router# show ip slb dfp
DFP Manager:
      Current passwd:NONE Pending passwd:NONE
      Passwd timeout:0 sec

Agent IP          Port    Timeout   Retry Count   Interval
---------------------------------------------------------------
161.44.2.34       61936   0         0             180 (Default)
```

Table 4 describes the fields shown in the display.

Table 4 show ip slb dfp Field Descriptions

Field	Description
DFP Manager	Indicates that the following information applies to the DFP manager.
Current passwd	Current password for the DFP manager, if any.
Pending passwd	Pending password for the DFP manager, if any.
Passwd timeout	For the DFP manager, delay period, in seconds, during which both the current password and the pending password are accepted.
Agent IP	IP address of the agent about which information is being displayed.
Port	TCP or UDP port number of the agent. The valid range is 1 to 65535.
Timeout	Time period, in seconds, during which the DFP manager must receive an update from the DFP agent. A value of 0 means there is no timeout.
Retry Count	Number of times the DFP manager attempts to establish the TCP connection to the DFP agent. A value of 0 means there are infinite retries.
Interval	Interval, in seconds, between retries.

The following example displays detailed information about DFP agents and managers:

```
Router# show ip slb dfp detail
DFP Manager
      Current passwd <none> Pending passwd <none>
      Passwd timeout 0 sec
      Unexpected errors 0
% No DFP Agents configured
```

Table 5 describes the fields shown in the display.

Table 5 show ip slb dfp detail Field Descriptions

Field	Description
DFP Manager	Indicates that the following information applies to the DFP manager.
Current passwd	Current DFP password for MD5 authentication.
Pending passwd	Pending new DFP password for MD5 authentication.
Passwd timeout	Delay period, in seconds, during which both the current password and the pending password are accepted.
Unexpected errors	Number of unexpected errors encountered by th DFP manager.
No DFP Agents configured	Indicates that there are no DFP agents associated with th DFP manager.

The following example displays detailed information about DFP manager 55.55.55.2:

```
Router# show ip slb dfp manager 55.55.55.2
DFP Manager 55.55.55.2 Connection state Connected
   Timeout = 20
   Last message sent 033537 UTC 01/02/00
```

Table 6 describes the fields shown in the display.

Table 6 show ip slb dfp manager Field Descriptions

Field	Description
DFP Manager	Indicates that the following information applies to the DFP manager.
Connection state	Current connection state of the DFP manager.
Timeout	Time period, in seconds, during which the DFP manager must receive an update from the DFP agent. A value of 0 means there is no timeout.
Last message sent	Date and time of the last message sent by the DFP manager.

The following example displays detailed information about weights assigned to real servers for load balancing:

```
Router# show ip slb dfp weights
Real IP Address 17.17.17.17 Protocol TCP Port 22 Bind_ID 111 Weight 111
      Set by Agent 161.44.2.3458490 at 132241 UTC 12/03/99
Real IP Address 17.17.17.17 Protocol TCP Port www Bind_ID 1 Weight 1
      Set by Agent 161.44.2.3458490 at 132241 UTC 12/03/99
Real IP Address 68.68.68.68 Protocol TCP Port www Bind_ID 4 Weight 4
      Set by Agent 161.44.2.3458490 at 132241 UTC 12/03/99
Real IP Address 85.85.85.85 Protocol TCP Port www Bind_ID 5 Weight 5
      Set by Agent 161.44.2.3458490 at 132241 UTC 12/03/99
```

Table 7 describes the fields shown in the display.

Table 7 show ip slb dfp weights Field Descriptions

Field	Description
Real IP Address	IP address of the real server for which weight is reported.
Protocol	Protocol used for the port.
Port	Port for which the following bind ID is being reported.
Bind_ID	Bind ID of this instance of the real server.
Weight	Weight calculated for the real IP address.
Set by Agent	Agent that set the weight, and the date and time the weight was set.

show ip slb firewallfarm

To display firewall farm information, use the **show ip slb firewallfarm** command in privileged EXEC mode.

show ip slb firewallfarm [**detail**]

Syntax Description

detail	(Optional) Displays detailed information.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following is sample output from the **show ip slb firewallfarm** command:

```
Router# show ip slb firewallfarm

firewall farm    hash        state         reals
------------------------------------------------
FIRE1            IPADDR      OPERATIONAL     2
```

Table 8 describes the fields shown in the display.

Table 8 show ip slb firewallfarm Field Descriptions

Field	Description
firewall farm	Name of the firewall farm.
hash	Load-balancing algorithm used to select a firewall for the firewall farm: • IPADDR—Uses the source and destination IP addresses in the algorithm. • IPADDRPORT—Uses the source and destination TCP or User Datagram Protocol (UDP) port numbers, in addition to the source and destination IP addresses, in the algorithm. See the **predictor hash address (firewall farm)** command for more details.
state	Current state of the firewall farm: • OPERATIONAL—Functioning properly. • OUTOFSERVICE—Removed from the load-balancing predictor lists. • STANDBY—Backup firewall farm, ready to become operational if the active firewall farm fails.
reals	Number of firewalls that are members of the firewall farm.

show ip slb fragments

To display information from the IOS Server Load Balancing (IOS SLB) fragment database, use the **show ip slb fragments** command in privileged EXEC mode.

show ip slb fragments

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following sample output from the **show ip slb fragments** command shows fragment information for virtual server 10.11.11.11:

```
Router# show ip slb fragments

ip src          id    forward         src nat         dst nat
---------------------------------------------------------------------
10.11.2.128     12    10.11.2.128     10.11.11.11     10.11.2.128
10.11.2.128     13    10.11.2.128     10.11.11.11     10.11.2.128
10.11.2.128     14    10.11.2.128     10.11.11.11     10.11.2.128
10.11.2.128     15    10.11.2.128     10.11.11.11     10.11.2.128
10.11.2.128     16    10.11.2.128     10.11.11.11     10.11.2.128
```

Table 9 describes the fields shown in the display.

Table 9 show ip slb fragments Field Descriptions

Field	Description
ip src	Source IP address of the fragment.
id	IP ID of the fragment, set by the packet originator.
forward	IP address to which the fragment is being forwarded.
src nat	If using Network Address Translation (NAT), new source IP address after NAT.
dst nat	If using NAT, new destination IP address after NAT.

show ip slb gtp

To display IOS Server Load Balancing (IOS SLB) general packet radio service (GPRS) Tunneling Protocol (GTP) information, use the **show ip slb gtp** command in privileged EXEC mode.

show ip slb gtp {**gsn** [*gsn-ip-address*] | **nsapi** [*nsapi-key*] [**detail**]}

Syntax Description

gsn	(Optional) Displays IOS SLB database information for the specified gateway GPRS support node (GGSN) or serving GPRS support node (SGSN).
gsn-ip-address	(Optional) IP address of the GGSN or SGSN for which information is to be displayed. If you do not specify a *gsn-ip-address*, IOS SLB displays information for all GGSNs and SGSNs.
nsapi	(Optional) Displays IOS SLB database information for the specified Network Service Access Point Identifier (NSAPI).
nsapi-key	(Optional) Key of the NSAPI for which information is to be displayed. If you do not specify an *nsapi-key*, IOS SLB displays information for all NSAPIs.
detail	(Optional) Displays additional, more detailed information.

Defaults

If you specify **gsn** and you do not specify a *gsn-ip-address*, IOS SLB displays information for all GGSNs and SGSNs.
If you specify **nsapi** and you do not specify an *nsapi-key*, IOS SLB displays information for all NSAPIs.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(13)E3	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following is sample output from the **show ip slb gtp gsn** command for a specific GGSN or SGSN:

```
Router# show ip slb gtp gsn 12.12.12.1

type ip              recovery-ie  purging
------------------------------------------
SGSN 12.12.12.1      UNKNOWN      N
```

Table 10 describes the fields shown in the display.

Table 10 show ip slb gtp gsn Field Descriptions

Field	Description
type	Type of GSN (either GGSN or SGSN).
ip	IP address of the GGSN or SGSN.

Table 10 show ip slb gtp gsn Field Descriptions (continued)

recovery-ie	Last seen recovery IE for this GGSN or SGSN.
purging	Indicates whether Packet Data Protocol (PDP) contexts belonging to this GGSN or SGSN are being purged as a result of path failure: • **Y (Yes)**—PDP contexts are being purged. • **N (No)**—PDP contexts are not being purged.

The following is sample output from the **show ip slb gtp nsapi** command:

```
Router# show ip slb gtp nsapi

nsapi key        real                    nsapi count session count
------------------------------------------------------------------
11111111111111F1 112.112.112.3           1           1
```

The following is sample output from the **show ip slb gtp nsapi** command for a specific NSAPI key:

```
Router# show ip slb gtp nsapi 11111111111111F1

nsapi key        real                    nsapi count session count
------------------------------------------------------------------
11111111111111F1 112.112.112.3           1           1
```

Table 11 describes the fields shown in the display.

Table 11 show ip slb gtp nsapi Field Descriptions

Field	Description
nsapi key	Key for the session. This is the IMSI.
real	Real server to which the session is assigned.
nsapi count	Number of NSAPIs bound to the session. This is the number of PDP contexts (mobile sessions) on the GGSN associated with the IMSI.
session count	Number of sessions to which the NSAPI is currently bound. Normally, the NSAPI is bound to one session, but it is bound to two sessions in transition during an update.

The following is sample output from the **show ip slb gtp nsapi detail** command:

```
Router# show ip slb gtp nsapi detail

IMSI key = 11111111111111F1, real = 112.112.112.3, nsapi count = 1, session count = 1
no vserver          key              client                  state      seq
----------------------------------------------------------------------------
5  SERVER1          0009E8810009E881 12.12.12.1:2123         GTP_INIT   0
```

Table 12 describes the fields shown in the display.

Table 12 show ip slb gtp nsapi detail Field Descriptions

Field	Description
IMSI key	IMSI key for the session.
real	Real server to which the session is assigned.
nsapi count	Number of NSAPIs bound to the session. This is the number of PDP contexts (mobile sessions) on the GGSN associated with this IMSI.
session count	Number of sessions to which the NSAPI is currently bound. Normally, the NSAPI is bound to one session, but it is bound to two sessions in transition during an update.
no	NSAPI number.
vserver	Name of the virtual server.
key	Session key.
client	SGSN IP address and port number.
state	State of the session. Possible states are: • **GTP_ESTAB**—The session has been established successfully. • **GTP_INIT**—The PDP contexts have been deleted as a result of a delete request or a deletion in GGSN, and IOS SLB is waiting to destroy the session after the GTP_TIMEOUT. • **GTPIO_REQ_CLIENT**—Waiting for a response from the real server.
seq	Sequence number in the last delete request.

show ip slb natpool

To display the IP IOS Server Load Balancing (IOS SLB) Network Address Translation (NAT) configuration, use the **show ip slb natpool** command in privileged EXEC mode.

show ip slb natpool [**name** *pool*] [**detail**]

Syntax Description

name *pool*	(Optional) Displays the specified NAT pool.
detail	(Optional) Lists all the interval ranges currently allocated in the client NAT pool.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following is sample output from the default **show ip slb natpool** command:

```
Router# show ip slb natpool
nat client B  1.1.1.6  1.1.1.8  Netmask 255.255.255.0
nat client A  1.1.1.1  1.1.1.5  Netmask 255.255.255.0
```

The following is sample output from the **show ip slb natpool** command with the **detail** parameter:

```
Router# show ip slb natpool detail
nat client A  1.1.1.1  1.1.1.5  Netmask 255.255.255.0
     Start NAT        Last NAT         Count     ALLOC/FREE
     -------------------------------------------------------
     1.1.1.1:11001    1.1.1.1:16333    0005333   ALLOC
     1.1.1.1:16334    1.1.1.1:19000    0002667   ALLOC
     1.1.1.1:19001    1.1.1.5:65535    0264675   FREE

nat client B  1.1.1.6  1.1.1.8  Netmask 255.255.255.0
     Start NAT        Last NAT         Count     ALLOC/FREE
     -------------------------------------------------------
     1.1.1.6:11001    1.1.1.6:16333    0005333   ALLOC
     1.1.1.6:16334    1.1.1.6:19000    0002667   ALLOC
     1.1.1.6:19001    1.1.1.8:65535    0155605   FREE
```

Table 13 describes the fields shown in the display.

Table 13 show ip slb napool detail Field Descriptions

Field	Description
Start NAT	Starting NAT address in a range of addresses in the client NAT pool.
Last NAT	Last NAT address in a range of addresses in the client NAT pool.

Table 13 show ip slb napool detail Field Descriptions (continued)

Count	Number of NAT addresses in the range.
ALLOC/FREE	Indicates whether the range of NAT addresses has been allocated or is free.

Related Commands

Command	Description
ip slb natpool	Configures the IOS Server Load Balancing (IOS SLB) Network Address Translation (NAT).

show ip slb probe

To display information about an IOS Server Load Balancing (IOS SLB) probe, use the **show ip slb probe** command in privileged EXEC mode.

show ip slb probe [**name** *probe*] [**detail**]

Syntax Description

name *probe*	(Optional) Displays information about the specified probe.
detail	(Optional) Displays detailed information, including the SA Agent operation ID, which you can correlate with the output of the **show rtr operational-state** command in EXEC mode.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following is sample output from the **show ip slb probe** command:

```
Router# show ip slb probe

Server:Port            State        Outages  Current  Cumulative
----------------------------------------------------------------
10.10.4.1:0            OPERATIONAL        0  never    00:00:00
10.10.5.1:0            FAILED             1  00:00:06 00:00:06
```

Table 14 describes the fields shown in the display.

Table 14 show ip slb probe Field Descriptions

Field	Description
Server:Port	IP address and port of the real server.
State	Operational state of the probe: • FAILED—The probe has succeeded in the past but has currently failed. • OPERATIONAL—The probe is functioning normally. • TESTING—The probe has never succeeded, due to no response. IOS SLB keeps no counters or timers for this state. For a detailed listing of real server states, see the **show ip slb reals** command.
Outages	Number of intervals between successful probes.

Table 14 show ip slb probe Field Descriptions (continued)

Current	Time since the last probe success. That is, the duration (so far) of the current outage.
Cumulative	Total time the real server has been under test by the probe and has failed the probe test. This value is the sum of the Current time plus the total time of all previous outages.

show ip slb reals

To display information about the real servers, use the **show ip slb reals** command in privileged EXEC mode.

show ip slb reals [**sfarm** *server-farm*] [**detail**]

Syntax Description

sfarm *server-farm*	(Optional) Displays information about those real servers associated with the specified server farm or firewall farm.
detail	(Optional) Displays detailed information.

Command Modes

Privileged EXEC (#)

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(13)E	The **vserver** keyword and *virtual-server* argument were replaced with the **sfarm** keyword and *server-farm* argument.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.
12.2(33)SRC	The output for the **detail** keyword for a real server in a server farm was updated to display the configured maximum number of connections allowed (**rate**).
15.0(1)S	The output for the **detail** keyword for a real server in a server farm was updated to display the real server's IPv4, IPv6, or dual-stack address.

Usage Guidelines

If no options are specified, the command displays information about all real servers.

In a configuration with stateful backup, if a probe changes state at the same time that the primary IOS SLB device fails over to the backup IOS SLB device, the output from the **show ip slb reals** command for the backup device displays the state of the probe before the failover, not the actual current state.

Examples

The following is sample output from the **show ip slb reals** command:

```
Router# show ip slb reals

real              farm name        weight   state           conns
-------------------------------------------------------------------
10.80.2.112       FRAG             8        OUTOFSERVICE    0
10.80.5.232       FRAG             8        OPERATIONAL     0
10.80.15.124      FRAG             8        OUTOFSERVICE    0
10.254.2.2        FRAG             8        OUTOFSERVICE    0
10.80.15.124      LINUX            8        OPERATIONAL     0
```

```
10.80.15.125     LINUX            8        OPERATIONAL     0
10.80.15.126     LINUX            8        OPERATIONAL     0
10.80.90.25      SRE              8        OPERATIONAL     220
10.80.90.26      SRE              8        OPERATIONAL     216
10.80.90.27      SRE              8        OPERATIONAL     216
10.80.90.28      SRE              8        TESTING         1
10.80.90.29      SRE              8        OPERATIONAL     221
10.80.90.30      SRE              8        OPERATIONAL     224
10.80.30.3       TEST             100      READY_TO_TEST   0
10.80.30.4       TEST             100      READY_TO_TEST   0
10.80.30.5       TEST             100      READY_TO_TEST   0
10.80.30.6       TEST             100      READY_TO_TEST   0
```

Table 15 describes the fields shown in the display.

Table 15   show ip slb reals Field Descriptions

Field	Description
real	IP address of the real server about which information is being displayed. Used to identify each real server. Information about each real server is displayed on a separate line.
farm name	Name of the server farm or firewall farm with which the real server is associated.
weight	Weight assigned to the real server. The weight identifies the real server's capacity, relative to other real servers in the server farm.
state	Current state of the real server. • DFP_THROTTLED—The Dynamic Feedback Protocol (DFP) agent sent a weight of 0 for this real server (send no further connections to this real server). • FAILED—The real server has failed as a result of either no response or reset (RST) responses to client traffic. (See the **faildetect numconns (real server)** command for more information about controlling tolerance for no responses and RSTs.) The real server has been removed from use by the predictor algorithms. The retry timer has started. • MAXCONNS_THROTTLE—The number of connections on the real server exceeds the configured maximum number of simultaneous active connections (**maxconns**). • OPERATIONAL—The real server is functioning properly and is being used for load-balancing. • OPER_WAIT—The real server is waiting to become operational (waiting for a timeout or some other condition to be met). • OUTOFSERVICE—The real server was configured with **no inservice** and has been removed from the load-balancing predictor lists. • PROBE_FAILED—The probe has succeeded in the past but has currently failed. This failure might occur at the same time user connections fail, or it might not. • PROBE_TESTING—The probe has never succeeded, due to no response. The initial probe timed out waiting for a success.

Table 15 show ip slb reals Field Descriptions (continued)

	• READY_TO_TEST—The real server is queued for testing after being in FAILED state until the retry timer expired. • TESTING—The real server is queued for assignment. When a single user connection is assigned to a real server that is in READY_TO_TEST state, the real server is placed in TESTING state. If the test succeeds, the real server is placed back in OPERATIONAL state. • TEST_WAIT—The real server is waiting to begin testing (waiting for a timeout or some other condition to be met).
conns	Number of connections associated with the real server. In general packet radio service (GPRS) load balancing, number of sessions associated with the real server. In per-packet server load balancing, number of request packets that have been load balanced to each real server, using the connection count.

The following is sample output from the **show ip slb reals detail** command for a dual-stack real server in a server farm:

```
Router# show ip slb reals detail

172.16.88.5, SF1, state = OPERATIONAL, type = server
  ipv6 = 2342:2342:2343:FF04:2388:BB03:3223:8912
  conns = 0, dummy_conns = 0, maxconns = 4294967295
  weight = 8, weight(admin) = 8, metric = 0, remainder = 0
  reassign = 3, retry = 60
  failconn threshold = 8, failconn count = 0
  failclient threshold = 2, failclient count = 0
  total conns established = 0, total conn failures = 0
  server failures = 0
```

The following is sample output from the **show ip slb reals detail** command for a real server in a firewall farm:

```
Router# show ip slb reals detail

10.10.3.2, F, state = OPERATIONAL, type = firewall
  conns = 0, dummy_conns = 0, maxconns = 4294967295
  weight = 8, weight(admin) = 8, metric = 0, remainder = 0
  total conns established = 8377, hash count = 0
  server failures = 0
  interface FastEthernet1/0, MAC 0000.0c41.1063
```

Table 16 describes the fields shown in the above detail displays.

Table 16 show ip slb reals detail Field Descriptions

Field	Description
IPv4 or IPv6 address	IPv4 or IPv6 address of the real server about which information is being displayed. Used to identify each real server. Information about each real server is displayed on a separate line.
farm name	Name of the server farm or firewall farm with which the real server is associated.

Table 16 show ip slb reals detail Field Descriptions (continued)

state	Current state of the real server. • DFP_THROTTLED—The Dynamic Feedback Protocol (DFP) agent sent a weight of 0 for this real server (send no further connections to this real server). • FAILED—The real server has failed as a result of either no response or reset (RST) responses to client traffic. (See the **faildetect numconns (real server)** command for more information about controlling tolerance for no responses and RSTs.) The real server has been removed from use by the predictor algorithms. The retry timer has started. • MAXCONNS_THROTTLE—The number of connections on the real server exceeds the configured maximum number of simultaneous active connections (**maxconns**). • OPERATIONAL—The real server is functioning properly and is being used for load-balancing. • OPER_WAIT—The real server is waiting to become operational (waiting for a timeout or some other condition to be met). • OUTOFSERVICE—The real server was configured with **no inservice** and has been removed from the load-balancing predictor lists. • PROBE_FAILED—The probe has succeeded in the past but has currently failed. This failure might occur at the same time user connections fail, or it might not. • PROBE_TESTING—The probe has never succeeded, due to no response. The initial probe timed out waiting for a success. • READY_TO_TEST—The real server is queued for testing after being in FAILED state until the retry timer expired. • TESTING—The real server is queued for assignment. When a single user connection is assigned to a real server that is in READY_TO_TEST state, the real server is placed in TESTING state. If the test succeeds, the real server is placed back in OPERATIONAL state. • TEST_WAIT—The real server is waiting to begin testing (waiting for a timeout or some other condition to be met).
type	Indicates whether the real server is associated with a server farm (server) or firewall farm (firewall).
ipv6	IPv6 address of the real server about which information is being displayed, if dual-stack.
conns	Number of connections associated with the real server. In general packet radio service (GPRS) load balancing, number of sessions associated with the real server. In per-packet server load balancing, number of request packets that have been load balanced to each real server, using the connection count.
dummy_conns	Internal counter used in debugging.
maxconns	Maximum number of active connections allowed on the real server at one time.

Table 16 show ip slb reals detail Field Descriptions (continued)

weight	Weight assigned to the real server. The weight identifies the real server's capacity, relative to other real servers in the server farm. This value could be changed by DFP.
weight(admin)	Configured (or default) weight assigned to the real server.
metric	Internal counter used in debugging.
remainder	Internal counter used in debugging.
reassign	Total number of consecutive unacknowledged SYNchronize sequence numbers (SYNs) or Create Packet Data Protocol (PDP) requests since the last time the **clear ip slb counters** command was issued.
retry	Interval, in seconds, to wait between the detection of a failure on the real server and the next attempt to connect to the server.
rate	Maximum number of connections per second allowed on the real server.
failconn threshold	Maximum number of consecutive connection failures allowed before the real server is considered to have failed.
failconn count	Total number of consecutive connection failures since the last time the **clear ip slb counters** command was issued.
failclient threshold	Maximum number of unique client connection failures allowed before the real server is considered to have failed.
failclient count	Total number of unique client connection failures since the last time the **clear ip slb counters** command was issued.
total conns established	Total number of successful connection assignments since the last time the **clear ip slb counters** command was issued.
total conn failures	Total number of unsuccessful connection assignments since the last time the **clear ip slb counters** command was issued.
server failures	Total number of times this real server has been marked failed.
hash count	Total number of times the hash algorithm has been called.
interface	Type of interface.
MAC	MAC address of the firewall.

show ip slb replicate

To display the IOS Server Load Balancing (IOS SLB) replication configuration, use the **show ip slb replicate** command in privileged EXEC mode.

show ip slb replicate

Syntax Description

This command has no arguments or keywords.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(2)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(14)ZA5	This command was modified to support slave replication.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following is sample output from the **show ip slb replicate** command:

```
Router# show ip slb replicate
VS1, state = NORMAL, interval = 10
 Slave Replication: Enabled
 Slave Replication statistics:
  unsent conn updates:         0
  conn updates received:       0
  conn updates transmitted:    0
  update messages received:    0
  update messages transmitted: 0
 Casa Replication:
  local = 1.1.1.1 remote = 2.2.2.2 port = 1024
  current password = <none> pending password = <none>
  password timeout = 180 sec (Default)
 Casa Replication statistics:
  unsent conn updates:        0
  conn updates received:      0
  conn updates transmitted:   0
  update packets received:    0
  update packets transmitted: 0
  failovers:                  0
```

Table 17 describes the fields shown in the display.

Table 17 show ip slb replicate Field Descriptions

Field	Description
state	Current replication state of the virtual server: • DUMPING—Dumping the connection table to the Hot Standby Router Protocol (HSRP) peer device. • NORMAL—Functioning properly. • PREEMPTING—Preparing to preempt the HSRP peer device and assume an active role.
interval	Replication buffering interval, in seconds.
Slave Replication	Indicates whether Slave Replication is enabled or disabled.
unsent conn updates	Number of Slave Replication or CASA Replication connection updates waiting to be sent.
conn updates received	Number of Slave Replication or CASA Replication connection updates received.
conn updates transmitted	Number of Slave Replication or CASA Replication connection updates sent.
update packets received	Number of Slave Replication or CASA Replication connection update packets received.
update packets transmitted	Number of Slave Replication or CASA Replication connection update packets sent.
local	Listening IP address for CASA Replication state exchange messages that are advertised.
remote	Destination IP address for all CASA Replication state exchange signals.
port	TCP or User Datagram Protocol (UDP) port number or port name for all CASA Replication state exchange signals.
current password	Current CASA Replication password for Message Digest Algorithm Version 5 (MD5) authentication, if any.
pending password	Pending CASA Replication password for MD5 authentication, if any.
failovers	Number of CASA Replication failovers detected.

Related Commands

Command	Description
request (HTTP probe)	Configures an HTTP probe to check the status of the real servers.

show ip slb serverfarms

To display information about the server farms, use the **show ip slb serverfarms** command in privileged EXEC mode.

show ip slb serverfarms [**name** *serverfarm-name*] [**detail**]

Syntax Description

name	(Optional) Displays information about only a particular server farm.
serverfarm-name	(Optional) Name of the server farm.
detail	(Optional) Displays detailed server farm information.

Defaults

No default behavior or values.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following is sample output from the **show ip slb serverfarms** command:

```
Router# show ip slb serverfarms

server farm      predictor     reals   bind id
-------------------------------------------------
FRAG             ROUNDROBIN    4       0
LINUX            ROUNDROBIN    3       0
SRE              ROUNDROBIN    6       0
TEST             ROUNDROBIN    4       0
```

Table 18 describes the fields shown in the display.

Table 18 show ip slb serverfarms Field Descriptions

Field	Description
server farm	Name of the server farm about which information is being displayed. Information about each server farm is displayed on a separate line.
predictor	Type of load-balancing algorithm (ROUNDROBIN or LEASTCONNS) used by the server farm.

Table 18 show ip slb serverfarms Field Descriptions (continued)

reals	Number of real servers configured in the server farm.
bind id	Bind ID configured on the server farm.

show ip slb sessions

To display information about sessions handled by IOS Server Load Balancing (IOS SLB), use the **show ip slb sessions** command in privileged EXEC mode.

show ip slb sessions [**gtp** | **gtp-inspect** | **ipmobile** | **radius**] [**vserver** *virtual-server*] [**client** *ip-address netmask*] [**detail**]

Syntax Description

gtp	(Optional) Displays information about general packet radio service (GPRS) Tunneling Protocol (GTP) sessions being handled by IOS SLB.
gtp-inspect	(Optional) Displays information about GTP sessions being handled by IOS SLB that have GTP cause code inspection enabled.
ipmobile	(Optional) Displays information about Mobile IP sessions being handled by IOS SLB.
radius	(Optional) Displays information about RADIUS sessions being handled by IOS SLB.
vserver *virtual-server*	(Optional) Displays information about sessions being handled by the specified virtual server.
client *ip-address netmask*	(Optional) Displays information about sessions associated with the specified client IP address or subnet
detail	(Optional) Displays detailed information.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.1(13)E3	The **gtp** and **gtp-inspect** keywords were added.
12.2(14)ZA2	The **ipmobile** keyword was added.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following is sample output from the **show ip slb sessions** command for RADIUS sessions:

```
Router# show ip slb sessions radius

Source                Dest                   Retry
Addr/Port             Addr/Port           Id Count  Real             Vserver
------------------------------------------------------------------------------
10.10.11.1/1645       10.10.11.2/1812     15      1  10.10.10.1   RADIUS_ACCT
```

Table 19 describes the fields shown in the display.

Table 19 show ip slb sessions radius Field Descriptions

Field	Description
Source Addr/Port	Source IP address and port number for the session.
Dest Addr/Port	Destination IP address and port number for the session.
Id	RADIUS identifier for the session.
Retry Count	Number of times a RADIUS request was sent by a RADIUS client without receiving a response from the RADIUS server (proxy or otherwise).
Real	IP address of the SSG RADIUS server (proxy or otherwise).
Vserver	Name of the virtual server whose sessions are being monitored and displayed.

The following example shows IOS SLB GTP session data:

```
Router# show ip slb sessions gtp

vserver         key              client           real                  state
----------------------------------------------------------------------------------
10.10.10.10     1234567890123456 5.5.5.5          10.10.1.1             GTP_ESTAB
```

Table 20 describes the fields shown in the display.

Table 20 show ip slb sessions gtp Field Descriptions

Field	Description
vserver	Name of the virtual server whose GTP sessions are being monitored and displayed. Information about each session is displayed on a separate line.
key	Network Service Access Point Identifier (NSAPI) key being used by the GTP session.
client	Client IP address being used by the GTP session.
real	Real IP address of the GTP session.
state	Current state of the GTP session: • **GTP_ESTAB**—The session has been established successfully. • **GTP_INIT**—The Packet Data Protocol (PDP) contexts have been deleted as a result of a delete request or a deletion in gateway GPRS support node (GGSN), and IOS SLB is waiting to destroy the session after the GTP_TIMEOUT. • **GTPIO_REQ_CLIENT**—Waiting for a response from the real server.

The following example shows IOS SLB Mobile IP session data:

```
Router# show ip slb sessions ipmobile
vserver        NAI hash          client          real                retries
----------------------------------------------------------------------------
VIRTUAL_HA     0xFFFF            1.1.1.1/434     10.10.1.1           1
```

Table 21 describes the fields shown in the display.

Table 21 show ip slb sessions ipmobile Field Descriptions

Field	Description
vserver	Name of the virtual server whose Mobile IP sessions are being monitored and displayed. Information about each session is displayed on a separate line.
NAI hash	Network access identifier (NAI) in the Registration Request (RRQ), used by IOS SLB as a unique identifier.
client	Client IP address being used by the Mobile IP session.
real	Real IP address of the Mobile IP session.
retries	Number of foreign agent retries for the Mobile IP session.

show ip slb static

To display the IOS Server Load Balancing (IOS SLB) server Network Address Translation (NAT) configuration, use the **show ip slb static** command in privileged EXEC mode.

show ip slb static

Syntax Description

This command has no arguments or keywords.

Defaults

The default behavior is to display the entire IOS SLB server NAT configuration.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following is sample output from the **show ip slb static** command:

```
Router# show ip slb static

real                    action         address         counter
---------------------------------------------------------------
10.11.3.4               drop           0.0.0.0         0
10.11.3.1               NAT            10.11.11.11     3
10.11.3.2               NAT sticky     10.11.11.12     0
10.11.3.3               NAT per-packet 10.11.11.13     0
```

Table 22 describes the fields shown in the display.

Table 22 show ip slb static Field Descriptions

Field	Description
real	IP address of the real server.
action	Action to be taken by the real server: • drop—The real server is configured to have its packets dropped by IOS SLB, if the packets do not correspond to existing connections. • NAT—The real server is configured to use server NAT, and to use its own virtual IP address when translating addresses. • NAT per-packet—The real server is configured to use server NAT and per-packet server load balancing. • NAT sticky—The real server is configured to use server NAT for sticky connections. • pass-thru—The real server is not configured to use server NAT.
address	Virtual IP address used by the real server when translating addresses using server NAT. Address 0.0.0.0 means the real server is not configured for server NAT.
counter	For actions drop and NAT per-packet, indicates the number of packets processed by the real server. For actions NAT and NAT sticky, indicates the number of packets received by, but not necessarily processed by, the real server.

show ip slb stats

To display IOS Server Load Balancing (IOS SLB) statistics, use the **show ip slb stats** command in privileged EXEC mode.

show ip slb stats

Syntax Description

This command has no arguments or keywords.

Defaults

No default behavior or values.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(9)E	This command was modified to support general packet radio service (GPRS) load balancing.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Examples

The following is sample output from the **show ip slb stats** command:

```
Router# show ip slb stats
Pkts via normal switching:     779
Pkts via special switching:    0
Pkts via slb routing:          0
Pkts Dropped:                  4
Connections Created:           4
Connections Established:       4
Connections Destroyed:         4
Connections Reassigned:        5
Zombie Count:                  0
Connections Reused:            0
Connection Flowcache Purges:   0
Failed Connection Allocs:      0
Failed Real Assignments:       0
RADIUS framed-ip Sticky Count: 0
RADIUS username Sticky Count:            0
RADIUS calling-station-id Sticky Count:  0
GTP IMSI Sticky Count:         0
```

Table 23 describes the fields shown in the display.

Table 23 show ip slb stats Field Descriptions

Field	Description
Pkts via normal switching	Number of packets handled by IOS SLB via normal switching since the last time counters were cleared. Normal switching is when IOS SLB packets are handled on normal IOS switching paths (CEF, fast switching, and process level switching).
Pkts via special switching	Number of packets handled by IOS SLB via special switching since the last time counters were cleared. Special switching is when IOS SLB packets are handled on hardware-assisted switching paths.
Pkts via slb routing	Number of packets handled by IOS SLB via SLB routing since the last time counters were cleared.
Pkts dropped	Number of packets dropped or consumed by IOS SLB since the last time counters were cleared. The **Pkts dropped** field can increase for one or more of the following reasons: • Ping probes and other Internet Control Message Protocol (ICMP) packets addressed to a virtual IP address are dropped. • TCP data packets in which the **conn** entry is not available as a result of an idle timeout, failure of a probe, or failure of a real server, are dropped. • UDP traceroute packets addressed to a virtual IP address are dropped. • UDP packets addressed to a virtual IP address with a port number other than the one configured in the virtual server are dropped. If the virtual server uses the **any 0** port number, IOS SLB forwards the UDP packets to the real server. • Fragmented packets that cannot be reassembled are dropped.
Connections Created	Number of connections (or sessions, in general packet radio service [GPRS] load balancing and the Home Agent Director) created since the last time counters were cleared.
Connections Established	Number of connections (or sessions, in GPRS load balancing and the Home Agent Director) created and that have become established since the last time counters were cleared.
Connections Destroyed	Number of connections (or sessions, in GPRS load balancing and the Home Agent Director) destroyed since the last time counters were cleared.

Table 23 show ip slb stats Field Descriptions (continued)

Connections Reassigned	Number of connections (or sessions, in GPRS load balancing and the Home Agent Director) reassigned to a different real server since the last time counters were cleared.
Zombie Count	Number of connections (or sessions, in GPRS load balancing and the Home Agent Director) that are currently pending destruction (awaiting a timeout or some other condition to be met).
Connections Reused	Number of zombie connections (or sessions, in GPRS load balancing and the Home Agent Director) reused since the last time counters were cleared. A zombie connection is reused if it receives a TCP SYNchronize sequence number (SYN) or User Datagram Protocol (UDP) packet and succeeds in connecting to a real server. The zombie connection becomes a real connection and the zombie count is decremented.
Connection Flowcache Purges	Number of times the connection flow cache was purged since the last time counters were cleared.
Failed Connection Allocs	Number of times the allocation of a connection (or session, in GPRS load balancing) failed since the last time counters were cleared.
Failed Real Assignments	Number of times the assignment of a real server failed since the last time counters were cleared.
RADIUS framed-ip Sticky Count	Number of entries in the RADIUS framed-IP sticky database.
RADIUS username Sticky Count	Number of entries in the RADIUS username sticky database.
RADIUS calling-station-id Sticky Count	Number of entries in the RADIUS calling-station-ID sticky database.
GTP IMSI Sticky Count	Number of entries in the GTP IMSI sticky database.

show ip slb sticky

To display the IOS Server Load Balancing (IOS SLB) sticky database, use the **show ip slb sticky** command in privileged EXEC mode.

show ip slb sticky [**client** *ip-address netmask* | **gtp imsi** [**id** *imsi*] | **radius calling-station-id** [**id** *string*] | **radius framed-ip** [**client** *ip-address netmask*] | **radius username** [**name** *string*]]

Syntax Description

client *ip-address netmask*	(Optional) Displays only those sticky database entries associated with the specified client IP address or subnet.
gtp imsi	(Optional) Displays only entries associated with the IOS SLB general packet radio service (GPRS) Tunneling Protocol (GTP) International Mobile Subscriber ID (IMSI) sticky database, and shows all of the Network Service Access Point Identifiers (NSAPIs) that the user has used as primary Packet Data Protocols (PDPs).
id *imsi*	(Optional) Displays only those sticky database entries associated with the specified IMSI.
radius calling-station-id	(Optional) Displays only entries associated with the IOS SLB RADIUS calling-station-ID sticky database.
id *string*	(Optional) Displays only those sticky database entries associated with the specified calling station ID.
radius framed-ip	(Optional) Displays only entries associated with the IOS SLB RADIUS framed-IP sticky database.
radius username	(Optional) Displays only entries associated with the IOS SLB RADIUS username sticky database.
name *string*	(Optional) Displays only those sticky database entries associated with the specified username.

Defaults

If no options are specified, the command displays information about all virtual servers.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(11b)E	The **radius** keyword was added.
12.1(12c)E	The **framed-ip**, **username**, **name**, *netmask*, and *string* keywords and arguments were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(14)ZA5	The **calling-station-id** and **id** keywords and the *string* argument were added.

Release	Modification
12.2(18)SXE	The **gtp imsi** and **id** keywords and the *imsi* argument were added.

Examples

The following is sample output from the **show ip slb sticky** command:

```
Router# show ip slb sticky

client            netmask           group  real                  conns
-----------------------------------------------------------------------
10.10.2.12        255.255.0.0       4097   10.10.3.2             1
```

Table 24 describes the fields shown in the display.

Table 24 show ip slb sticky Field Descriptions

Field	Description
client	Client IP address or subnet which is bound to this sticky assignment.
netmask	Subnet mask for this sticky assignment.
group	Group ID for this sticky assignment.
real	Real server used by all clients connecting with the client IP address or subnet detailed on this line.
conns	Number of connections currently sharing this sticky assignment.

The following is sample output from the **show ip slb sticky gtp imsi** command:

```
Router# show ip slb sticky gtp imsi

IMSI                  Real         Group ID   vs_index  refcount  nsapi
----------------------------------------------------------------------
11111111111111FF      10.10.10.1   5          10        1         6
11123411111111FF      10.10.10.2   5          10        1         9
```

Table 25 describes the fields shown in the display.

Table 25 show ip slb sticky gtp imsi Field Descriptions

Field	Description
IMSI	IMSI bound to this sticky assignment in the IOS SLB GTP IMSI sticky database.
Real	IP address of the GTP IMSI real server.
Group ID	Group ID for this sticky assignment.
vs_index	Virtual index, out of a maximum of 500.
refcount	Number of NSAPIs used as primary PDPs.
nsapi	NSAPI used as a primary PDP.

The following is sample output from the **show ip slb sticky radius calling-station-id** command:

```
Router# show ip slb sticky radius calling-station-id

calling-station-id  group id     server real  framed-ips
-----------------------------------------------------
```

```
6228212             15           10.10.10.1   1
```

Table 26 describes the fields shown in the display.

Table 26 show ip slb sticky radius calling-station-id Field Descriptions

Field	Description
calling-station-id	Calling station ID bound to an SSG RADIUS proxy in the IOS SLB RADIUS calling-station-ID sticky database.
group id	Group ID for this sticky assignment.
server real	IP address of the SSG RADIUS proxy server.
framed-ips	Number of IP addresses bound to the SSG RADIUS proxy in the IOS SLB RADIUS framed-IP sticky database.

The following is sample output from the **show ip slb sticky radius framed-ip** command:

```
Router# show ip slb sticky radius framed-ip

framed-ip        group id     server real   route i/f
-----------------------------------------------------
1.1.1.1          15           10.10.10.1    <any>
```

Table 27 describes the fields shown in the display.

Table 27 show ip slb sticky radius framed-ip Field Descriptions

Field	Description
framed-ip	IP address bound to a Cisco Service Selection Gateway (SSG) RADIUS proxy in the IOS SLB RADIUS framed-IP sticky database.
group id	Group ID for this sticky assignment.
server real	IP address of the SSG RADIUS proxy server.
route i/f	Route interface.

The following is sample output from the **show ip slb sticky radius username** command:

```
Router# show ip slb sticky radius username

username         group id     server real   framed-ips
-----------------------------------------------------
9198783355       15           10.10.10.1    1
```

Table 28 describes the fields shown in the display.

Table 28 show ip slb sticky radius username Field Descriptions

Field	Description
username	Username bound to an SSG RADIUS proxy in the IOS SLB RADIUS username sticky database.
group id	Group ID for this sticky assignment.

Table 28 show ip slb sticky radius username Field Descriptions (continued)

server real	IP address of the SSG RADIUS proxy server.
framed-ips	Number of IP addresses bound to the SSG RADIUS proxy in the IOS SLB RADIUS framed-IP sticky database.

show ip slb vservers

To display information about the virtual servers, use the **show ip slb vservers** command in privileged EXEC mode.

show ip slb vservers [**name** *virtual-server*] [**redirect**] [**detail**]

Syntax Description

name *virtual-server*	(Optional) Displays information about the specified virtual server.
redirect	(Optional) Displays information about redirect virtual servers.
detail	(Optional) Displays detailed information.

Command Modes

Privileged EXEC

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.
12.2(18)SXF	The output for this command was modified to reflect the GTP sticky query option on the **idle (virtual server)** command.
12.2(33)SRA	This command was integrated into Cisco IOS Release 12.2(33)SRA.

Usage Guidelines

If no options are specified, the command displays information about all virtual servers.

Examples

The following is sample output from the **show ip slb vservers** command:

```
Router# show ip slb vservers

slb vserver      prot   virtual               state          conns
---------------------------------------------------------------------
TEST             TCP    80.80.254.3:80        OPERATIONAL    1013
TEST21           TCP    80.80.254.3:21        OUTOFSERVICE   0
TEST23           TCP    80.80.254.3:23        OUTOFSERVICE   0
```

Table 29 describes the fields shown in the display.

Table 29 show ip slb vservers Field Descriptions

Field	Description
slb vserver	Name of the virtual server about which information is being displayed. Information about each virtual server is displayed on a separate line.
prot	Protocol being used by the virtual server.

Table 29 show ip slb vservers Field Descriptions (continued)

virtual	Virtual IP address of the virtual server, including the network mask, if configured.
state	Current state of the virtual server: • FAILED—Real server represented by this virtual server has been removed from use by the predictor algorithms; retry timer started. • OPERATIONAL—Functioning properly. • OUTOFSERVICE—Removed from the load-balancing predictor lists. • STANDBY—Backup virtual server, ready to become operational if active virtual server fails.
conns	Number of connections (or sessions, in general packet radio service [GPRS] load balancing and the Home Agent Director) associated with the virtual server.

The following sample output from the **show ip slb vservers detail** command shows detailed data for a virtual server with route health injection (advertise=TRUE):

```
Router# show ip slb vservers detail
RH1, state = OPERATIONAL, v_index = 6
  virtual = 5.5.5.5/32:80, TCP, service = NONE, advertise = TRUE
  server farm = RHSF, delay = 10, idle = 3600
  backup server farm = BACKUP, use count = 0, backup sticky = FALSE
  sticky timer = 0, sticky subnet = 255.255.255.255
  sticky group id = 0
  synguard counter = 0, synguard period = 0
  conns = 1, total conns = 31484, syns = 0, syn drops = 0
  standby group = None
```

Table 30 describes the fields shown in the display.

Table 30 show ip slb vservers detail Field Descriptions

Field	Description
RH1	Name of the virtual server about which information is being displayed (in this case, RH1). Information about each virtual server is displayed on a separate line.
state	Current state of the virtual server: FAILED—Real server represented by this virtual server has been removed from use by the predictor algorithms; retry timer started. OPERATIONAL—Functioning properly. OUTOFSERVICE—Removed from the load-balancing predictor lists. STANDBY—Backup virtual server, ready to become operational if active virtual server fails.
v_index	Virtual index, out of a maximum of 500.
virtual	Virtual IP address of the virtual server, including the network mask, if configured.
TCP	Protocol being used by the virtual server (in this case, TCP).
service	Service, such as HTTP or Telnet, associated with the virtual server.

Table 30 show ip slb vservers detail Field Descriptions (continued)

advertise	Current state of host route advertisement for this virtual server: TRUE—Host route is being advertised. FALSE—Host route is not being advertised.
server farm	Name of the server farm associated with the virtual server.
delay	Delay timer duration, in seconds, for this virtual server.
idle	Idle connection timer duration, in seconds, for this virtual server.
backup server farm	Name of the backup server farm associated with the virtual server.
use count	Number of times the backup server farm has taken over for the primary server farm in this period.
backup sticky	Indicates whether sticky connections are used in the backup server farm: • TRUE—Sticky connections are used in the backup server farm. • FALSE—Sticky connections are not used in the backup server farm.
sticky timer	Sticky timer duration, in seconds, for this virtual server.
sticky subnet	Sticky subnet in which this virtual server is placed, for coupling of services.
sticky group id	Sticky group in which this virtual server is placed, for coupling of services.
synguard counter	Number of unacknowledged SYNchronize sequence numbers (SYNs) that are allowed to be outstanding to this virtual server.
synguard period	Interval, in milliseconds, for SYN threshold monitoring for this virtual server.
conns	Number of active connections currently associated with the virtual server.
total conns	Total number of connections that have been associated with the virtual server since coming INSERVICE.
syns	Number of SYNs handled by the virtual server in this period.
syn drops	Number of SYNs dropped by the virtual server in this period.
standby group	Hot Standby Router Protocol (HSRP) group name with which the virtual server is associated.

The following sample output from the **show ip slb vservers name detail** command shows detailed data for virtual server GGSN_SERVER with GTP sticky query enabled:

```
Router# show ip slb vservers name GGSN_SERVER detail
GGSN_SERVER, state = OPERATIONAL, v_index = 7, interface(s) = <any>
  virtual = 10.10.195.1/32:0, UDP, service = GTP, advertise = TRUE
  server farm = GGSN, delay = 10, idle = 3600
  gtp: request idle = 30, slb notification retry = 2
  gtp sticky query: <enabled>, max retries: 3     <<<<<<<<<<<<<<
  sticky: <none>
  sticky: group id = 4097 <assigned>
  synguard counter = 0, synguard period = 0
  conns = 0, total conns = 17192, syns = 0, syn drops = 0
  standby group = None
```

Table 31 describes the fields shown in the display.

Table 31 show ip slb vservers name detail Field Descriptions

Field	Description
GGSN_SERVER	Name of the virtual server about which information is being displayed (in this case, GGSN_SERVER).
state	Current state of the virtual server: FAILED—Real server represented by this virtual server has been removed from use by the predictor algorithms; retry timer started. OPERATIONAL—Functioning properly. OUTOFSERVICE—Removed from the load-balancing predictor lists. STANDBY—Backup virtual server, ready to become operational if active virtual server fails.
v_index	Virtual index, out of a maximum of 500.
interface(s)	Type of interface.
virtual	Virtual IP address of the virtual server, including the network mask, if configured.
UDP	Protocol being used by the virtual server (in this case, UDP).
service	Service, such as GTP, HTTP, or Telnet, associated with the virtual server (in this case, GTP).
advertise	Current state of host route advertisement for this virtual server: TRUE—Host route is being advertised. FALSE—Host route is not being advertised.
server farm	Name of the server farm associated with the virtual server.
delay	Delay timer duration, in seconds, for this virtual server.
idle	Idle connection timer duration, in seconds, for this virtual server.
gtp request idle	GTP idle connection timer duration in seconds.
slb notification	Number of times IOS SLB can reassign a rejected Create PDP Context to a new real Cisco gateway GPRS support node (GGSN).
gtp sticky query	For GTP IMSI sticky, indicates whether IOS SLB is to query the GGSN before deleting any GTP IMSI sticky objects.
max retries	Maximum number of queries IOS SLB is to send to the GGSN when there is no response from the GGSN.
sticky	Indicates whether sticky connections are enabled for this virtual server.
sticky group id	Sticky group in which this virtual server is placed, for coupling of services.
synguard counter	Number of unacknowledged SYNchronize sequence numbers (SYNs) that are allowed to be outstanding to this virtual server.
synguard period	Interval, in milliseconds, for SYN threshold monitoring for this virtual server.
conns	Number of active connections currently associated with the virtual server.
total conns	Total number of connections that have been associated with the virtual server since coming INSERVICE.
syns	Number of SYNs handled by the virtual server in this period.

Table 31 show ip slb vservers name detail Field Descriptions (continued)

syn drops	Number of SYNs dropped by the virtual server in this period.
standby group	Hot Standby Router Protocol (HSRP) group name with which the virtual server is associated.

The following sample output from the **show ip slb vservers name detail** command shows detailed data for RADIUS virtual server GGSN_SERVER_1RLB_SERVER with maps enabled:

```
Router# show ip slb vservers name RLB_SERVER detail
RLB_VSERVER, state = OPERATIONAL, v_index = 9, interface(s) = <any>
 virtual = 10.10.10.10/32:1812, UDP, service = RADIUS, advertise = TRUE
 serverfarm maps:
  map 1: priority = 1, serverfarm = FARM1, backup = FARM2
  map 2: priority = 2, serverfarm = FARM2, backup = FARM1
  server farm = FARM3, delay = 10, idle = 3600
  radius request idle = 30, radius framed-ip idle = 7200
  radius framed-ip delay = 10
  sticky: <none>
  sticky: group id = 0
  synguard counter = 0, synguard period = 0
  conns = 0, total conns = 0, syns = 0, syn drops = 0
  standby group = None
```

Table 32 describes the fields shown in the display.

Table 32 show ip slb vservers name detail Field Descriptions

Field	Description
RLB_VSERVER	Name of the RADIUS virtual server about which information is being displayed (in this case, RLB_VSERVER).
state	Current state of the virtual server: FAILED—Real server represented by this virtual server has been removed from use by the predictor algorithms; retry timer started. OPERATIONAL—Functioning properly. OUTOFSERVICE—Removed from the load-balancing predictor lists. STANDBY—Backup virtual server, ready to become operational if active virtual server fails.
v_index	Virtual index, out of a maximum of 500.
interface(s)	Type of interface.
virtual	Virtual IP address of the virtual server, including the network mask, if configured.
UDP	Protocol being used by the virtual server (in this case, UDP).
service	Service, such as GTP, HTTP, or Telnet, associated with the virtual server (in this case, GTP).
advertise	Current state of host route advertisement for this virtual server: TRUE—Host route is being advertised. FALSE—Host route is not being advertised.

Table 32 show ip slb vservers name detail Field Descriptions (continued)

serverfarm maps	List of IOS SLB server farm maps associated with this virtual server. Information about each map is displayed on a separate line.
priority	Priority of the map.
serverfarm	Server farm with which the map is associated.
backup	Backup server farm, if any.
server farm	Name of the server farm associated with the virtual server. Information about each server farm is displayed on a separate line.
map ID	Map associated with the server farm.
priority	Priority of the map.
delay	Delay timer duration, in seconds, for this virtual server.
idle	Idle connection timer duration, in seconds, for this virtual server.
radius request idle	Idle duration, in seconds, for RADIUS entries in the IOS SLB session database.
radius framed-ip idle	Idle duration, in seconds, for entries in the IOS SLB RADIUS framed-IP sticky database.
radius framed-ip delay	Delay timer duration, in seconds, for entries in the IOS SLB RADIUS framed-IP sticky database.
sticky	Indicates whether sticky connections are enabled for this virtual server.
sticky group id	Sticky group in which this virtual server is placed, for coupling of services.
synguard counter	Number of unacknowledged SYNchronize sequence numbers (SYNs) that are allowed to be outstanding to this virtual server.
synguard period	Interval, in milliseconds, for SYN threshold monitoring for this virtual server.
conns	Number of active connections currently associated with the virtual server.
total conns	Total number of connections that have been associated with the virtual server since coming INSERVICE.
syns	Number of SYNs handled by the virtual server in this period.
syn drops	Number of SYNs dropped by the virtual server in this period.
standby group	Hot Standby Router Protocol (HSRP) group name with which the virtual server is associated.

snmp-server enable traps slb

To enable IOS SLB traps for real- and virtual-server state changes, use the **snmp-server enable traps slb** global configuration command. To disable the traps use the **no** form of this command.

snmp-server enable traps slb {**real** | **virtual**}

no snmp-server enable traps slb {**real** | **virtual**}

Syntax Description

real	Enables traps for real server state changes.
virtual	Enables traps for virtual server state changes.

Defaults

IOS SLB traps for real- and virtual-server state changes are not enabled.

Command Modes

Global configuration

Command History

Release	Modification
12.1(11b)E	This command was introduced.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example enables IOS SLB traps for real server state changes:

```
Router(config)# snmp-server enable traps slb real
```

sticky (firewall farm datagram protocol)

To assign all connections from a client to the same firewall, use the **sticky** command in firewall farm datagram protocol configuration mode. To remove the client/server coupling, use the **no** form of this command.

sticky *duration* [**netmask** *netmask*] [**source** | **destination**]

no sticky

Syntax Description

duration	Sticky timer duration in seconds. Valid values range from 0 to 65535.
netmask *netmask*	(Optional) Places the virtual server as part of a sticky subnet, for coupling of services.
source	(Optional) Bases sticky on source IP address.
destination	(Optional) Bases sticky on destination IP address.

Defaults

Virtual servers are not associated with any groups.

Command Modes

Firewall farm datagram protocol configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(12c)E	The **source** and **destination** keywords were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example specifies that if a client's subsequent request for a firewall farm is made within 60 seconds of the previous request, then the same firewall is used for the connection:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# protocol datagram
Router(config-slb-fw-udp)# sticky 60
```

Related Commands

Command	Description
protocol datagram	Enters firewall farm datagram protocol configuration mode.
show ip slb firewallfarm	Displays information about the firewall farm configuration.
shoq ip slb sticky	Displays information about the IOS Server Load Balancing (IOS SLB) database.

sticky (firewall farm TCP protocol)

To assign all connections from a client to the same firewall, use the **sticky** command in firewall farm TCP protocol configuration mode. To remove the client/server coupling, use the **no** form of this command.

sticky *duration* [**netmask** *netmask*] [**source** | **destination**]

no sticky

Syntax Description

duration	Sticky timer duration in seconds. Valid values range from 0 to 65535.
netmask *netmask*	(Optional) Places the virtual server as part of a sticky subnet, for coupling of services.
source	(Optional) Bases sticky on source IP address.
destination	(Optional) Bases sticky on destination IP address.

Defaults

Virtual servers are not associated with any groups.

Command Modes

Firewall farm TCP protocol configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(12c)E	The **source** and **destination** keywords were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example specifies that if a client's subsequent request for a firewall farm is made within 60 seconds of the previous request, then the same firewall is used for the connection:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# protocol tcp
Router(config-slb-fw-tcp)# sticky 60
```

Related Commands

Command	Description
protocol tcp	Enters firewall farm TCP protocol configuration mode.
shoq ip slb firewallfarm	Displays information about the firewall farm configuration.
show ip slb sticky	Displays information about the IOS Server Load Balancing (IOS SLB) database.

sticky (virtual server)

To assign all connections from a client to the same real server, use the **sticky** command in SLB virtual server configuration mode. To remove the client/server coupling, use the **no** form of this command.

sticky {*duration* [**group** *group-id*] [**netmask** *netmask*] | **gtp imsi** [**group** *group-id*] | **radius calling-station-id** | **radius framed-ip** [**group** *group-id*] | **radius username** [**msid-cisco**] [**group** *group-id*]}

no sticky {*duration* [**group** *group-id*] [**netmask** *netmask*] | **gtp imsi** [**group** *group-id*] | **radius calling-station-id** | **radius framed-ip** [**group** *group-id*] | **radius username** [**msid-cisco**] [**group** *group-id*]}

Syntax Description

duration	Sticky timer duration in seconds. Valid values range from 0 to 65535.
group *group-id*	(Optional) Places the virtual server in the specified sticky group, for coupling of services. All virtual servers that have the same sticky group ID share the sticky entry for a user. In essence, the **group** keyword and *group-id* argument tie multiple virtual servers together. Valid values range from 0 to 255.
netmask *netmask*	(Optional) Places the virtual server as part of the specified sticky subnet, for coupling of services. Client sessions whose source IP addresses fall within the *netmask* are directed to the same real server.
gtp imsi	Enables IOS SLB to load-balance general packet radio service (GPRS) Tunneling Protocol (GTP) Packet Data Protocol (PDP) context create requests to the same real server that processed all previous create requests for a given International Mobile Subscriber ID (IMSI).
radius calling-station-id	Enables IOS SLB to create the IOS SLB RADIUS calling-station-ID sticky database and direct RADIUS requests from a given calling station ID to the same service gateway.
radius framed-ip	Enables IOS Server Load Balancing (IOS SLB) to create the IOS SLB RADIUS framed-IP sticky database and direct RADIUS requests and non-RADIUS flows from a given end user to the same service gateway.
radius username	Enables IOS SLB to create the IOS SLB RADIUS username sticky database and direct RADIUS requests from a given end user to the same service gateway.
msid-cisco	(Optional) Enables IOS SLB to support Cisco PDSNs that provide MSID-based access (also known as MSID-based access, Cisco variant).

Defaults

Sticky connections are not tracked.
Virtual servers are not associated with any groups.

Command Modes

SLB virtual server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(2)E	The **netmask** keyword and *netmask* argument were added.
12.1(11b)E	The **radius framed-ip** keywords were added.
12.1(12c)E	The **radius username** and **msid-cisco** keywords were added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(14)ZA5	The **radius calling-station-id** keywords were added.
12.2(18)SXE	The **gtp imsi** keywords were added.

Usage Guidelines

The last real server that was used for a connection from a client is stored for the set *duration* seconds. If a new connection from the client to the virtual server is initiated during that time, the same real server that was used for the previous connection is chosen for the new connection. If two virtual servers are placed in the same group, coincident connection requests for those services from the same IP address are handled by the same real server.

In Virtual Private Network (VPN) server load balancing, remember the following requirements:

- For IPSec flows, you must specify a sticky connection between the User Datagram Protocol (UDP) virtual server and the Encapsulation Security Payload (ESP) virtual server.
- For PPTP flows, you must specify a sticky connection between the TCP virtual server and the Generic Routing Encapsulation (GRE) virtual server.
- You must specify a *duration* of at least 15 seconds.

In general packet radio service (GPRS) load balancing and the Home Agent Director, the **sticky** command is not supported.

In RADIUS load balancing, remember the following requirements:

- If you configure the **sticky radius framed-ip** command, you must also configure the **virtual** command with the **service radius** keywords specified.
- If you configure the **sticky radius calling-station-id** command or the **sticky radius username** command, you must also configure the **virtual** command with the **service radius** keywords specified, and you must configure the **sticky radius framed-ip** command.
- You cannot configure both the **sticky radius calling-station-id** command and the **sticky radius username** command on the same virtual server.

For GTP load balancing, IOS SLB creates a sticky database object when it processes the first GTP PDP create request for a given IMSI. IOS SLB removes the sticky object when it receives a notification to do so from the real server, or as a result of inactivity. When the last PDP belonging to an IMSI is deleted on the GGSN, it sends a notification to IOS SLB to remove the sticky object.

In GTP load balancing, if you configure the **sticky gtp imsi** command, you must also configure the **virtual** command with the **service gtp** keywords specified.

Examples

The following example specifies that if a client's subsequent request for a virtual server is made within 60 seconds of the previous request, then the same real server is used for the connection. This example also places the virtual server in group 10.

```
Router(config)# ip slb vserver VS1
Router(config-slb-vserver)# sticky 60 group 10
```

Related Commands

Command	Description
show ip slb sticky	Displays information about the IOS Server Load Balancing (IOS SLB) database.
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).
virtual	Configures the virtual server attributes.

synguard (virtual server)

To limit the rate of TCP SYNchronize sequence numbers (SYNs) handled by a virtual server to prevent a SYN flood denial-of-service attack, use the **synguard** command in SLB virtual server configuration mode. To remove the threshold, use the **no** form of this command.

synguard *syn-count* [*interval*]

no synguard

Syntax Description

syn-count	Number of unacknowledged SYNs that are allowed to be outstanding to a virtual server. Valid values range from 0 (off) to 4294967295. The default is 0.
interval	(Optional) Interval, in milliseconds, for SYN threshold monitoring. Valid values range from 50 to 5000. The default is 100 milliseconds (ms).

Defaults

The default number of unacknowledged SYNs that are allowed to be outstanding to a virtual server is 0 (off).
The default interval is 100 ms.

Command Modes

SLB virtual server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

In general packet radio service (GPRS) load balancing and the Home Agent Director, the **synguard** command has no meaning and is not supported.

Examples

The following example sets the threshold of unacknowledged SYNs to 50:

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# synguard 50
```

Related Commands

Command	Description
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).
virtual	Configures the virtual server attributes.

url (WSP probe)

To specify the URL path that a Wireless Session Protocol (WSP) probe is to request from the server, use the **url** command in WSP probe configuration mode. To restore the default settings, use the **no** form of this command.

url [*path*]

no url [*path*]

Syntax Description

path	(Optional) Path from the server. This argument is case-sensitive.

Defaults

If no URL path is specified, the default is /.

Command Modes

WSP probe configuration

Command History

Release	Modification
12.1(5a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example configures a ping probe named PROBE3, enters WSP probe configuration mode, and configures the probe to request URL path http://localhost/test.txt:

```
Router(config)# ip slb probe PROBE3 wsp
Router(config-slb-probe)# url http://localhost/test.txt
```

Related Commands

Command	Description
ip slb probe wsp	Configures a Wireless Session Protocol (WSP) probe name and enters WSP probe configuration mode.
show ip slb probe	Displays information about an IOS Server Load Balancing (IOS SLB) probe.

virtual

To configure virtual server attributes, use the **virtual** command in SLB virtual server configuration mode. To remove the attributes, use the **no** form of this command.

Encapsulation Security Payload (ESP) and Generic Routing Encapsulation (GRE) Protocols

virtual *ip-address* [*netmask* [**group**]] {**esp** | **gre** | *protocol*}

no virtual *ip-address* [*netmask* [**group**]] {**esp** | **gre** | *protocol*}

TCP and User Datagram Protocol (UDP)

virtual *ip-address* [*netmask* [**group**]] {**tcp** | **udp**} [*port* | **any**] [**service** *service*]

no virtual *ip-address* [*netmask* [**group**]] {**tcp** | **udp**} [*port* | **any**] [**service** *service*]

Syntax Description

ip-address	IP address for this virtual server instance, used by clients to connect to the server farm.
netmask	(Optional) IP network mask for transparent web cache load balancing. The default is 0.0.0.0 (all subnets).
group	(Optional) Allows the virtual subnet to be advertised. If you do not specify the **group** keyword, the virtual subnet cannot be advertised.
esp	Performs load balancing for only Encapsulation Security Payload (ESP) connections.
gre	Performs load balancing for only Generic Routing Encapsulation (GRE) connections.
protocol	Protocol for which load balancing is performed. The valid range is 2 to 127.
tcp	Performs load balancing for only TCP connections.
udp	Performs load balancing for only User Datagram Protocol (UDP) connections.

port	(Optional) IOS Server Load Balancing (IOS SLB) virtual port (the TCP or UDP port number or port name). If specified, only the connections for the specified port on the server are load-balanced. The ports and the valid name or number for the *port* argument are as follows: • All ports: **any 0** • Connectionless secure Wireless Session Protocol (WSP): **wsp-wtls 9202** • Connectionless WSP: **wsp 9200** • Connection-oriented secure WSP: **wsp-wtp-wtls 9203** • Connection-oriented WSP: **wsp-wtp 9201** • Domain Name System: **dns 53** • File Transfer Protocol: **ftp 21** • General packet radio service (GPRS) tunneling protocol (GTP): **gtp 3386** • HTTP over Secure Socket Layer: **https 443** • Internet Key Exchange (IKE): **isakmp 500** • Mapping of airline traffic over IP, Type A: **matip-a 350** • Network News Transport Protocol: **nntp 119** • Post Office Protocol v2: **pop2 109** • Post Office Protocol v3: **pop3 110** • Simple Mail Transport Protocol: **smtp 25** • Telnet: **telnet 23** • X.25 over TCP (XOT): **xot 1998** • World Wide Web (HTTP): **www 80** Specify a port number of 0 to configure an all-port virtual server (that is, a virtual server that accepts flows destined for all ports except GTP ports).
any	(Optional) Performs load balancing on all ports.
service *service*	(Optional) Couples connections associated with a given service, such as HTTP or Telnet, so all related connections from the same client use the same real server. The following are the valid types of connection coupling: • **ftp**—Couples FTP data connections with the control session that created them. • **gtp**—Enables GPRS load balancing without general packet radio service (GPRS) tunneling protocol (GTP) cause code inspection enabled, which allows load-balancing decisions to be made using Layer 5 information. You can balance UDP flows without awareness of GTP by omitting the **service gtp** keywords. • **gtp-inspect**—Enables GPRS load balancing with GTP cause code inspection enabled. • **ipmobile**—Enables the Home Agent Director. • **per-packet**—Does not maintain connection objects for packets destined for this virtual server. • **radius**—Enables IOS SLB to build RADIUS session objects for RADIUS load balancing.

Defaults

No default behavior or values.

Command Modes

SLB virtual server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.1(5a)E	The **wsp**, **wsp-wtp**, **wsp-wtls**, and **wsp-wtp-wtls** keywords were added.
12.1(9)E	The **gtp** option was added as a new value on the *service* argument.
12.1(11b)E	The following keywords, arguments, and options were added: • The **esp**, **gre**, and **all** keywords • The *protocol* argument • The **isakmp** option on the *port* argument • The **per-packet** and **radius** options on the *service* argument The **wsp**, **wsp-wtp**, **wsp-wtls**, and **wsp-wtp-wtls** keywords were changed to options for the *port* argument.
12.1(12c)E	The **group** keyword was added.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.1(13)E3	The **gtp-inspect** option was added as a new value on the *service* argument.
12.2(14)ZA2	The **ipmobile** option was added as a new value on the *service* argument.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The **no virtual** command is allowed only if the virtual server was removed from service by the **no inservice** command.

For some applications, it is not feasible to configure all the virtual server TCP or UDP port numbers for IOS SLB. To support such applications, you can configure IOS SLB virtual servers to accept flows destined for all ports. To configure an all-port virtual server, specify a port number of 0 or any.

Note In general, you should use port-bound virtual servers instead of all-port virtual servers. When you use all-port virtual servers, flows can be passed to servers for which no application port exists. When servers reject these flows, IOS SLB might fail the server and remove it from load balancing.

Specifying port 9201 for connection-oriented WSP mode also activates the Wireless Application Protocol (WAP) finite state machine (FSM), which monitors WSP and drives the session FSM accordingly.

In RADIUS load balancing, IOS SLB maintains session objects in a database to ensure that re-sent RADIUS requests are load-balanced to the same real server.

Examples

The following example specifies that the virtual server with the IP address 10.0.0.1 performs load balancing for TCP connections for the port named www. The virtual server processes HTTP requests.

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# virtual 10.0.0.1 tcp www
```

The following example specifies that the virtual server with the IP address 10.0.0.13 performs load balancing for UDP connections for all ports. The virtual server processes HTTP requests.

```
Router(config)# ip slb vserver PUBLIC_HTTP
Router(config-slb-vserver)# virtual 10.0.0.13 udp 0
```

Related Commands

Command	Description
ip slb vserver	Identifies a virtual server.
show ip slb vservers	Displays information about the virtual servers defined to IOS Server Load Balancing (IOS SLB).

weight (firewall farm real server)

To specify a real server's capacity, relative to other real servers in the firewall farm, use the **weight** command in firewall farm real server configuration mode. To restore the default weight value, use the **no** form of this command.

weight *setting*

no weight

Syntax Description

setting	Weight setting to use for the real server predictor algorithm. Valid settings range from 1 to 255. The default weight setting is 8.

Defaults

The default setting to use for the real server predictor algorithm is 8.

Command Modes

Firewall farm real server configuration

Command History

Release	Modification
12.1(3a)E	This command was introduced.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Examples

The following example specifies the relative weights of three real servers as 16, 8 (by default), and 24, respectively:

```
Router(config)# ip slb firewallfarm FIRE1
Router(config-slb-fw)# real 10.10.1.1
Router(config-slb-fw-real)# weight 16
Router(config-slb-fw-real)# inservice
Router(config-slb-fw-real)# exit
Router(config-slb-fw)# real 10.10.1.2
Router(config-slb-fw-real)# inservice
Router(config-slb-fw-real)# exit
Router(config-slb-fw)# real 10.10.1.3
Router(config-slb-fw-real)# weight 24
```

Related Commands

Command	Description
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
shoq ip slb firewallfarm	Displays information about the firewall farm configuration.
show ip slb reals	Displays information about the real servers.

weight (real server)

To specify a real server's capacity, relative to other real servers in the server farm, use the **weight** command in SLB real server configuration mode. To restore the default weight value, use the **no** form of this command.

weight *setting*

no weight

Syntax Description

setting	Weight setting to use for the real server predictor algorithm. Valid settings range from 1 to 255. The default weight setting is 8.

Defaults

The default setting to use for the real server predictor algorithm is 8.

Command Modes

SLB real server configuration

Command History

Release	Modification
12.0(7)XE	This command was introduced.
12.1(5)T	This command was integrated into Cisco IOS Release 12.1(5)T.
12.2	This command was integrated into Cisco IOS Release 12.2.
12.2(14)S	This command was integrated into Cisco IOS Release 12.2(14)S.
12.2(18)SXE	This command was integrated into Cisco IOS Release 12.2(18)SXE.

Usage Guidelines

The static weights you define using this command are overridden by the weights calculated by Dynamic Feedback Protocol (DFP). If DFP is removed from the network, IOS Server Load Balancing (IOS SLB) reverts to these static weights.

Examples

The following example specifies the relative weights of three real servers as 16, 8 (by default), and 24, respectively:

```
Router(config)# ip slb serverfarm PUBLIC
!-----First real server
Router(config-slb-sfarm)# real 10.10.1.1
!-----Assigned weight of 16
Router(config-slb-real)# weight 16
!-----Enabled
Router(config-slb-real)# inservice
Router(config-slb-real)# exit
!-----Second real server
Router(config-slb-sfarm)# real 10.10.1.2
!-----Enabled with default weight
Router(config-slb-real)# inservice
Router(config-slb-real)# exit
!-----Third real server
```

```
Router(config-slb-sfarm)# real 10.10.1.3
!-----Assigned weight of 24, not enabled
Router(config-slb-real)# weight 24
```

Related Commands

Command	Description
real (server farm)	Identifies a real server by IP address and optional port number as a member of a server farm and enters real server configuration mode.
show ip slb reals	Displays information about the real servers.
show ip slb serverfarms	Displays information about the server farm configuration.

FAQ (Frequently Asked Questions)

The following questions and answers can help you troubleshoot IOS SLB, if you have problems.

Question	Answer
Can I use IOS SLB to load-balance clients and real servers that are on the same LAN or VLAN?	**NO!** **IOS SLB does not support load balancing of flows between clients and real servers that are on the same LAN or VLAN. The packets being load-balanced cannot enter and leave the load-balancing device on the same interface.**
Why is IOS SLB not marking my connections as ESTABLISHED even though I'm transferring data?	If you are using dispatched mode, make sure there are no alternate paths that allow outbound flows to bypass IOS SLB. Also, make sure the clients and real servers are not on the same IP subnet (that is, they are not on the same LAN or VLAN).
Why am I able to connect to real servers directly, but unable to connect to the virtual server?	Make sure that the virtual IP address is configured as a loopback in each of the real servers (if you are running in dispatched mode).
Why is IOS SLB not marking my real server as failed when I disconnect it from the network?	Tune the values for the **numclients**, **numconns**, and **delay** keywords. If you have a very small client population (for example, in a test environment), the **numclients** keyword could be causing the problem. This parameter prevents IOS SLB from mistaking the failure of a small number of clients for the failure of a real server.
Why does IOS SLB show my real server as INSERVICE even though I have taken it down or physically disconnected it?	The INSERVICE and OUTOFSERVICE states indicate whether the network administrator *intends* for that real server to be used when it is operational. A real server that was INSERVICE but was removed from the selection list dynamically by IOS SLB as a result of automatic failure detection, is marked as FAILED. Use the **show ip slb reals detail** command to display these real server states. Beginning with release 12.1(1)E, INSERVICE is changed to OPERATIONAL, to better reflect what is actually occurring.
How can I verify that IOS SLB sticky connections are working properly?	Use the following procedure: 1. Configure the sticky connections. 2. Start a client connection. 3. Enter the **show ip slb reals detail** and **show ip slb conns** commands. 4. Examine the real server connection counts. The real server whose count increased is the one to which the client connection is assigned. 5. Enter the **show ip slb sticky** command to display the sticky relationships stored by IOS SLB. 6. End the connection. 7. Ensure that the real server's connection count decreased. 8. Restart the connection, after waiting no longer than the sticky timeout value. 9. Enter the **show ip slb conns** command again. 10. Examine the real server connection counts again, and verify that the sticky connection is assigned to the same real server as before.

Question	Answer
How can I verify that server failures are being detected correctly?	Use the following procedure: 1. Use a large client population. If the number of clients is very small, tune the **numclients** keyword on the **faildetect numconns (real server)** command so that the servers are not displayed as FAILED. 2. Enter the **show ip slb reals detail** command to show the status of the real servers. 3. Examine the status and connection counts of the real servers. – Servers that failed show a status of FAILED, TESTING, or READY_TO_TEST, based on whether IOS SLB is checking that the server came back up when the command was sent. – When a real server fails, connections that are assigned but not established (no SYN or ACK is received) are reassigned to another real server on the first inbound SYN after the **reassign** threshold is met. However, any connections that were already established are forwarded to the same real server because, while it might not be accepting new connections, it might be servicing existing ones. – For weighted least connections, a real server that has just been placed in service starts slowly so that it is not overloaded with new connections. (See the "Slow Start" section on page 17 for more information.) Therefore, the connection counts displayed for a new real server show connections going to other real servers (despite the new real server's lower count). The connection counts also show "dummy connections" to the new real server, which IOS SLB uses to artificially inflate the connection counts for the real server during the slow start period.
Does the **no inservice** command take a resource out of service immediately?	When you use the **no** form of the **inservice** command to remove a firewall, firewall farm, real server, or virtual server from service, the resource acquiesces gracefully. No new connections are assigned, and existing connections are allowed to complete. To stop all existing connections for an entire firewall farm or virtual server immediately, use the **clear ip slb connections** command.
I configured both IOS SLB and input ACLs on the same Catalyst 6500 Family Switch, and now I see TCAM Capacity Exceeded messages. Why?	If you configure IOS SLB and either input ACLs or firewall load balancing on the same Catalyst 6500 Family Switch, you can exceed the capacity of the TCAM on the Policy Feature Card (PFC). To correct the problem, use the **mls ip slb search wildcard rp** command to reduce the amount of TCAM space used by IOS SLB, but be aware that this command can result in a slight increase in route processor utilization.

Glossary

access control list—See *ACL*.

ACL—access control list. Mechanism used to limit the kind of information clients can access, and limit what they can do with the information.

active standby—Redundancy scheme in which two IOS SLB devices can load-balance the same virtual IP address while at the same time acting as backups for each other. See also *stateful backup* and *stateless backup*.

bearer network—Network that carries messages of a transport-layer protocol, and ultimately also of the session-layer protocols, between physical devices. A single session can use more than one bearer network.

CASA—Cisco Application Services Architecture. CASA is a protocol designed to allow network appliances to selectively control the flow of IP packets through a router, switch, or other network device.

CDMA—Code Division Multiple Access. Digital spread-spectrum modulation technique used mainly with personal communication devices such as mobile phones.

CDMA2000—Third-generation (3-G) version of CDMA.

client NAT—Translation scheme in which the client IP address is replaced with an IP address associated with one of a group of load-balancing devices, resulting in outbound flows being routed to the correct device. See also *directed mode* and *server NAT.*

client subsystem—Users, such as IOS SLB or GPRS, of the DFP agent function.

cluster—Set of computer systems that are connected through multisystem hardware or software to supply services traditionally provided by a single system. This arrangement provides higher availability and better scalability of the system.

Code Division Multiple Access—See *CDMA*.

content-aware networking—Networking strategy that enables content to be dynamically distributed. Because content can be dynamically cached, it can be located at any given place at any given time and distributed between the servers and the location of the web cache. Cisco has developed the ContentFlow architecture and the DFP to enable networks to provide content-aware networking services.

ContentFlow architecture—Cisco's content-aware networking architecture that describes message flows and actions in a distributed environment.

DFP—Dynamic Feedback Protocol. Allows host agents to dynamically report the change in status of the host systems providing a virtual service. The status reported is a relative weight that specifies a host server's capacity to perform work.

DFP agent—Object in a load-balanced environment that dynamically reports changes in status of the host systems that provide a virtual service. The status reported is a relative weight that specifies a host server's capacity to perform work. See also *DFP manager.*

DFP manager—Object in a load-balanced environment that collects status reports from DFP agents. See also *DFP agent*.

directed mode—Session redirection mode in which the virtual server can be assigned an IP address that is not known to any of the real servers. IOS SLB translates packets exchanged between a client and real server, translating the virtual server IP address to a real server IP address through NAT. See also *dispatched mode* and *NAT.*

dispatched mode—Session redirection mode in which the virtual server address is known to the real servers. The virtual server IP address must be configured as a loopback address, or secondary IP address, on each of the real servers. IOS SLB redirects packets to the real servers at the media access control (MAC) layer. Since the virtual server IP address is not modified in dispatched mode, the real servers must be Layer 2-adjacent to IOS SLB, or intervening routers might not be able to route to the chosen real server. See also *directed mode*.

Dynamic Feedback Protocol—See *DFP.*

Encapsulation Security Payload—See *ESP.*

ESP—Encapsulation Security Payload. Most common IPSec protocol, used for both encryption and data authentication.

FA—Foreign agent. Router on a mobile node's visited network which provides routing services to the mobile node while registered. The foreign agent detunnels and delivers datagrams to the mobile node that were tunneled by the mobile node's home agent. For datagrams sent by a mobile node, the foreign agent may serve as a default router for registered mobile nodes.

firewall—Router or access server, or several routers or access servers, designated as a buffer between any connected public networks and a private network. A firewall router uses access lists and other methods to ensure the security of the private network.

firewall farm—Group of firewalls.

firewall load balancing—Load-balancing scheme in which the network administrator configures a group of firewalls into a firewall farm. When a client initiates a connection, IOS SLB chooses a firewall for the connection based on a hash algorithm.

foreign agent—See *FA*.

gateway GPRS support node—See *GGSN*.

General packet radio service—See *GPRS*.

Generic Routing Encapsulation—See *GRE*.

GGSN—Gateway GPRS Support Node. A GPRS network entity that serves as the mobile wireless gateway between an SGSN and PDNs. The GGSN allows mobile wireless users to access PDNs. See also *GPRS*, *GSM*, *GTP*, and *SGSN*.

Global System for Mobile Communications—See *GSM*.

GPRS—General packet radio service. An ETSI standard that defines the implementation of packet data services on a GSM network. See also *GGSN*, *GSM*, *GTP*, and *SGSN*.

GPRS Tunneling Protocol—See *GTP*.

GSM—Global System for Mobile Communications. A second-generation (2G) mobile wireless networking standard defined by ETSI and deployed widely throughout the world. See also *GGSN*, *GPRS*, *GTP*, and *SGSN*.

GSN—GGSN or SGSN. See *GGSN* and *SGSN*.

GRE—generic routing encapsulation. Encapsulates flows with new packet headers to ensure delivery to specific destinations.

GTP—GPRS Tunneling Protocol. Protocol that handles the flow of user packet data and signaling information between the SGSN and GGSN in a GPRS network. GTP is defined on both the Gn and Gp interfaces of a GPRS network. See also *GGSN*, *GPRS*, *GSM*, and *SGSN*.

HA—Home agent. Router on a mobile node's home network which tunnels packets to the mobile node while it is away from home. It keeps current location information for registered mobile nodes called a mobility binding.

home address—IP address that is assigned for an extended time to a mobile node. It remains unchanged regardless of where the node is attached to the Internet.

home agent—See *HA*.

home network—The network or virtual network which matches the subnet address of the mobile node.

HSRP—Hot Standby Router Protocol. Provides high network availability and transparent network topology changes. HSRP creates a Hot Standby router group with a lead router that services all packets sent to the Hot Standby address. The lead router is monitored by other routers in the group, and if it fails, one of these standby routers inherits the lead position and the Hot Standby group address. See also *redundancy*, *stateful backup*, and *stateless backup*.

HTTP redirect load balancing—Load-balancing scheme in which all HTTP requests that belong to the same transaction are directed to the same real server.

ICMP—Internet Control Message Protocol. Message control and error-reporting protocol between a host server and a gateway to the Internet. ICMP uses Internet Protocol (IP) datagrams, but the messages are processed by the IP software and are not directly apparent to the application user.

IKE—Internet Key Exchange Protocol. Defines the procedures for authenticating a communicating peer, creation and management of Security Associations, key generation techniques, and mitigation of threats (such as denial of service and replay attacks), all of which are necessary to establish and maintain secure communications in an Internet environment.

Internet Control Message Protocol—See *ICMP*.

Internet Key Exchange Protocol—See *IKE*.

IOS SLB—IOS Server Load Balancing. Load-balancing function in which the network administrator defines a virtual server that represents a group of real servers in a cluster of network servers known as a server farm. When a client initiates a connection to the virtual server, IOS SLB chooses a real server for the connection based on a configured load-balancing algorithm.

IP Security—See *IPSec*.

IPSec—IP Security. Family of protocols designed to provide security to packets sent over IP.

load balancing—Spreading user requests among available servers within a cluster of servers, based on a variety of algorithms.

MD5—Message Digest Algorithm Version 5. Neighbor router authentication scheme used to ensure reliability and security when routing updates are exchanged between neighbor routers.

Message Digest Algorithm Version 5—See *MD5*.

mobile node—A host or router that changes its point of attachment from one network or subnet to another. A mobile node may change its location without changing its IP address; it may continue to communicate with other Internet nodes at any location using its home IP address, assuming link-layer connectivity to a point of attachment is available.

Mobile Station Identification—See *MSID*.

MSID—Mobile Station Identification. A number that uniquely identifies a mobile station.

NAS—Network Access Server. Device providing local network access to users across a remote access network such as the PSTN.

NAT—Network Address Translation. Modification of one or more of the following fields in an IP packet: source IP address, destination IP address, source TCP/UDP port, destination TCP/UDP port. See also *client NAT*, and *server NAT*.

NetFlow switching—High-performance network-layer switching path that captures as part of its switching function a rich set of traffic statistics including user, protocol, port, and type of service information.

Network Access Server—See *NAS*.

Network Address Translation—See *NAT*.

packet data protocol—See *PDP*.

Packet Data Serving Node—See *PDSN*.

PDP—Packet data protocol. Network protocol used by external packet data networks that communicate with a GPRS network. IP is an example of a PDP supported by GPRS.

PDSN—Packet Data Serving Node. Cisco's standards-compliant solution that enables packet data services in a CDMA environment. The PDSN acts as an access gateway for simple IP and mobile stations. It provides foreign agent support and packet transport for virtual private networking. It also acts as an authentication, authorization, and accounting (AAA) client.

Point-to-Point Tunneling Protocol—See *PPTP*.

port-bound—Server configuration scheme in which a virtual server IP address represents one set of real servers for one service, such as Hypertext Transfer Protocol (HTTP), and a different set of real servers for another service, such as Telnet.

PPTP—Point-to-Point Tunneling Protocol. Protocol used to ensure that messages sent from one VPN node to another are secure.

RADIUS—Remote Authentication Dial In User Service. Protocol used for authentication authorization and configuration information between a NAS and a shared authentication server.

real server—The specification of a physical server associated with a virtual server. The specification includes the real server's IP address and an optional weight to be used by the virtual server predictor.

redundancy—The duplication of devices, services, or connections so that, in the event of a failure, the redundant devices, services, or connections can perform the work of those that failed. See also *stateful backup*, and *stateless backup*.

Remote Authentication Dial In Use Service—See *RADIUS*.

round robin—See *weighted round robin*.

Secure Socket Layer—See *SSL*.

server cluster—See *server farm*.

server farm—Also called a server cluster. Group of real servers that provide various applications and services.

Server Load Balancing—See *IOS SLB*.

server NAT—Translation scheme in which the virtual server IP address is replaced with the real server IP address (and vice versa), allowing servers to be many hops away from the load-balancing device, and enabling intervening routers to route to them without requiring tunnelling. See also *client NAT*, *directed mode*, and *server port translation*.

server port translation—Translation scheme in which the virtual server port number is replaced with the real server port number (and vice versa), allowing servers to be many hops away from the load-balancing device, and enabling intervening routers to route to them without requiring tunnelling. See also *client NAT*, *directed mode*, and *server NAT*.

services manager—Functionality built into IOS SLB that makes load-balancing decisions based on application availability, server capacity, and load distribution algorithms such as weighted round robin or weighted least connections, or the DFP. The services manager determines a real server for the packet flow using load balancing and server/application feedback.

serving GPRS support node—See *SGSN*.

SGSN—serving GPRS support node. A GPRS network entity that sends data to and receives data from mobile stations, and maintains information about the location of a mobile station. The SGSN communicates between the mobile station and the GGSN; the GGSN provides access to the data network. See also *GGSN*, *GPRS*, *GSM*, and *GTP*.

SLB—See *IOS SLB*.

SSL—Secure Socket Layer. Encryption technology for the web used to provide secure transactions such as the transmission of credit card numbers for e-commerce.

stateful backup—Redundancy scheme that enables IOS SLB to incrementally backup its load-balancing decisions, or "keep state," between primary and backup switches. See also *active standby* and *stateless backup*.

stateless backup—Redundancy scheme that provides high network availability by routing IP flows from hosts on Ethernet networks without relying on the availability of a single Layer 3 switch. See also *active standby* and *stateful backup*.

sticky connections—Load-balancing scheme in which new connections from a client IP address or subnet are assigned to the same real server (for server load balancing) or firewall (for firewall load balancing) as were previous connections from that address or subnet.

Virtual Private Network—See *VPN*.

virtual server—Presents a single address that represents an application server farm to clients.

VPN—Virtual Private Network. Private network that uses the Internet to connect some nodes.

WAP—Wireless Application Protocol. Suite of protocols used to deliver services to wireless devices.

weighted least connection—Load-balancing algorithm in which the next real server chosen for a new connection to the virtual server is the server with the fewest active connections. Each real server is assigned a weight, *n*, that represents its capacity to handle connections, as compared to the other real servers associated with the virtual server. The server with the fewest connections is based on the number of active connections on each server, and on the relative capacity of each server. The capacity of a given real server is calculated as the assigned weight of that server divided by the sum of the assigned weights of all of the real servers associated with that virtual server, or $n_1/(n_1+n_2+n_3...)$.

weighted round robin—Load-balancing algorithm in which the real server used for a new connection to the virtual server is chosen in a circular fashion. Each real server is assigned a weight, *n*, that represents its capacity to handle connections, as compared to the other real servers associated with the virtual server. New connections are assigned to a given real server *n* times before the next real server in the list is chosen.

Wireless Application Protocol—See *WAP*.

Wireless Session Protocol—See *WSP*.

Wireless Transaction Protocol—See *WTP*.

Wireless Transport Security Layer—See *WTLS*.

workload agents—Value-added software components developed for specific platforms by third-party developers. Workload agents run on server platforms or on platforms that manage server farms. Workload agents deliver server and application information to the services manager. This information enables the services manager to make optimum server selection.

WSP—Wireless Session Protocol. Session-layer protocol of the WAP suite.

WTLS—Wireless Transport Security Layer. Layer that provides security between WAP clients and WAP gateways.

WTP—Wireless Transaction Protocol. Transaction-layer protocol of the WAP suite.