Configuring GLBP

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Gateway Load Balancing Protocol (GLBP) protects data traffic from a failed router or circuit, like Hot Standby Router Protocol (HSRP) and Virtual Router Redundancy Protocol (VRRP), while allowing packet load sharing between a group of redundant routers.

Finding Feature Information

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

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

Restrictions for GLBP

Enhanced Object Tracking (EOT) is not stateful switchover (SSO)-aware and cannot be used with GLBP in SSO mode.

Prerequisites for GLBP

Before configuring GLBP, ensure that the routers can support multiple MAC addresses on the physical interfaces. For each GLBP forwarder to be configured, an additional MAC address is used.

Information About GLBP

GLBP Overview

GLBP provides automatic router backup for IP hosts configured with a single default gateway on an IEEE 802.3 LAN. Multiple first-hop routers on the LAN combine to offer a single virtual first-hop IP router while sharing the IP packet forwarding load. Other routers on the LAN may act as redundant GLBP routers that will become active if any of the existing forwarding routers fail.

GLBP performs a similar function for the user as HSRP and VRRP. HSRP and VRRP allow multiple routers to participate in a virtual router group configured with a virtual IP address. One member is elected to be the active router to forward packets sent to the virtual IP address for the group. The other routers in the group are redundant until the active router fails. These standby routers have unused bandwidth that the protocol is not using. Although multiple virtual router groups can be configured for the same set of routers, the hosts must be configured for different default gateways, which results in an extra administrative burden. The advantage of GLBP is that it additionally provides load balancing over multiple routers (gateways) using a single virtual IP address and multiple virtual MAC addresses. The forwarding load is shared among all routers in a GLBP group rather than being handled by a single router while the other routers stand idle. Each host is configured with the same virtual IP address, and all routers in the virtual router group participate in forwarding packets. GLBP members communicate between each other through hello messages sent every 3 seconds to the multicast address 224.0.0.102, UDP port 3222 (source and destination).

GLBP Active Virtual Gateway

Members of a GLBP group elect one gateway to be the active virtual gateway (AVG) for that group. Other group members provide backup for the AVG if the AVG becomes unavailable. The AVG assigns a virtual MAC address to each member of the GLBP group. Each gateway assumes responsibility for forwarding

packets sent to the virtual MAC address assigned to it by the AVG. These gateways are known as active virtual forwarders (AVFs) for their virtual MAC address.
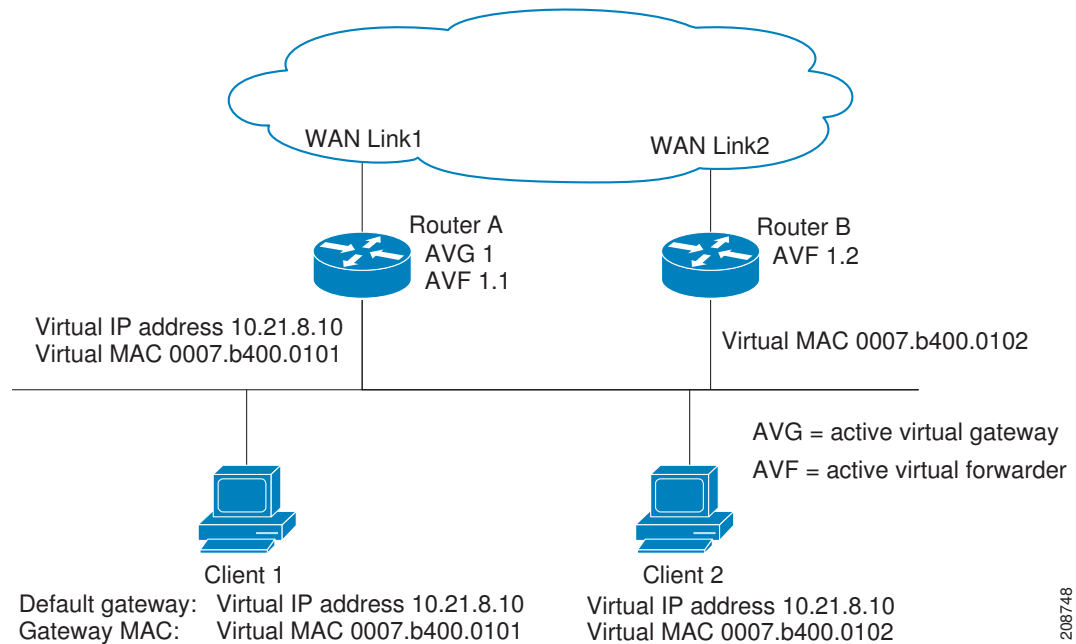
The AVG is also responsible for answering Address Resolution Protocol (ARP) requests for the virtual IP address. Load sharing is achieved by the AVG replying to the ARP requests with different virtual MAC addresses.

Prior to Cisco IOS Release 15.0(1)M1, 12.4(24)T2, 15.1(2)T, and later releases, when the **no glbp load-balancing** command is configured, the AVG always responds to ARP requests with the MAC address of its AVF.

In Cisco IOS Release 15.0(1)M1, 12.4(24)T2, 15.1(2)T, and later releases, when the **no glbp load-balancing** command is configured, if the AVG does not have an AVF, it preferentially responds to ARP requests with the MAC address of the first listening virtual forwarder (VF), which will causes traffic to route via another gateway until that VF migrates back to being the current AVG.

In the figure below, Router A is the AVG for a GLBP group, and is responsible for the virtual IP address 10.21.8.10. Router A is also an AVF for the virtual MAC address 0007.b400.0101. Router B is a member of the same GLBP group and is designated as the AVF for the virtual MAC address 0007.b400.0102. Client 1 has a default gateway IP address of 10.21.8.10 and a gateway MAC address of 0007.b400.0101. Client 2 shares the same default gateway IP address but receives the gateway MAC address 0007.b400.0102 because Router B is sharing the traffic load with Router A.

Figure 1   **GLBP Topology**

If Router A becomes unavailable, Client 1 will not lose access to the WAN because Router B will assume responsibility for forwarding packets sent to the virtual MAC address of Router A, and for responding to packets sent to its own virtual MAC address. Router B will also assume the role of the AVG for the entire GLBP group. Communication for the GLBP members continues despite the failure of a router in the GLBP group.

GLBP Virtual MAC Address Assignment

A GLBP group allows up to four virtual MAC addresses per group. The AVG is responsible for assigning the virtual MAC addresses to each member of the group. Other group members request a virtual MAC address after they discover the AVG through hello messages. Gateways are assigned the next MAC address in sequence. A virtual forwarder that is assigned a virtual MAC address by the AVG is known as a primary virtual forwarder. Other members of the GLBP group learn the virtual MAC addresses from hello messages. A virtual forwarder that has learned the virtual MAC address is referred to as a secondary virtual forwarder.

GLBP Virtual Gateway Redundancy

GLBP operates virtual gateway redundancy in the same way as HSRP. One gateway is elected as the AVG, another gateway is elected as the standby virtual gateway, and the remaining gateways are placed in a listen state.

If an AVG fails, the standby virtual gateway will assume responsibility for the virtual IP address. A new standby virtual gateway is then elected from the gateways in the listen state.

GLBP Virtual Forwarder Redundancy

Virtual forwarder redundancy is similar to virtual gateway redundancy with an AVF. If the AVF fails, one of the secondary virtual forwarders in the listen state assumes responsibility for the virtual MAC address.

The new AVF is also a primary virtual forwarder for a different forwarder number. GLBP migrates hosts away from the old forwarder number using two timers that start as soon as the gateway changes to the active virtual forwarder state. GLBP uses the hello messages to communicate the current state of the timers.

The redirect time is the interval during which the AVG continues to redirect hosts to the old virtual forwarder MAC address. When the redirect time expires, the AVG stops using the old virtual forwarder MAC address in ARP replies, although the virtual forwarder will continue to forward packets that were sent to the old virtual forwarder MAC address.

The secondary holdtime is the interval during which the virtual forwarder is valid. When the secondary holdtime expires, the virtual forwarder is removed from all gateways in the GLBP group. The expired virtual forwarder number becomes eligible for reassignment by the AVG.

GLBP Gateway Priority

GLBP gateway priority determines the role that each GLBP gateway plays and what happens if the AVG fails.

Priority also determines if a GLBP router functions as a backup virtual gateway and the order of ascendancy to becoming an AVG if the current AVG fails. You can configure the priority of each backup virtual gateway with a value of 1 through 255 using the **glbp priority** command.

In the "GLBP Topology" figure, if Router A—the AVG in a LAN topology—fails, an election process takes place to determine which backup virtual gateway should take over. In this example, Router B is the only other member in the group so it will automatically become the new AVG. If another router existed in the same GLBP group with a higher priority, then the router with the higher priority would be elected. If both routers have the same priority, the backup virtual gateway with the higher IP address would be elected to become the active virtual gateway.

By default, the GLBP virtual gateway preemptive scheme is disabled. A backup virtual gateway can become the AVG only if the current AVG fails, regardless of the priorities assigned to the virtual gateways.

You can enable the GLBP virtual gateway preemptive scheme using the **glbp preempt** command. Preemption allows a backup virtual gateway to become the AVG, if the backup virtual gateway is assigned a higher priority than the current AVG.

GLBP Gateway Weighting and Tracking

GLBP uses a weighting scheme to determine the forwarding capacity of each router in the GLBP group. The weighting assigned to a router in the GLBP group can be used to determine whether it will forward packets and, if so, the proportion of hosts in the LAN for which it will forward packets. Thresholds can be set to disable forwarding when the weighting for a GLBP group falls below a certain value, and when it rises above another threshold, forwarding is automatically reenabled.

The GLBP group weighting can be automatically adjusted by tracking the state of an interface within the router. If a tracked interface goes down, the GLBP group weighting is reduced by a specified value. Different interfaces can be tracked to decrement the GLBP weighting by varying amounts.

By default, the GLBP virtual forwarder preemptive scheme is enabled with a delay of 30 seconds. A backup virtual forwarder can become the AVF if the current AVF weighting falls below the low weighting threshold for 30 seconds. You can disable the GLBP forwarder preemptive scheme using the **no glbp forwarder preempt** command or change the delay using the **glbp forwarder preempt delay minimum** command.

GLBP Client Cache

The GLBP client cache contains information about network hosts that are using a GLBP group as the default gateway.

When an IPv4 Address Resolution Protocol (ARP) request or an IPv6 Neighbor Discovery (ND) request for a GLBP virtual IP address is received from a network host by a GLBP group's active virtual gateway (AVG), a new entry is created in the GLBP client cache. The cache entry contains information about the host that sent the ARP or ND request and which forwarder the AVG has assigned to it.

The GLBP client cache stores the MAC address of each host that is using a particular GLBP group, the number of the GLBP forwarder that each network host has been assigned to and the total number of network hosts currently assigned to each forwarder in a GLBP group. The GLBP client cache also stores the protocol address used by each network host and the time elapsed since the host-to-forwarder assignment was last updated.

The GLBP client cache can store information on up to 2000 network hosts for a GLBP group. The expected normal maximum configuration is 1000 network hosts. You can configure a lower maximum number of network hosts that will be cached for each GLBP group independently based on the number of network hosts that are using each GLBP group by using the **glbp client-cache maximum** command. This command enables you to limit the amount of memory used by the cache per GLBP group. If the GLBP client cache has reached the maximum configured number of clients and a new client is added, the least recently updated client entry will be discarded. Reaching this condition indicates that the configured maximum limit is too small.

The amount of memory that is used by the GLBP client cache depends on the number of network hosts using GLBP groups for which the client cache is enabled. For each host at least 20 bytes is required, with an additional 3200 bytes per GLBP group.

You can display the contents of the GLBP client cache using the **show glbp detail** command on the router that is currently the AVG for a GLBP group. If you issue the **show glbp detail** command on any other router in a GLBP group, you will be directed to reissue the command on the AVG to view client cache information. The **show glbp detail** command also displays statistics about the GLBP client cache usage and the distribution of clients among forwarders. These statistics are accurate as long as the cache timeout

and client limit parameters have been set appropriately. Appropriate values would be where the number of end hosts on the network does not exceed the configured limit and where the maximum end host ARP cache timeout does not exceed the configured GLBP client cache timeout.

You can enable or disable the GLBP client cache independently for each GLBP group by using the **glbp client-cache** command. The GLBP client cache is disabled by default. There is no limit on the number of groups for which the GLBP client cache can be enabled.

You can configure GLBP cache entries to time out after a specified time by using the **timeout** keyword option with the **glbp client-cache maximum** command.

GLBP MD5 Authentication

GLBP MD5 authentication uses the industry-standard MD5 algorithm for improved reliability and security. MD5 authentication provides greater security than the alternative plain text authentication scheme and protects against spoofing software.

MD5 authentication allows each GLBP group member to use a secret key to generate a keyed MD5 hash that is part of the outgoing packet. A keyed hash of an incoming packet is generated and, if the hash within the incoming packet does not match the generated hash, the packet is ignored.

The key for the MD5 hash can either be given directly in the configuration using a key string or supplied indirectly through a key chain. The key string cannot exceed 100 characters in length.

A router will ignore incoming GLBP packets from routers that do not have the same authentication configuration for a GLBP group. GLBP has three authentication schemes:

- No authentication
- Plain text authentication
- MD5 authentication

GLBP packets will be rejected in any of the following cases:

- The authentication schemes differ on the router and in the incoming packet.
- MD5 digests differ on the router and in the incoming packet.
- Text authentication strings differ on the router and in the incoming packet.

ISSU--GLBP

GLBP supports In Service Software Upgrade (ISSU). In Service Software Upgrade (ISSU) allows a high-availability (HA) system to run in Stateful Switchover (SSO) mode even when different versions of Cisco IOS software are running on the active and standby Route Processors (RPs) or line cards.

ISSU provides the ability to upgrade or downgrade from one supported Cisco IOS release to another while continuing to forward packets and maintain sessions, thereby reducing planned outage time. The ability to upgrade or downgrade is achieved by running different software versions on the active RP and standby RP for a short period of time to maintain state information between RPs. This feature allows the system to switch over to a secondary RP running upgraded (or downgraded) software and continue forwarding packets without session loss and with minimal or no packet loss. This feature is enabled by default.

For detailed information about ISSU, see the *Cisco IOS In Service Software Upgrade Process* in the *Cisco IOS High Availability Configuration Guide*

For detailed information about ISSU on the 7600 series routers, see the *ISSU and eFSU on Cisco 7600 Series Routers* document at the following URL:

http://www.cisco.com/en/US/docs/routers/7600/ios/12.2SR/configuration/guide/efsuovrw.html

GLBP SSO

With the introduction of the GLBP SSO feature, GLBP is stateful switchover (SSO) aware. GLBP can detect when a router is failing over to the secondary router processor (RP) and continue in its current group state.

SSO functions in networking devices (usually edge devices) that support dua RPs. SSO provides RP redundancy by establishing one of the RPs as the active processor and the other RP as the standby processor. SSO also synchronizes critical state information between the RPs so that network state information is dynamically maintained between RPs.

Without SSO-awareness, if GLBP is deployed on a router with redundant RPs, a switchover of roles between the active RP and the standby RP results in the router relinquishing its activity as a GLBP group member and then rejoining the group as if it had been reloaded. The GLBP SSO feature enables GLBP to continue its activities as a group member during a switchover. GLBP state information between redundant RPs is maintained so that the standby RP can continue the router's activities within the GLBP during and after a switchover.

This feature is enabled by default. To disable this feature, use the **no glbp sso** command in global configuration mode.

For more information, see the *Stateful Swithover* document in the *Cisco IOS High Availability Configuration Guide*.

GLBP Benefits

Load Sharing

You can configure GLBP in such a way that traffic from LAN clients can be shared by multiple routers, thereby sharing the traffic load more equitably among available routers.

Multiple Virtual Routers

GLBP supports up to 1024 virtual routers (GLBP groups) on each physical interface of a router and up to four virtual forwarders per group.

Preemption

The redundancy scheme of GLBP enables you to preempt an active virtual gateway with a higher priority backup virtual gateway that has become available. Forwarder preemption works in a similar way, except that forwarder preemption uses weighting instead of priority and is enabled by default.

Authentication

GLBP supports the industry-standard message digest 5 (MD5) algorithm for improved reliability, security, and protection against GLBP-spoofing software. A router within a GLBP group with a different authentication string than other routers will be ignored by other group members. You can alternatively use a simple text password authentication scheme between GLBP group members to detect configuration errors.

How to Configure GLBP

Enabling and Verifying GLBP

Perform this task to enable GLBP on an interface and verify its configuration and operation. GLBP is designed to be easy to configure. Each gateway in a GLBP group must be configured with the same group number, and at least one gateway in the GLBP group must be configured with the virtual IP address to be used by the group. All other required parameters can be learned.

If VLANs are in use on an interface, the GLBP group number must be different for each VLAN.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask* [**secondary**]
5. **glbp** *group* **ip** [*ip-address* [**secondary**]]
6. **exit**
7. **show glbp** [*interface-type interface-number*] [*group*] [*state*] [**brief**]

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.

Command or Action	Purpose
Step 3 **interface** *type number* **Example:** `Router(config)# interface GigabitEthernet 0/0/0`	Specifies an interface type and number, and enters interface configuration mode.
Step 4 **ip address** *ip-address mask* [**secondary**] **Example:** `Router(config-if)# ip address 10.21.8.32 255.255.255.0`	Specifies a primary or secondary IP address for an interface.
Step 5 **glbp** *group* **ip** [*ip-address* [**secondary**]] **Example:** `Router(config-if)# glbp 10 ip 10.21.8.10`	Enables GLBP on an interface and identifies the primary IP address of the virtual gateway. • After you identify a primary IP address, you can use the **glbp** *group* **ip** command again with the **secondary** keyword to indicate additional IP addresses supported by this group.
Step 6 **exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode, and returns the router to global configuration mode.
Step 7 **show glbp** [*interface-type interface-number*] [*group*] [*state*] [**brief**] **Example:** `Router(config)# show glbp 10`	(Optional) Displays information about GLBP groups on a router. • Use the optional **brief** keyword to display a single line of information about each virtual gateway or virtual forwarder.

Example

In the following example, sample output is displayed about the status of the GLBP group, named 10, on the router:

```
Router# show glbp 10

GigabitEthernet0/0/0 - Group 10
  State is Active
    2 state changes, last state change 23:50:33
  Virtual IP address is 10.21.8.10
  Hello time 5 sec, hold time 18 sec
    Next hello sent in 4.300 secs
  Redirect time 600 sec, forwarder time-out 7200 sec
  Authentication text "stringabc"
  Preemption enabled, min delay 60 sec
  Active is local
  Standby is unknown
  Priority 254 (configured)
```

```
            Weighting 105 (configured 110), thresholds: lower 95, upper 105
              Track object 2 state Down decrement 5
        Load balancing: host-dependent
        There is 1 forwarder (1 active)
        Forwarder 1
          State is Active
            1 state change, last state change 23:50:15
          MAC address is 0007.b400.0101 (default)
          Owner ID is 0005.0050.6c08
          Redirection enabled
          Preemption enabled, min delay 60 sec
          Active is local, weighting 105
```

Customizing GLBP

Customizing the behavior of GLBP is optional. Be aware that as soon as you enable a GLBP group, that group is operating. It is possible that if you first enable a GLBP group before customizing GLBP, the router could take over control of the group and become the AVG before you have finished customizing the feature. Therefore, if you plan to customize GLBP, it is a good idea to do so before enabling GLBP.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask* [**secondary**]
5. **glbp** *group* **timers** [**msec**] *hellotime* [**msec**] *holdtime*
6. **glbp** *group* **timers redirect** *redirect timeout*
7. **glbp** *group* **load-balancing** [**host-dependent** | **round-robin** | **weighted**]
8. **glbp** *group* **priority** *level*
9. **glbp** *group* **preempt** [**delay minimum** *seconds*]
10. **glbp** *group* **client-cache maximum** *number* [**timeout** *minutes*]
11. **glbp** *group* **name** *redundancy-name*
12. **exit**
13. **no glbp sso**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose

Step 3   **interface** *type number*
 	
Example:
 	
`Router(config)# interface`
`fastethernet 0/0`
	Specifies an interface type and number, and enters interface configuration mode.

Step 4   **ip address** *ip-address mask* [**secondary**]
 	
Example:
 	
`Router(config-if)# ip address`
`10.21.8.32 255.255.255.0`
	Specifies a primary or secondary IP address for an interface.

Step 5   **glbp** *group* **timers** [**msec**] *hellotime* [**msec**] *holdtime*
 	
Example:
 	
`Router(config-if)# glbp 10 timers`
`5 18`
	Configures the interval between successive hello packets sent by the AVG in a GLBP group.
	
	• The *holdtime* argument specifies the interval in seconds before the virtual gateway and virtual forwarder information in the hello packet is considered invalid.
	• The optional **msec** keyword specifies that the following argument will be expressed in milliseconds, instead of the default seconds.

Step 6   **glbp** *group* **timers redirect** *redirect timeout*
 	
Example:
 	
`Router(config-if)# glbp 10 timers`
`redirect 1800 28800`
	Configures the time interval during which the AVG continues to redirect clients to an AVF. The default is 600 seconds (10 minutes).
	
	• The *timeout* argument specifies the interval in seconds before a secondary virtual forwarder becomes invalid. The default is 14,400 seconds (4 hours).
	
	Note The zero value for the *redirect* argument cannot be removed from the range of acceptable values because preexisting configurations of Cisco IOS software already using the zero value could be negatively affected during an upgrade. However, be advised that a zero setting is not recommended and, if used, results in a redirect timer that never expires. If the redirect timer does not expire, then when a router fails, new hosts continue to be assigned to the failed router instead of being redirected to the backup.

Step 7   **glbp** *group* **load-balancing** [**host-dependent** | **round-robin** | **weighted**]
 	
Example:
 	
`Router(config-if)# glbp 10 load-`
`balancing host-dependent`
	Specifies the method of load balancing used by the GLBP AVG.

Command or Action	Purpose

Step 8 **glbp** *group* **priority** *level*
 	
Example:
 	
`Router(config-if)# glbp 10`
`priority 254`
	Sets the priority level of the gateway within a GLBP group.
	
	• The default value is 100.

Step 9 **glbp** *group* **preempt** [**delay minimum** *seconds*]
 	
Example:
 	
`Router(config-if)# glbp 10 preempt`
`delay minimum 60`
	Configures the router to take over as AVG for a GLBP group if it has a higher priority than the current AVG.
	
	• This command is disabled by default.
	• Use the optional **delay** and **minimum** keywords and the *seconds* argument to specify a minimum delay interval in seconds before preemption of the AVG takes place.

Step 10 **glbp** *group* **client-cache maximum** *number* [**timeout** *minutes*]
 	
Example:
 	
`Router(config-if)# glbp 10 client-`
`cache maximum 1200 timeout 245`
	(Optional) Enables the GLBP client cache.
	
	• This command is disabled by default.
	• Use the *number* argument to specify the maximum number of clients the cache will hold for this GLBP group. The range is from 8 to 2000.
	• Use the optional **timeout** *minutes* keyword and argument pair to configure the maximum amount of time a client entry can stay in the GLBP client cache after the client information was last updated. The range is from 1 to 1440 minutes (one day).
	
	Note For IPv4 networks, Cisco recommends setting a GLBP client cache timeout value that is slightly longer than the maximum expected end-host Address Resolution Protocol (ARP) cache timeout value.

Step 11 **glbp** *group* **name** *redundancy-name*
 	
Example:
 	
`Router(config-if)# glbp 10 name`
`abc123`
	Enables IP redundancy by assigning a name to the GLBP group.
	
	• The GLBP redundancy client must be configured with the same GLBP group name so the redundancy client and the GLBP group can be connected.

Step 12 **exit** **Example:** `Router(config-if)# exit`	Exits interface configuration mode, and returns the router to global configuration mode.
Step 13 **no glbp sso** **Example:** `Router(config)# no glbp sso`	(Optional) Disables GLBP support of SSO.

Configuring GLBP MD5 Authentication Using a Key String

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask* [**secondary**]
5. **glbp** *group-number* **authentication md5 key-string** [**0** | **7**] *key*
6. **glbp** *group-number* **ip** [*ip-address* [**secondary**]]
7. Repeat Steps 1 through 6 on each router that will communicate.
8. **end**
9. **show glbp**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface Ethernet0/1`	Configures an interface type and enters interface configuration mode.
Step 4	**ip address** *ip-address mask* [**secondary**] **Example:** `Router(config-if)# ip address 10.0.0.1 255.255.255.0`	Specifies a primary or secondary IP address for an interface.

	Command or Action	Purpose
Step 5	**glbp** *group-number* **authentication md5 key-string** [**0** | **7**] *key* **Example:** Router(config-if)# glbp 1 authentication md5 key-string d00b4r987654321a	Configures an authentication key for GLBP MD5 authentication. • The key string cannot exceed 100 characters in length. • No prefix to the *key* argument or specifying **0** means the key is unencrypted. • Specifying **7** means the key is encrypted. The key-string authentication key will automatically be encrypted if the **service password-encryption** global configuration command is enabled.
Step 6	**glbp** *group-number* **ip** [*ip-address* [**secondary**]] **Example:** Router(config-if)# glbp 1 ip 10.0.0.10	Enables GLBP on an interface and identifies the primary IP address of the virtual gateway.
Step 7	Repeat Steps 1 through 6 on each router that will communicate.	—
Step 8	**end** **Example:** Router(config-if)# end	Returns to privileged EXEC mode.
Step 9	**show glbp** **Example:** Router# show glbp	(Optional) Displays GLBP information. • Use this command to verify your configuration. The key string and authentication type will be displayed if configured.

Configuring GLBP MD5 Authentication Using a Key Chain

Perform this task to configure GLBP MD5 authentication using a key chain. Key chains allow a different key string to be used at different times according to the key chain configuration. GLBP will query the appropriate key chain to obtain the current live key and key ID for the specified key chain.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **key chain** *name-of-chain*
4. **key** *key-id*
5. **key-string** *string*
6. **exit**
7. **exit**
8. **interface** *type number*
9. **ip address** *ip-address mask* [**secondary**]
10. **glbp** *group-number* **authentication md5 key-chain** *name-of-chain*
11. **glbp** *group-number* **ip** [*ip-address* [**secondary**]]
12. Repeat Steps 1 through 10 on each router that will communicate.
13. **end**
14. **show glbp**
15. **show key chain**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**key chain** *name-of-chain* **Example:** `Router(config)# key chain glbp2`	Enables authentication for routing protocols and identifies a group of authentication keys and enters key-chain configuration mode.
Step 4	**key** *key-id* **Example:** `Router(config-keychain)# key 100`	Identifies an authentication key on a key chain. • The value for the *key-id* argument must be a number.

Command or Action	Purpose
Step 5 **key-string** *string* **Example:** Router(config-keychain-key)# key-string abc123	Specifies the authentication string for a key and enters key-chain key configuration mode. • The value for the *string* argument can be 1 to 80 uppercase or lowercase alphanumeric characters; the first character cannot be a numeral.
Step 6 **exit** **Example:** Router(config-keychain-key)# exit	Returns to key-chain configuration mode.
Step 7 **exit** **Example:** Router(config-keychain)# exit	Returns to global configuration mode.
Step 8 **interface** *type number* **Example:** Router(config)# interface Ethernet0/1	Configures an interface type and enters interface configuration mode.
Step 9 **ip address** *ip-address mask* [**secondary**] **Example:** Router(config-if)# ip address 10.21.0.1 255.255.255.0	Specifies a primary or secondary IP address for an interface.
Step 10 **glbp** *group-number* **authentication md5 key-chain** *name-of-chain* **Example:** Router(config-if)# glbp 1 authentication md5 key-chain glbp2	Configures an authentication MD5 key chain for GLBP MD5 authentication. • The key chain name must match the name specified in Step 3.
Step 11 **glbp** *group-number* **ip** [*ip-address* [**secondary**]] **Example:** Router(config-if)# glbp 1 ip 10.21.0.12	Enables GLBP on an interface and identifies the primary IP address of the virtual gateway.

	Command or Action	Purpose
Step 12	Repeat Steps 1 through 10 on each router that will communicate.	—
Step 13	**end** **Example:** Router(config-if)# end	Returns to privileged EXEC mode.
Step 14	**show glbp** **Example:** Router# show glbp	(Optional) Displays GLBP information. • Use this command to verify your configuration. The key chain and authentication type will be displayed if configured.
Step 15	**show key chain** **Example:** Router# show key chain	(Optional) Displays authentication key information.

Configuring GLBP Text Authentication

Text authentication provides minimal security. Use MD5 authentication if security is required.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask* [**secondary**]
5. **glbp** *group-number* **authentication text** *string*
6. **glbp** *group-number* **ip** [*ip-address* [**secondary**]]
7. Repeat Steps 1 through 6 on each router that will communicate.
8. **end**
9. **show glbp**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** Router(config)# interface Ethernet0/1	Configures an interface type and enters interface configuration mode.
Step 4	**ip address** *ip-address mask* [**secondary**] **Example:** Router(config-if)# ip address 10.0.0.1 255.255.255.0	Specifies a primary or secondary IP address for an interface.
Step 5	**glbp** *group-number* **authentication text** *string* **Example:** Router(config-if)# glbp 10 authentication text stringxyz	Authenticates GLBP packets received from other routers in the group. • If you configure authentication, all routers within the GLBP group must use the same authentication string.
Step 6	**glbp** *group-number* **ip** [*ip-address* [**secondary**]] **Example:** Router(config-if)# glbp 1 ip 10.0.0.10	Enables GLBP on an interface and identifies the primary IP address of the virtual gateway.
Step 7	Repeat Steps 1 through 6 on each router that will communicate.	—

Command or Action	Purpose
Step 8 **end**	Returns to privileged EXEC mode.
Example: `Router(config-if)# end`	
Step 9 **show glbp**	(Optional) Displays GLBP information. • Use this command to verify your configuration.
Example: `Router# show glbp`	

Configuring GLBP Weighting Values and Object Tracking

GLBP weighting is used to determine whether a GLBP group can act as a virtual forwarder. Initial weighting values can be set and optional thresholds specified. Interface states can be tracked and a decrement value set to reduce the weighting value if the interface goes down. When the GLBP group weighting drops below a specified value, the group will no longer be an active virtual forwarder. When the weighting rises above a specified value, the group can resume its role as an active virtual forwarder.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **track** *object-number* **interface** *type number* {**line-protocol** | **ip routing**}
4. **exit**
5. **interface** *type number*
6. **glbp** *group* **weighting** *maximum* [**lower** *lower*] [**upper** *upper*]
7. **glbp** *group* **weighting track** *object-number* [**decrement** *value*]
8. **glbp** *group* **forwarder preempt** [**delay minimum** *seconds*]
9. **exit**
10. **show track** [*object-number* | **brief**] [**interface** [**brief**] | **ip route** [**brief**] | **resolution** | **timers**]

DETAILED STEPS

Command or Action	Purpose
Step 1 **enable**	Enables privileged EXEC mode. • Enter your password if prompted.
Example: `Router> enable`	

	Command or Action	Purpose
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**track** *object-number* **interface** *type number* {**line-protocol** | **ip routing**} **Example:** Router(config)# track 2 interface POS 6/0/0 ip routing	Configures an interface to be tracked where changes in the state of the interface affect the weighting of a GLBP gateway, and enters tracking configuration mode. • This command configures the interface and corresponding object number to be used with the **glbp weighting track** command. • The **line-protocol** keyword tracks whether the interface is up. The **ip routing** keywords also check that IP routing is enabled on the interface, and an IP address is configured.
Step 4	**exit** **Example:** Router(config-track)# exit	Returns to global configuration mode.
Step 5	**interface** *type number* **Example:** Router(config)# interface GigabitEthernet 0/0/0	Enters interface configuration mode.
Step 6	**glbp** *group* **weighting** *maximum* [**lower** *lower*] [**upper** *upper*] **Example:** Router(config-if)# glbp 10 weighting 110 lower 95 upper 105	Specifies the initial weighting value, and the upper and lower thresholds, for a GLBP gateway.
Step 7	**glbp** *group* **weighting track** *object-number* [**decrement** *value*] **Example:** Router(config-if)# glbp 10 weighting track 2 decrement 5	Specifies an object to be tracked that affects the weighting of a GLBP gateway. • The *value* argument specifies a reduction in the weighting of a GLBP gateway when a tracked object fails.

	Command or Action	Purpose
Step 8	**glbp** *group* **forwarder preempt** [**delay minimum** *seconds*] **Example:** `Router(config-if)# glbp 10 forwarder preempt delay minimum 60`	Configures the router to take over as AVF for a GLBP group if the current AVF for a GLBP group falls below its low weighting threshold. • This command is enabled by default with a delay of 30 seconds. • Use the optional **delay** and **minimum** keywords and the *seconds* argument to specify a minimum delay interval in seconds before preemption of the AVF takes place.
Step 9	**exit** **Example:** `Router(config-if)# exit`	Returns to privileged EXEC mode.
Step 10	**show track** [*object-number* | **brief**] [**interface** [**brief**] | **ip route** [**brief**] | **resolution** | **timers**] **Example:** `Router# show track 2`	Displays tracking information.

Troubleshooting GLBP

GLBP introduces five privileged EXEC mode commands to enable display of diagnostic output concerning various events relating to the operation of GLBP. The **debug condition glbp**,**debug glbp errors**, **debug glbp events**, **debug glbp packets**, and **debug glbp terse** commands are intended only for troubleshooting purposes because the volume of output generated by the software can result in severe performance degradation on the router. Perform this task to minimize the impact of using the **debug glbp** commands.

This procedure will minimize the load on the router created by the **debug condition glbp**or **debug glbp** command because the console port is no longer generating character-by-character processor interrupts. If you cannot connect to a console directly, you can run this procedure via a terminal server. If you must break the Telnet connection, however, you may not be able to reconnect because the router may be unable to respond due to the processor load of generating the debugging output.

This task requires a router running GLBP to be attached directly to a console.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **no logging console**
4. Use Telnet to access a router port and repeat Steps 1 and 2.
5. **end**
6. **terminal monitor**
7. **debug condition glbp** *interface-type interface-number group* [*forwarder*]
8. **terminal no monitor**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**no logging console** **Example:** Router(config)# no logging console	Disables all logging to the console terminal. • To reenable logging to the console, use the**logging console** command in global configuration mode.
Step 4	Use Telnet to access a router port and repeat Steps 1 and 2.	Enters global configuration mode in a recursive Telnet session, which allows the output to be redirected away from the console port.
Step 5	**end** **Example:** Router(config)# end	Exits to privileged EXEC mode.

Command or Action	Purpose
Step 6 **terminal monitor** **Example:** `Router# terminal monitor`	Enables logging output on the virtual terminal.
Step 7 **debug condition glbp** *interface-type interface-number group* [*forwarder*] **Example:** `Router# debug condition glbp GigabitEthernet0/0/0 1`	Displays debugging messages about GLBP conditions. • Try to enter only specific **debug condition glbp** or **debug glbp** commands to isolate the output to a certain subcomponent and minimize the load on the processor. Use appropriate arguments and keywords to generate more detailed debug information on specified subcomponents. • Enter the specific **no debug condition glbp** or **no debug glbp** command when you are finished.
Step 8 **terminal no monitor** **Example:** `Router# terminal no monitor`	Disables logging on the virtual terminal.

Configuration Examples for GLBP

Example: Customizing GLBP Configuration

```
Router(config)# interface fastethernet 0/0
Router(config-if)# ip address 10.21.8.32 255.255.255.0
Router(config-if)# glbp 10 timers 5 18
Router(config-if)# glbp 10 timers redirect 1800 28800
Router(config-if)# glbp 10 load-balancing host-dependent
Router(config-if)# glbp 10 priority 254
Router(config-if)# glbp 10 preempt delay minimum 60
Router(config-if)# glbp 10 client-cache maximum 1200 timeout 245
```

Example: Configuring GLBP MD5 Authentication Using Key Strings

The following example shows how to configure GLBP MD5 authentication using a key string:

```
Router(config)# interface Ethernet 0/1
```

```
Router(config-if)# ip address 10.0.0.1 255.255.255.0
Router(config-if)# glbp 2 authentication md5 key-string ThisStringIsTheSecretKey
Router(config-if)# glbp 2 ip 10.0.0.10
```

Example: Configuring GLBP MD5 Authentication Using Key Chains

In the following example, GLBP queries the key chain "AuthenticateGLBP" to obtain the current live key and key ID for the specified key chain:

```
Router(config)# key chain AuthenticateGLBP
Router(config-keychain)# key 1
Router(config-keychain-key)# key-string ThisIsASecretKey
Router(config-keychain-key)# exit
Router(config-keychain)# exit
Router(config)# interface Ethernet 0/1
Router(config-if)# ip address 10.0.0.1 255.255.255.0
Router(config-if)# glbp 2 authentication md5 key-chain AuthenticateGLBP
Router(config-if)# glbp 2 ip 10.0.0.10
```

Example: Configuring GLBP Text Authentication

```
Router(config)# interface GigabitEthernet 0/0/0
Router(config-if)# ip address 10.21.8.32 255.255.255.0
Router(config-if)# glbp 10 authentication text stringxyz
Router(config-if)# glbp 10 ip 10.21.8.10
```

Example: Configuring GLBP Weighting

In the following example, Router A is configured to track the IP routing state of the POS interface 5/0/0 and 6/0/0, an initial GLBP weighting with upper and lower thresholds is set, and a weighting decrement value of 10 is set. If POS interface 5/0/0 and 6/0/0 goes down, the weighting value of the router is reduced.

```
Router(config)# track 1 interface POS 5/0/0 ip routing
Router(config)# track 2 interface POS 6/0/0 ip routing
Router(config)# interface fastethernet 0/0/0
Router(config-if)# glbp 10 weighting 110 lower 95 upper 105
Router(config-if)# glbp 10 weighting track 1 decrement 10
Router(config-if)# glbp 10 weighting track 2 decrement 10
Router(config-if)# glbp 10 forwarder preempt delay minimum 60
```

Example: Enabling GLBP Configuration

In the following example, Router A is configured to enable GLBP, and the virtual IP address of 10.21.8.10 is specified for GLBP group 10:

```
Router(config)# interface GigabitEthernet 0/0/0
Router(config-if)# ip address 10.21.8.32 255.255.255.0
Router(config-if)# glbp 10 ip 10.21.8.10
```

Additional References

Related Documents

Related Topic	Document Title
GLBP commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS IP Application Services Command Reference*
In Service Software Upgrade (ISSU) configuration	"In Service Software Upgrade" process module in the *Cisco IOS High Availability Configuration Guide*
Key chains and key management commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS IP Routing Protocol-Independent Command Reference*
Object tracking	"Configuring Enhanced Object Tracking" module
Stateful Switchover	The "Stateful Switchover" module in the *Cisco IOS High Availability Configuration Guide*
VRRP	"Configuring VRRP" module
HSRP	"Configuring HSRP" module

Standards

Standards	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	—

MIBs

MIBs	MIBs Link
No new MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFCs	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	—

Technical Assistance

Description	Link
The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for GLBP

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

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

Table 1   Feature Information for GLBP

Feature Name	Releases	Feature Configuration Information
Gateway Load Balancing Protocol	Cisco IOS XE 3.1.0SG 12.2(14)S 12.2(15)T 15.0(1)S	GLBP protects data traffic from a failed router or circuit, like HSRP and VRRP, while allowing packet load sharing between a group of redundant routers.
		The following commands were introduced or modified by this feature: **glbp forwarder preempt, glbp ip, glbp load-balancing, glbp name, glbp preempt, glbp priority, glbp sso, glbp timers, glbp timers redirect, glbp weighting, glbp weighting track, show glbp**.

Feature Name	Releases	Feature Configuration Information
GLBP Client Cache	12.4(15)T 12.2(33)SXI	The GLBP client cache contains information about network hosts that are using a GLBP group as the default gateway.
		The GLBP client cache stores the MAC address of each host that is using a particular GLBP group, the number of the GLBP forwarder that each network host has been assigned to and the total number of network hosts currently assigned to each forwarder in a GLBP group. The GLBP client cache also stores the protocol address used by each network host and the time elapsed since the host-to-forwarder assignment was last updated.
		The following commands were introduced or modified by this feature: **glbp client-cache maximum** and **show glbp**.
GLBP MD5 Authentication	Cisco IOS XE 3.1.0SG 12.2(18)S 12.3(2)T 12.2(33)SXH	MD5 authentication provides greater security than the alternative plain text authentication scheme. MD5 authentication allows each GLBP group member to use a secret key to generate a keyed MD5 hash that is part of the outgoing packet. A keyed hash of an incoming packet is generated and, if the hash within the incoming packet does not match the generated hash, the packet is ignored.
		The following commands were modified by this feature: **glbp authentication**, **show glbp**.

Feature Name	Releases	Feature Configuration Information
ISSU--GLBP	12.2(31)SB2 12.2(33)SRB1	GLBP supports In Service Software Upgrade (ISSU). ISSU allows a high-availability (HA) system to run in Stateful Switchover (SSO) mode even when different versions of Cisco IOS software are running on the active and standby Route Processors (RPs) or line cards. This feature provides customers with the same level of HA functionality for planned outages due to software upgrades as is available with SSO for unplanned outages. That is, the system can switch over to a secondary RP and continue forwarding packets without session loss and with minimal or no packet loss. This feature is enabled by default. There are no new or modified commands for this feature.

Feature Name	Releases	Feature Configuration Information
SSO--GLBP	12.2(31)SB2 12.2(33)SRB 12.2(33)SXH 15.0(1)S	GLBP is now SSO aware. GLBP can detect when a router is failing over to the secondary RP and continue in its current GLBP group state.
		Prior to being SSO aware, GLBP was not able to detect that a second RP was installed and configured to take over in the event that the primary RP failed. When the primary failed, the GLBP device would stop participating in the GLBP group and, depending on its role, could trigger another router in the group to take over as the active router. With this enhancement, GLBP detects the failover to the secondary RP and no change occurs to the GLBP group. If the secondary RP fails and the primary is still not available, then the GLBP group detects this and re-elects a new active GLBP router.
		This feature is enabled by default.
		The following commands were introduced or modified by this feature: **debug glbp events**,**glbp sso**, **show glbp**.

Glossary

active RP—The Route Processor (RP) controls the system, provides network services, runs routing protocols and presents the system management interface.

AVF—active virtual forwarder. One virtual forwarder within a GLBP group is elected as active virtual forwarder for a specified virtual MAC address, and it is responsible for forwarding packets sent to that MAC address. Multiple active virtual forwarders can exist for each GLBP group.

AVG—active virtual gateway. One virtual gateway within a GLBP group is elected as the active virtual gateway, and is responsible for the operation of the protocol.

GLBP gateway—Gateway Load Balancing Protocol gateway. A router or gateway running GLBP. Each GLBP gateway may participate in one or more GLBP groups.

GLBP group—Gateway Load Balancing Protocol group. One or more GLBP gateways configured with the same GLBP group number on connected Ethernet interfaces.

ISSU—In Service Software Upgrade. A process that allows Cisco IOS XE software to be updated or otherwise modified while packet forwarding continues. In most networks, planned software upgrades are a

significant cause of downtime. ISSU allows Cisco IOS software to be modified while packet forwarding continues, which increases network availability and reduces downtime caused by planned software upgrades.

NSF—nonstop forwarding. The ability of a router to continue to forward traffic to a router that may be recovering from a failure. Also, the ability of a router recovering from a failure to continue to correctly forward traffic sent to it by a peer.

RP—Route Processor. A generic term for the centralized control unit in a chassis. Platforms usually use a platform-specific term, such as RSP on the Cisco 7500, the PRE on the Cisco 10000, or the SUP+MSFC on the Cisco 7600.

RPR—Route Processor Redundancy. RPR provides an alternative to the High System Availability (HSA) feature. HSA enables a system to reset and use a standby Route Processor (RP) if the active RP fails. Using RPR, you can reduce unplanned downtime because RPR enables a quicker switchover between an active and standby RP if the active RP experiences a fatal error.

RPR+—An enhancement to RPR in which the standby RP is fully initialized.

SSO—Stateful Switchover. Enables applications and features to maintain state information between an active and standby unit.

standby RP—An RP that has been fully initialized and is ready to assume control from the active RP should a manual or fault-induced switchover occur.

switchover—An event in which system control and routing protocol execution are transferred from the active RP to the standby RP. Switchover may be a manual operation or may be induced by a hardware or software fault. Switchover may include transfer of the packet forwarding function in systems that combine system control and packet forwarding in an indivisible unit.

vIP—virtual IP address. An IPv4 address. There must be only one virtual IP address for each configured GLBP group. The virtual IP address must be configured on at least one GLBP group member. Other GLBP group members can learn the virtual IP address from hello messages.