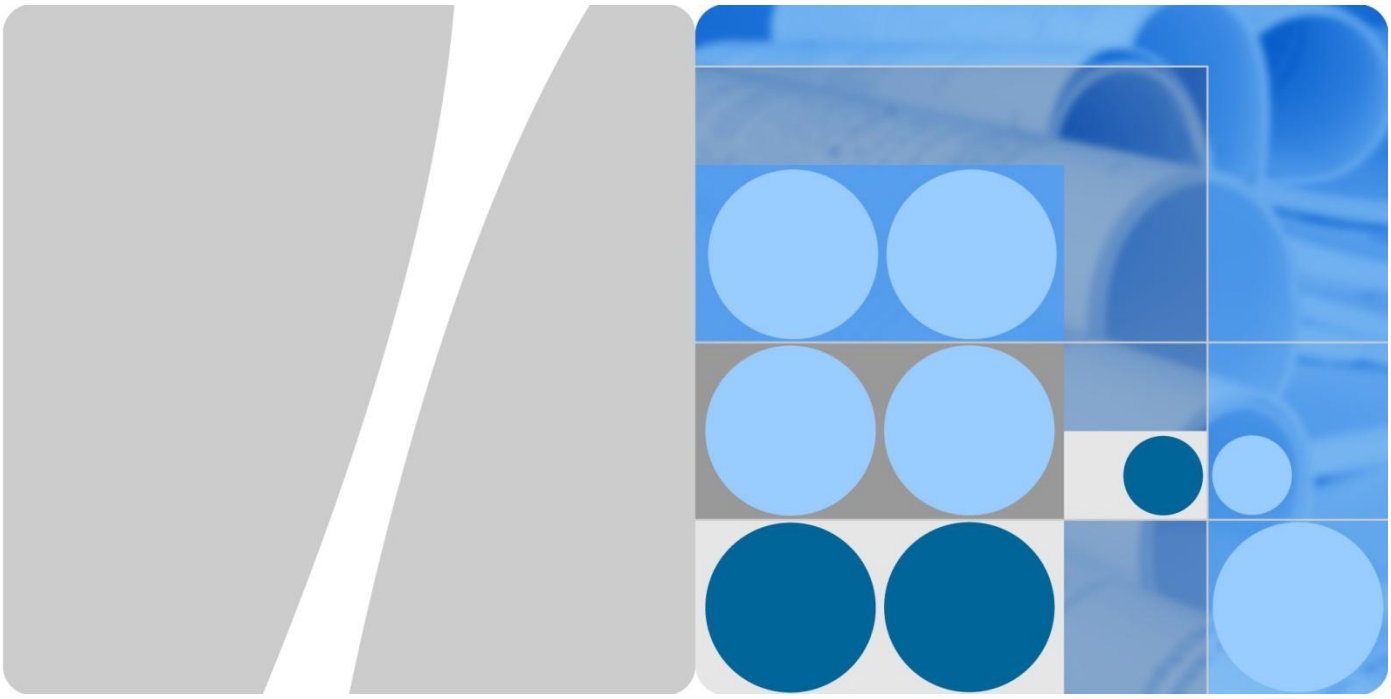

GLBP Replacement Technology White Paper

Issue 01

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About This Document

This document compares Cisco Gateway Load Balancing Protocol (GLBP) with the Virtual Router Redundancy Protocol (VRRP) and provides GLBP configuration procedures in hybrid networking scenarios.

Intended Audience

This document is intended for:

- Network planning engineers
- Commissioning engineers
- Data configuration engineers
- Onsite maintenance engineers
- Network monitoring engineers
- System maintenance engineers

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
 DANGER	Indicates a hazard with a high level or medium level of risk which, if not avoided, could result in death or serious injury.
 WARNING	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
 CAUTION	Indicates a potentially hazardous situation that, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results.
 TIP	Provides a tip that may help you solve a problem or save time.
 NOTE	Provides additional information to emphasize or supplement important points in the main text.

Change History

Changes between document issues are cumulative. The latest document issue contains all the changes made in earlier issues.

Issue 01 (2003-05-20)

This issue is the first official release.

Contents

1 Overview

1.1 Cisco GLBP

The Gateway Load Balancing Protocol (GLBP) provides extended functions based on the VRRP protocol. In a Virtual Router Redundancy Protocol (VRRP) group, a master router must be elected, and the backup router is in idle state. However, GLBP provides not only redundant gateways but also load balancing among gateways.

GLBP allows one virtual IP address to be mapped to up to four virtual MAC addresses to achieve load balancing. Members in a GLBP group have the same virtual IP address and communicate with each other through hello messages. The multicast IP address of these hello messages is 224.0.0.102, and the messages are carried in User Datagram Protocol (UDP) packets.

1.2 Working Principle

Members of a GLBP group elect one gateway as an active virtual gateway (AVG) for the group. The election process is similar to the process of VRRP Master election.

The selected AVG then assigns a virtual MAC address to each member of the GLBP group. Each member assumes responsibility for forwarding packets to the virtual MAC address that is assigned to it by the AVG. Members assigned with virtual MAC addresses are called Active Virtual Forwarders (AVFs).

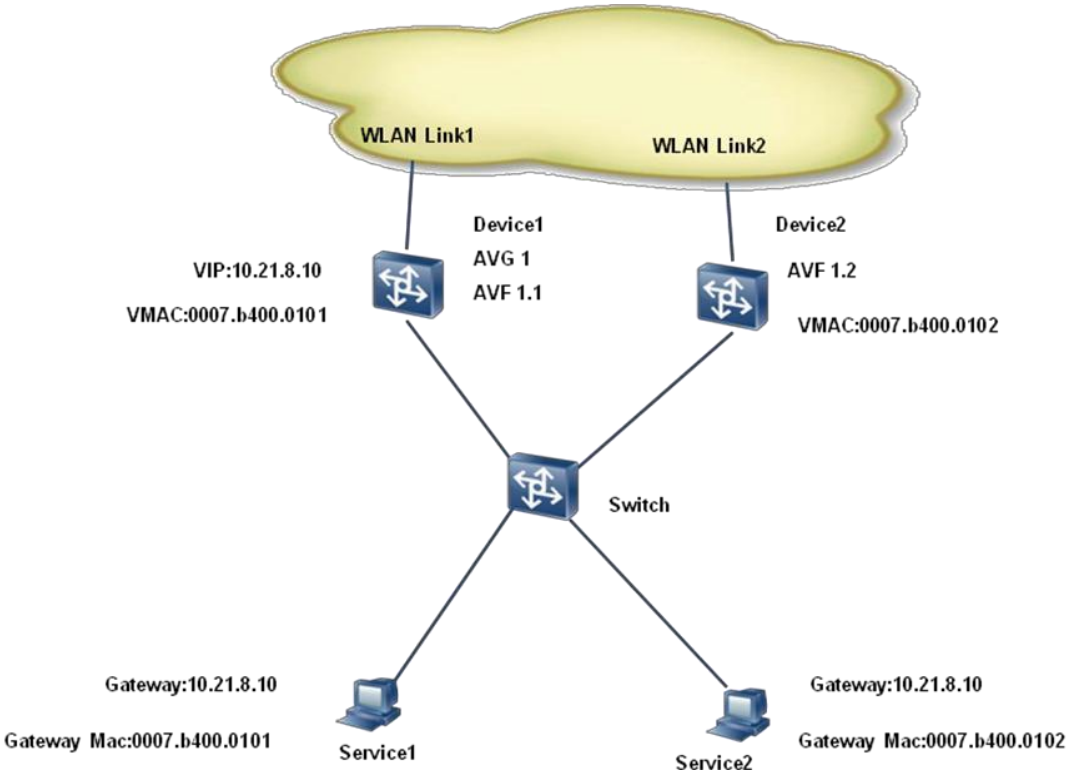
The AVG is responsible for responding to Address Resolution Protocol (ARP) request packets destined for the virtual IP address. Load balancing is achieved by the AVG responding to the ARP request packets with different virtual MAC addresses. Members of a GLBP group communicate with each other through hello messages. These hello messages are sent every 3 seconds and carry the assigned virtual MAC addresses.

After receiving a hello message, an AVF learns the virtual MAC address carried in the message and saves it as a redundant virtual MAC address.

An AVF contains the virtual MAC addresses assigned by the AVG and learned from other AVFs. An AVF that is assigned with the virtual MAC address by the AVG is known as a primary virtual forwarder. A virtual forwarder that has learned the virtual MAC address is called as a secondary virtual forwarder.

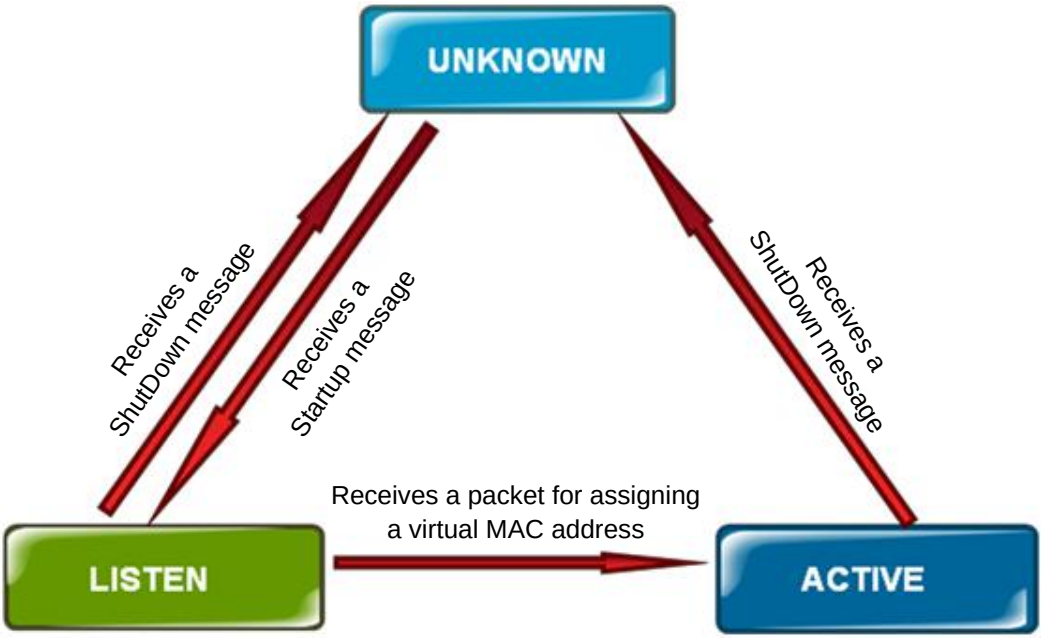
If an AVF fails, another AVF that has learned the virtual MAC address is elected to take over the faulty AVF to forward packets. The election process is similar to the process of VRRP

Master election. Since one virtual MAC address is unavailable but is still used by users for forwarding packets, a buffer time is required to switch to another virtual MAC address for forwarding packets. GLBP uses two timers to process packets sent from the original virtual MAC address. Before the first timer expires, the AVG can still uses the original virtual MAC address to respond to ARP request packets. Before the second timer expires, the packets from the original virtual MAC address can still be forwarded.



1.2.1 State Machines

GLBP defines three states.



- UNKNOWN: The initial status of all members in a GLBP group is UNKNOWN. When attributes are configured for the group members or member interfaces are Up, the members' states become UNKNOWN.
- LISTEN: When a GLBP group in UNKNOWN state receives a Startup message, the group changes its GLBP state to LISTEN.
- ACTIVE: When a GLBP group in LISTEN state receives a packet for assigning a virtual MAC address, the group changes its GLBP state to ACTIVE.

1.3 VRRP

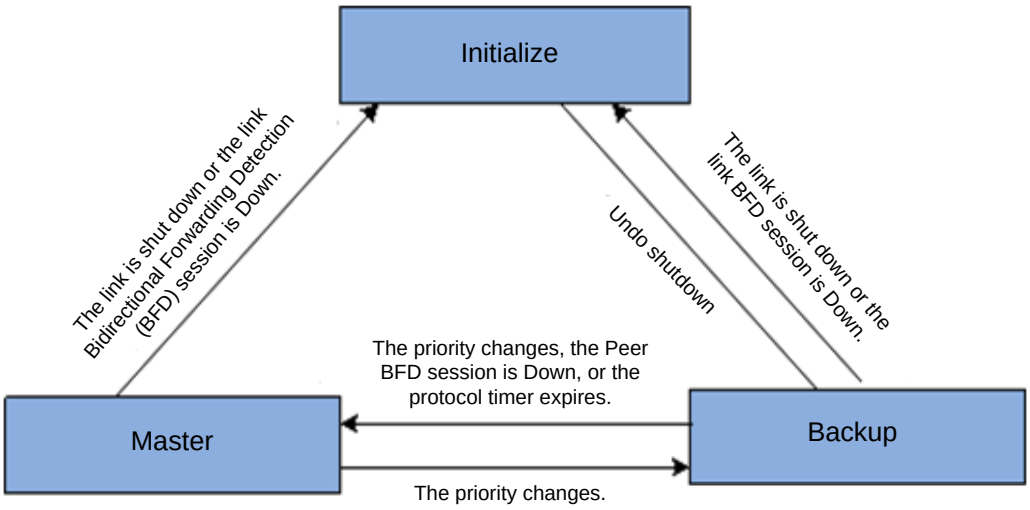
VRRP is defined by RFC2338, providing the backup mechanism for devices in LANs.

1.3.1 Working Principle

VRRP provides similar functions as Cisco GLBP and has a similar working principle as Cisco GLBP.

1.3.2 State Machines

VRRP defines three states.



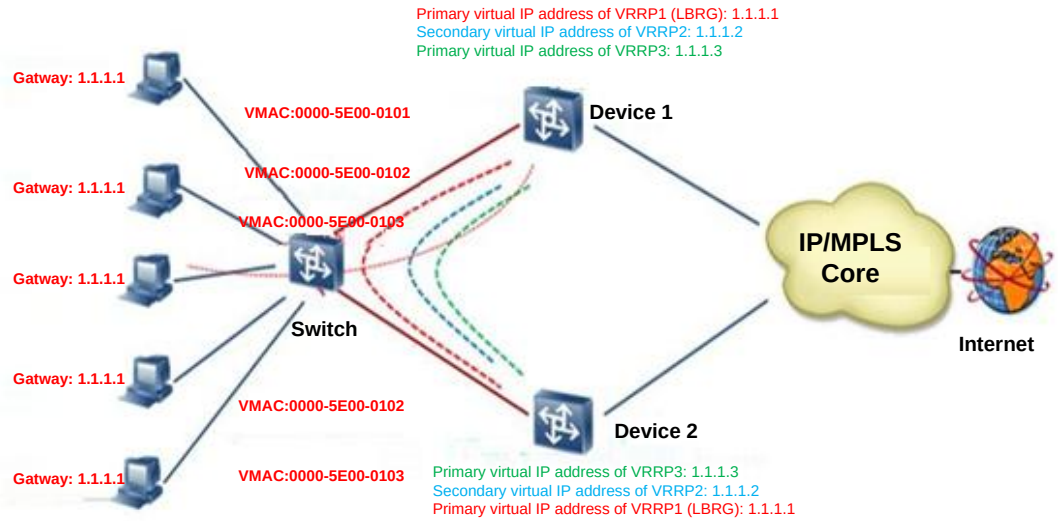
- Master: A master router forwards gateway traffic, responds to ARP request packets, and periodically sends VRRP protocol packets destined for the multicast IP address 224.0.0.18 to maintain the active/standby device status in the VRRP group.
- Backup: A backup router monitors heartbeat packets from the master router. If the priority changes or the backup router does not receive any packets from the master router within the Master_Down_Interval, the backup router becomes the master, but does not forward traffic or respond to ARP request packets destined for the virtual IP address.
- Initialize: When the VRRP-enabled interface is down, the device in **Initialize** state does not process VRRP packets, forward traffic, or take part in the active/standby device election in the VRRP group.

1.4 LBRG

Load-Balance Redundancy Group (LBRG) is a protocol extended by Huawei based on VRRP. The LBRG feature is supported by Huawei CE series switches and will be supported by later versions of Sx700 series campus switches in the future.

1.4.1 Working Principle

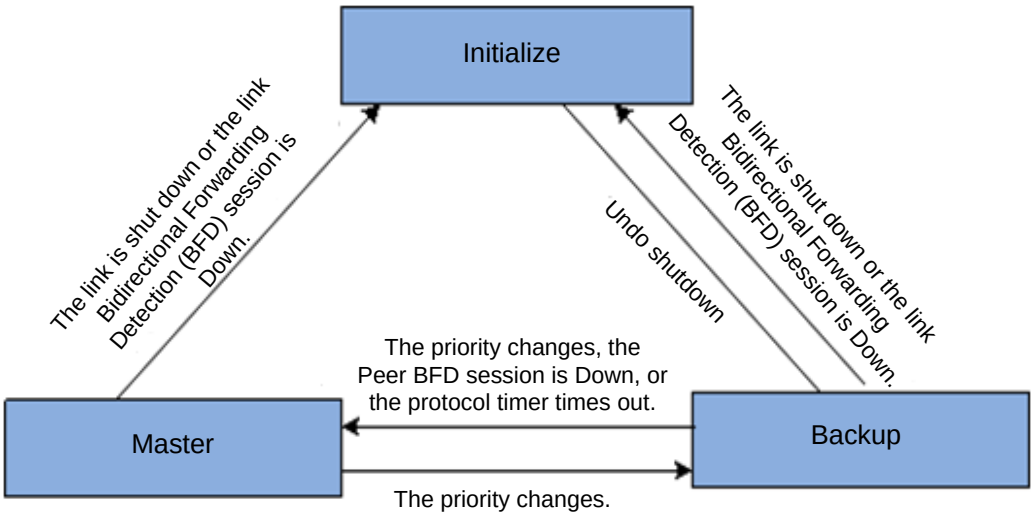
LBRG uses a virtual IP address to respond to packets from different virtual MAC addresses. User traffic is directed to and load balanced among outbound interfaces based on virtual MAC addresses.



Implementation: LBRG uses a virtual IP address to respond to packets from different virtual MAC addresses. User traffic is directed to and load balanced among outbound interfaces based on virtual MAC addresses.
Solution: 1. Set VRRP1 as the LBRG, and add VRRP2 and VRRP3 to the LBRG.
2. The active device in VRRP1 responds to ARP request packets when VRRP1 is used as the user gateway.
3. VRRP1 responds to ARP request packets with a virtual MAC address that is selected from the LBRG using the hash algorithm based on the user's IP address and MAC address.
4. VRRP1 cannot send gratuitous ARP packets after it is set as the LBRG.

1.4.2 State Machines

LBRG defines the same three states as those defined by VRRP.



- Master: A master router forwards gateway traffic, responds to ARP request packets, and periodically sends VRRP protocol packets destined for the multicast IP address 224.0.0.18 to maintain the active/standby device status in the VRRP group.
- Backup: A backup router monitors heartbeat packets from the master router. If the priority changes or the backup router does not receive any packets from the master router

within the Master_Down_Interval, the backup router becomes the master, but does not forward traffic or respond to ARP request packets destined for the virtual IP address.

- Initialize: When the VRRP-enabled interface is down, the device in **Initialize** state does not process VRRP packets, forward traffic, or take part in the active/standby device election in the VRRP group.

2 Replaceability Analysis

2.1 Replacement Solution

GLBP is a Cisco proprietary protocol and is not interoperable with other redundancy protocols. VRRP provides similar functions as GLBP and has been implemented on Huawei Sx700 series campus switches. Therefore, VRRP can be used to replace Cisco GLBP and can be smoothly upgraded to LBRG in the future.

Generally, a Cisco device and a Huawei device are not deployed for gateway redundancy. The VRRP protocol can be used to replace GLBP on the original network. This document describes the solution to replace GLBP on all gateway devices on a network.

2.2 Configuration Command Comparison

Configuration	Cisco	Huawei
Configuring a virtual IP address	glbp group ip [ip-address [secondary]]	vrrp vrid <virtual-router-id> [virtual-ip <virtual-address>] vrrp vrid <vrid> load-balance vrrp vrid <virtual-router-id> join load-balance-vrrp vrid <lb-vrid-value>
Configuring packet transmission parameters	glbp group timers [msec] hellotime [msec] holdtime	vrrp vrid <virtual-router-id> timer advertise { <adver-interval> | millisecond <millisecond-interval> }
Configuring a priority	glbp group priority level	vrrp vrid <vrid> priority <priority>
Configuring the preemption mode	glbp group preempt [delay minimum seconds]	vrrp vrid <vrid> preempt-mode timer delay <delay-time>
Configuring the authentication mode	glbp group-number authentication {text string | md5	vrrp vrid <virtual-router-id> authentication-mode { simple <key> | md5 <md5-key> }

Configuration	Cisco	Huawei
	{key-string [0 | 7] key | key-chain nameof-chain}}	
Configuring a tracking object	glbp group weighting track object-number [decrement value]	vrrp vrid <virtual-router-id> track interface { <interface-type> <interface-number> | <interface-name> } [increased <value-increased> | reduced <value-reduced>] vrrp vrid <virtual-router-id> track ip route <ip-address> { <mask> | <mask-length> } [vpn-instance <vpn-instance-name>] [reduced <value-reduced>]
Configuring the preemption mode for a forwarder	glbp group forwarder preempt [delay minimum seconds]	vrrp vrid <vrid> preempt-mode timer delay <delay-time>

Comparison between configuration commands on Cisco and Huawei devices:

- GLBP configuration on Cisco device:

```
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
```

- VRRP configuration:

```
interface Vlanif1
vrrp vrid 1 virtual-ip 192.168.16.254/*Set the same virtual IP address for routers in a VRRP group.
vrrp vrid 1 priority 120/*Define the priority of the active router in group 1. A router with a higher value is more likely to become the active router.
vrrp vrid 1 timer advertise 3/*Set the interval for sending hello messages and holdtime of hello messages. Specify that hello messages are exchanged every 3 seconds in group 1 and the active/standby switchover is triggered when a hello messages is not received within 9 seconds.
vrrp vrid 1 authentication-mode    md5/simple    cisco  /*Define the authentication mode.
track interface Ethernet0/0/0 reduced 20 /*Define the interface to be tracked.
```

- LBRG configuration:

```
interface Vlanif1
vrrp vrid 1 virtual-ip 192.168.16.254;  vrrp vrid 1 load-balance;
vrrp vrid 2
vrrp vrid 2 join load-balance-vrrp vrid 1
vrrp vrid 1 priority 120
vrrp vrid 1 timer advertise 3
```

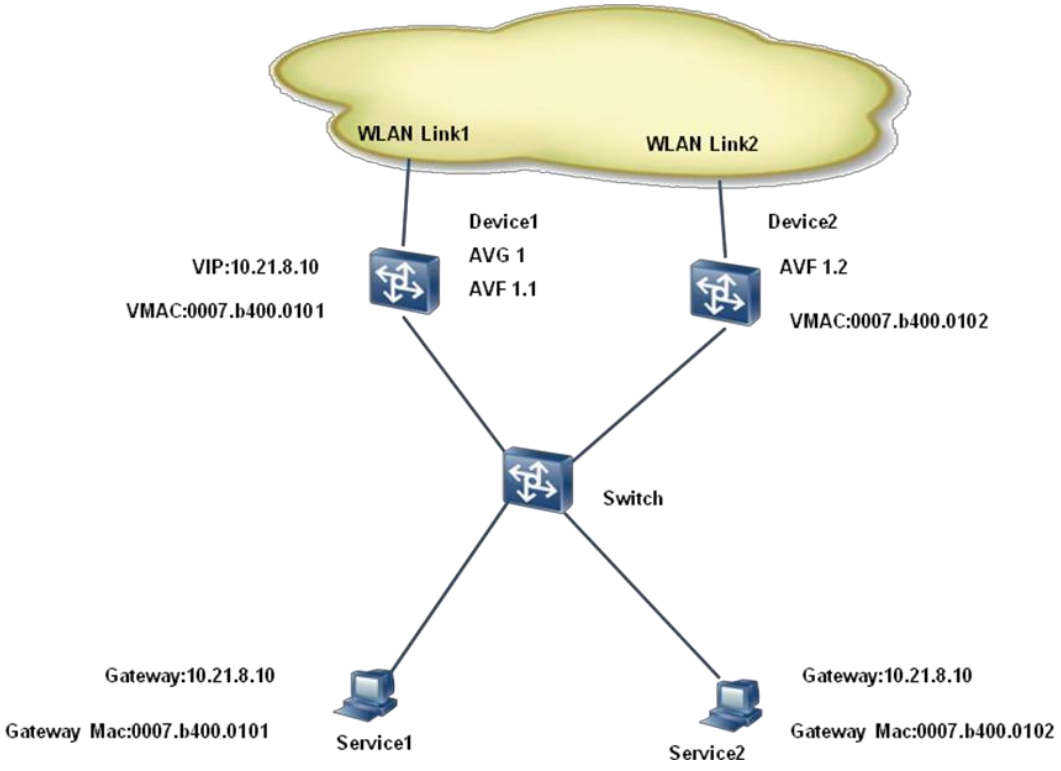
3 Hybrid Networking Example

3.1 Example 1: Basic Network Configuration

The following describes the basic configuration for Cisco GLBP gateway backup solution.

3.1.1 Network Topology

Figure 3-1 Typical GLBP networking diagram



A GLBP group consists of Device 1 and Device 2, which bear the load balancing function of redundant gateways.

3.1.2 Network Configuration

Configuration Requirements

A customer configures GLBP gateway functions on Cisco switches to provide redundancy protection and load balancing for user traffic.

Configuration Methods

Configure VLANIF interfaces and GLBP groups on the VLANIF interfaces.

Configuration Files

Cisco:

- Configuration file of Device 1

```
conf t  int vlan 1
ip address 10.21.8.1 255.255.255.0
glbp 10 ip 10.21.8.10
glbp 10 timers 5 18
glbp 10 priority 120 end
```

- Configuration file of Device 2

```
conf t  int vlan 1
ip address 10.21.8.1 255.255.255.0
glbp 10 ip 10.21.8.10
glbp 10 timers 5 18
glbp 10 priority 100 end
```

Huawei:

- Configuration file of Device 1

```
int vlan 1
ip address 10.21.8.1 255.255.255.0
vrrp vrid 10 virtial-ip 10.21.8.10 vrrp vrid 10 load-balance
vrrp vrid 10 priority 120
vrrp vrid 11
vrrp vrid 11 join load-balance vrid 10
```

- Configuration file of Device 2

```
int vlan 1
ip address 10.21.8.1 255.255.255.0
vrrp vrid 10 virtial-ip 10.21.8.10 vrrp vrid 10 load-balance
vrrp vrid 11
vrrp vrid 11 priority 120
vrrp vrid 11 join load-balance vrid 10
```

4 References

RFC 3768: http://www.rfc-editor.org/info/rfc3768