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1 Configuring GVRP

1.1 Introduction

1.1.1 Overview

Generic Attribute Registration Protocol (GARP) VLAN registration protocol (GVRP) is a protocol for dynamically configuring virtual local area network (VLAN) attributes. It propagates VLAN attributes through protocol packets, and implements automatic registration and deregistration of VLANs on an IEEE 802.1Q trunk port.

1.1.2 Background and Function

A network is huge and complex. It is impossible to learn the network topology and VLAN conditions in a short period of time, and manual configuration brings heavy workload and easily leads to errors. The GARP provides a mechanism to help the members of the same switching network to mutually distribute, propagate, and register information including VLAN and multicast address.

An application entity that complies with GARP is called a GARP application. At present, major GARP applications include GVRP and GARP Multicast Registration Protocol (GMRP). An application entity diffuses the attribute information through protocol data packets. The destination MAC address of protocol packets is the specific multicast MAC address. If a device supporting GARP receives packets of GARP application entities, it will distinguish different applications according to their destination MAC address, and then deliver the packets to different applications (GVRP or GMRP) for processing.

- GVRP is a GARP application. It can dynamically configure and diffuse VLAN attributes, and implements dynamic and automatic registration/deregistration of VLANs on an IEEE 802.1Q trunk port.
- GMRP is another GARP application. It provides a restricted multicast diffusion function similar to the IGMP probing technology.

With the VLAN automatic registration function of GVRP, you can configure the VLAN, and dynamically maintain the process of creating a VLAN and adding/deleting ports to/from a VLAN, ensuring the VLAN connectivity in the topology.

GVRP simplifies the VLAN configuration and management. It reduces the workload of manually configuring VLANs and adding ports to VLANs, and reduces the possibility of network disconnection due to inconsistent configuration.

1.1.3 Principles

1. Working Process

(1) GVRP advertising

If the GVRP function is enabled for a device and the advertising mode of the trunk port is **Normal**, the trunk port will regularly collect the VLAN information on the local port, encapsulate the information in GVRP packets and send them to the peer device, informing the peer device of the VLAN that the trunk

port has joined or exited. The VLAN information type is GVRP [Message Types](#), including Join message, Leave message, and LeaveAll message.

(2) GVRP registration (registration/deregistration)

The destination MAC address of a message packet is the specific multicast MAC address. After GVRP is enabled, the trunk port can recognize GVRP packets from other devices and obtain the VLAN registration or deregistration information by parsing the packets. If the registration mode is **Normal**, the port will create and join a VLAN dynamically, or the port will exit the VLAN and update the local VLAN registration information dynamically.

(3) GVRP advertisement diffusion

The device can also propagate the local VLAN registration information to other devices. The VLAN registration information includes the manually configured static registration information on the local device and the dynamic registration information from other devices. In this way, all devices in a VLAN maintain consistent VLAN information.

2. GVRP Advertising Modes

On a device with the GVRP function enabled, the trunk port decides to regularly collect or not collect VLAN information of the local port according to the advertising mode of the port (**Normal** or **Non-Applicant**). If the VLAN information is collected, the VLAN information is encapsulated in GVRP packets and sent to the peer device, informing the peer device of the VLAN where the device is. On such a basis, the peer device identifies the VLAN to be created.

- **Normal** mode: A device externally advertises its VLAN information, including dynamic and static VLAN information.
- **Non-Applicant** mode: A device does not advertise its VLAN information.

3. GVRP Registration Mode

After receiving GVRP packets from the interconnected trunk port, the peer device parses the VLAN information and decides to process or not to process the VLAN information according to the port registration mode (**Normal** or **Disabled**).

- **Normal** mode: The device processes the VLAN information, dynamically creates a new VLAN and adds the port that receives the packet to the VLAN, or removes it from the VLAN.
- **Disabled** mode: The device does not process the VLAN information in the received GVRP packet.

4. VLAN Registration and Deregistration

[Figure 1-1](#) shows the VLAN registration and deregistration process.

Figure 1-1 VLAN Registration and Deregistration



Device A sends a registration declaration to Device B through a GVRP advertisement, and the port of Device B receives the VLAN registration declaration and joins the VLAN contained in the declaration. This process is called VLAN registration.

Device A sends a deregistration declaration to Device B through a GVRP advertisement, and the port of Device B receives the VLAN deregistration declaration and exits the VLAN contained in the declaration. This process is called VLAN deregistration.

1.1.4 Basic Concepts

1. Static and Dynamic VLANs

- A manually created or deleted VLAN is a static VLAN.
- A VLAN dynamically created or deleted through GVRP is a dynamic VLAN.

The protocol state machine controls the process that a port joins or exits a dynamic VLAN. Only the trunk port that has received a GVRP registration or deregistration declaration can join or exit the dynamic VLAN created by GVRP; other trunk ports that have not received any GVRP registration or deregistration declaration cannot join or exit a dynamic VLAN, and even manual configuration cannot add or remove such a port to/from a dynamic VLAN.

The VLAN registration information propagated by GVRP includes the manually configured static registration information on the local device and the dynamic registration information from other devices. You can switch a dynamic VLAN to a static VLAN through configuration, but not the other way around.

2. Message Types

Terminals or bridge devices are GVRP members, and each port enabled with GVRP is called a GVRP application entity. The entities exchange information by transferring three types of messages.

- Join message

The device sends a Join message in the following cases.

- When a GVRP application entity wants other GVRP entities to register its own attribute information, it sends a Join message.
- When a GVRP application entity receives a Join message from another GVRP entity, it sends a Join message for diffusion.
- When a GVRP application entity is statically configured with attributes and requires other entities to register the attributes, it sends a Join message.

Two types of Join messages are available: JoinEmpty and JoinIn. The differences between the two are as follows:

- JoinEmpty message: Used to declare an unregistered attribute.
- JoinIn message: Used to declare a registered attribute.

- Leave message

The device sends a Leave message in the following cases.

- When a GVRP application entity wants other GVRP entities to deregister its own attribute information, it sends a Leave message.
 - When a GVRP application entity receives a Leave message from another GVRP entity, it sends a Leave message.
-

- When a GVRP application entity statically deregisters VLAN attributes and requires other entities to deregister the attributes, it sends a Leave message.

Two types of Leave messages are available: LeaveEmpty and LeaveIn. The differences between the two are as follows:

- LeaveEmpty message: Used to deregister an unregistered attribute.
- LeaveIn message: Used to deregister a registered attribute.
- LeaveAll message

After GVRP is enabled, each GVRP application entity will enable its own LeaveAll timer. If the LeaveAll timer of a GVRP entity times out, it will send a LeaveAll message to deregister all attributes, which will cause other GVRP entities to re-register the attribute information. If a GVRP entity receives a LeaveAll message from another entity, it will send a LeaveAll message and restart the LeaveAll timer to initiate a new cycle.

3. Timer Types

GVRP defines four timers to control GVRP message sending.

- Hold timer

The Hold timer defines the maximum delay interval *hold* before a port sends a Join message or Leave message. When a GVRP application entity has its attributes changed or receives a GVRP message from another entity, it enables the Hold timer. During the timeout period, the GVRP encapsulates all GVRP messages to be sent into packets as few as possible, and sends the packets when the timer times out. This reduces the quantity of sent packets and saves bandwidth resources. The interval is from 0 to *hold*.

- Join timer

The Join timer defines the waiting time for Join message retransmission, conducive to ensuring the reliability of Join message transmission. After sending a Join message, the GVRP application entity will wait for a Join timer interval. If it receives a JoinIn message sent from another entity before the Join timer times out, it will not resend the Join message; otherwise, it will resend the Join message. Each GVRP application entity has one Join timer, and all attributes share one Join timer.

- Leave timer

The Leave timer defines the waiting time from receiving a Leave message by the port to deleting the port from the VLAN, which helps to avoid frequent network changes. If the GVRP application entity wants other entities to deregister its VLAN attribute information, it will send a Leave message; the entity receiving the message will enable the Leave timer, and, if the port does not receive the Join message of the attribute information after the Leave timer times out, the state of the port becomes **Empty** and the port is removed from the VLAN member list; if the port receives the Join message of the attribute information before the Leave timer times out, the port will not be removed from the VLAN and the timer will time out.

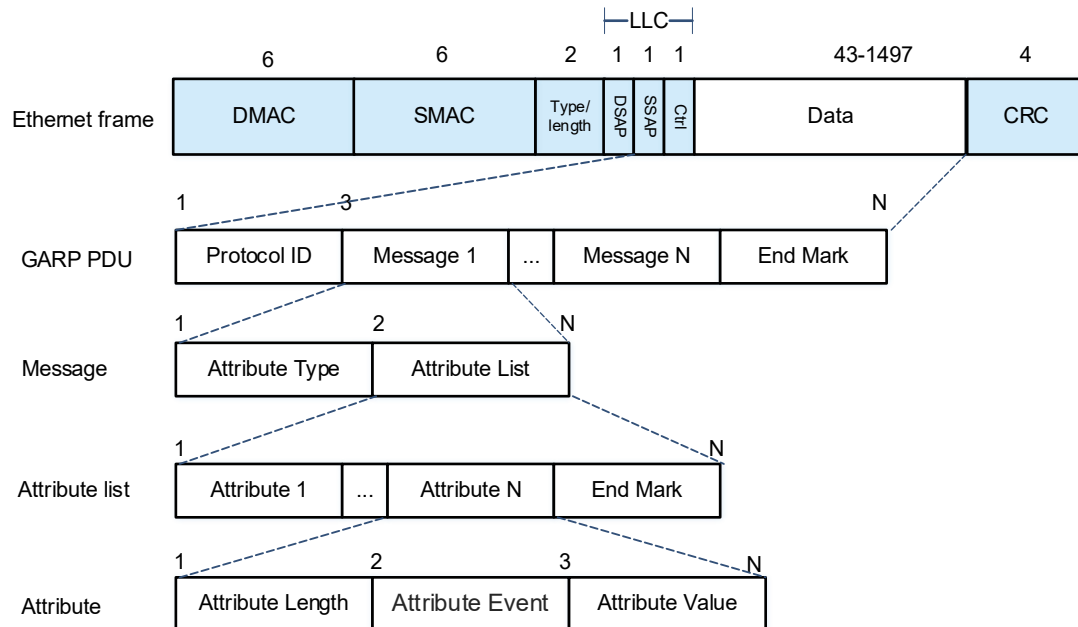
- LeaveAll timer

The LeaveAll timer defines the minimum time interval *leaveall* for the port to send a LeaveAll message. Each GVRP application entity enables its own LeaveAll timer when the entity is enabled. If the LeaveAll timer times out, the GVRP application entity will send a LeaveAll message to instruct other entities to re-register the attribute information. The interval ranges from *leaveall* to the sum of *leaveall* and *hold*. The LeaveAll message is also sent to the local port to trigger the Leave timer to start timing again and initiate a new cycle; if the port receives the LeaveAll message before the timer times out, the timer restarts timing.

1.1.5 Packet Format

The GVRP protocol packets are encapsulated in Ethernet frames. [Figure 1-1](#) shows the packet format.

Figure 1-1 GVRP Packet Format of Ethernet Frame



The following table describes the meaning of each GVRP Ethernet frame field.

Table 1-1 Meanings of GVRP Ethernet Frame Fields

Field	Number of Bytes	Description
Protocol ID	2	Indicates the protocol ID, 0x0001.
Message	N	Indicates a message. Each message consists of the attribute type and attribute list.
Attribute Type	1	Indicates the attribute type, defined by the specific GARP application. 0x01: Indicates GVRP application, and Attribute Value is VLAN ID .
Attribute List	N	Indicates the attribute list, composed of multiple attributes and the end mark.
Attribute	N	Indicates an attribute. Each attribute consists of the attribute length, attribute event, and attribute value.
Attribute Length	1	Indicates the attribute length. The value range is from 0x02 to 0xFF, that is, from 2 to 255.
Attribute Event	1	Indicates the event described by the attribute: 0x00: LeaveAll Event 0x01: JoinEmpty Event

Field	Number of Bytes	Description
		0x02: JoinIn Event 0x03: LeaveEmpty Event 0x04: LeaveIn Event 0x05: Empty Event
Attribute Value	N	Indicates the attribute value. The attribute value of GVRP is VLAN ID , but the attribute value of LeaveAll is invalid.
End Mark	1	Indicates the end mark of GVRP PDU, expressed using 0x00.

1.1.6 Protocols and Standards

- IEEE 802.1D: IEEE Standard for Local and metropolitan area networks: Media Access Control (MAC) Bridges
- IEEE 802.1Q: IEEE Standard for Local and Metropolitan Area Networks-Virtual Bridged Local Area Networks

1.2 Configuration Task Summary

- When the GVRP function is enabled, configuration includes the following tasks:
 - a [Configuring Basic Features](#)
 - b (Optional) [Configuring GVRP BPDU Tunnels](#)
- When the GVRP function is disabled, configuration includes the following tasks:
 - (Optional) [Configuring Transparent Transmission of GVRP BPDU](#)

1.3 Configuring Basic Features

1.3.1 Overview

The GVRP function is used to dynamically create or delete VLANs and add or remove ports to/from VLANs. Devices synchronize respective VLAN information to maintain communication in the topology. This function can reduce the manual configuration workload and simplify VLAN management.

1.3.2 Restrictions and Guidelines

- GVRP needs to be enabled on the two devices connected for communication. The GVRP function takes effect only on trunk ports. All the VLANs created by GVRP are tagged VLANs. GVRP information is transmitted only by trunk Links. The transmitted information contains the information on all VLANs on the current device, including dynamically learned VLANs and manually configured VLANs. The VLAN information that is dynamically learned by GVRP is saved in the memory temporarily, but not in the flash memory of the system. When the device is reset, all the information will be lost. Users cannot save the VLAN information that is dynamically learned.
- The relationship between GVRP and Spanning Tree Protocol (STP) is as follows.

- If STP is not enabled, all available ports can participate in GVRP.
- If STP is enabled, only ports in **Forwarding** state participate in GVRP (receiving and sending GVRP BPDU packets) and have their VLAN information diffused by GVRP.
- If Multi Spanning Tree Protocol (MSTP) is enabled, GVRP can run in the spanning tree context to which VLAN1 belongs. You cannot specify other spanning tree context for GVRP.
- If Single Spanning Tree Protocol (SSTP) is enabled, only ports in **Forwarding** state in the current spanning tree context participate in GVRP.
- Enable the function of creating VLAN dynamically.
 - The parameters of a dynamic VLAN created through GVRP cannot be modified manually.
 - When a port receives a JoinIn or JoinEmpty message containing a locally non-existent VLAN, GVRP may create this VLAN. After this function is enabled, when the device receives the Join message from GVRP, a VLAN will be created dynamically.
- Configure the registration mode of a port.
 - To enable dynamic VLAN registration on a port, run the **gvrp registration mode normal** command. To disable dynamic VLAN registration on a port, run the **gvrp register mode disable** command.
 - If dynamic VLAN registration is enabled, dynamic VLANs will be created on the local device when the port receives a GVRP packet carrying VLAN information from the peer end. If dynamic VLAN registration is disabled, no dynamic VLAN will be created on the local device when the port receives a GVRP packet from the peer end.
 - The two registration modes do not affect the static VLANs on the port. The registration mode for manually created static VLANs is always **Fixed Registrar**.
- Configure the timers.
 - GVRP uses the Hold, Leave, and LeaveAll timers to define the sending interval of various types of packets. The timers are controlled by the GVRP state machine and can be triggered by each other. The three timers are subject to this relationship: $3 \times \text{Hold} \leq \text{Leave} \leq \text{LeaveAll}$.
 - All devices that need to exchange GVRP information on the network must have consistent GVRP timer configuration; otherwise, the GVRP function will not take effect.
- Enable the GVRP function.
 - After the GVRP function is enabled, the device sends GVRP packets carrying VLAN information. After GVRP is disabled, the device does not send GVRP packets carrying VLAN information or process received GVRP packets.
 - When GVRP is not enabled globally, GVRP configuration not take effect. Only when GVRP is enabled globally, will GVRP configuration take effect.
 - The information of super VLAN and sub VLAN cannot be synchronized to the interconnected devices through GVRP.

1.3.3 Procedure

- (1) Enter the privileged EXEC mode.
enable
 - (2) Enter the global configuration mode.
-

configure terminal

- (3) Enable the function of creating VLANs dynamically.

gvrp dynamic-vlan-creation enable

Creating VLANs dynamically is disabled by default.

- (4) (Optional) Configure the GVRP timer.

gvrp timer { **join** *hold* | **leave** *leave* | **leaveall** *leaveall* }

By default, the maximum delay before a port sends a Join or Leave message is 200 ms, the waiting time from receiving a Leave message by the port to deleting the port from the VLAN is 600 ms, and the minimum time interval for the port to send a LeaveAll message is 10,000 ms.

- (5) Configure the interconnection interface as trunk port (the GVRP function takes effect only on trunk ports after being enabled globally).

- a** Enter the interface configuration mode.

interface *interface-type interface-number*

- b** Configure the port mode as trunk port.

switchport mode trunk

An interface works in access mode by default.

- c** Return to the global configuration mode.

exit

- (6) Enable the GVRP function globally.

gvrp enable

The GVRP function is disabled by default.

- (7) (Optional) Configure the advertising mode of a port.

- a** Enter the interface configuration mode.

interface *interface-type interface-number*

- b** Configure the advertising mode of a port.

gvrp applicant state { **normal** | **non-applicant** }

The advertising mode of a port is **Normal** by default, namely, advertisement will be sent.

- c** Return to the global configuration mode.

exit

- (8) (Optional) Configure the registration mode of a port.

- a** Enter the interface configuration mode.

interface *interface-type interface-number*

- b** Configure the registration mode of a port.

gvrp registration mode { **normal** | **disable** }

The registration mode of a port is **Normal** by default, namely, VLAN information will be updated dynamically.

- c** Return to the global configuration mode.

exit

1.4 Configuring GVRP BPDUs Tunnels

1.4.1 Overview

In the QinQ network, if GVRP of the user network and the SP network needs to be calculated separately without interfering with each other, you can configure the GVRP BPDUs tunnel so that the GVRP packets of the user network can be transmitted through the SP network tunnel.

The destination MAC address of GVRP BPDUs packets is the dedicated multicast address 0180.c200.0006. To avoid impact on the SP network by GVRP packets of the user network, when GVRP packets of the user network enter an edge device of the SP network, the edge device changes the destination MAC address of the packets from the GVRP dedicated address (0180.c200.0006) to the tunnel address (01d0.f800.0006 by default) before forwarding on the SP network. After the packets are forwarded to an edge device at the other end, the destination MAC address is restored from the tunnel address (01d0.f800.0006 by default) to the GVRP dedicated address (0180.c200.0006), and the packets are forwarded to the user network at the other end. In this way, the GVRP packets of the user network are transmitted through the tunnel of the SP network.

1.4.2 Restrictions and Guidelines

- The tunnel function takes effect only when the GVRP BPDUs tunnel is enabled in both global configuration mode and interface configuration mode. In the global configuration mode, run the **I2protocol-tunnel gvrp** command to enable the GVRP BPDUs tunnel function globally. In interface configuration mode, run the **I2protocol-tunnel gvrp enable** command to enable the GVRP BPDUs tunnel function on a port.
- The optional tunnel addresses of GVRP packets are 01d0.f800.0006 (default value) and 011a.a900.0006.

1.4.3 Procedure

- (1) Enter the privileged EXEC mode.

enable

- (2) Enter the global configuration mode.

configure terminal

- (3) Enter the configuration mode of the interface connected to the user network.

interface *interface-type interface-number*

- (4) Enable the GVRP BPDUs tunnel function on a port.

I2protocol-tunnel gvrp enable

The GVRP BPDUs tunnel function of a port is disabled by default.

- (5) Return to the global configuration mode.

exit

- (6) (Optional) Configure an address for the GVRP tunnel.

I2protocol-tunnel gvrp tunnel-dmac *mac-address*

The GVRP tunnel address is 01d0.f800.0006 by default.

- (7) Enable the GVRP BPDUs tunnel function globally.

I2protocol-tunnel gvrp

The global GVRP BPDU tunnel function is disabled by default.

1.5 Configuring Transparent Transmission of GVRP BPDU

1.5.1 Overview

In IEEE 802.1Q, the destination MAC address of GVRP BPDU packets is the dedicated multicast address 0180.c200.0006. Generally, devices complying with IEEE 802.1Q do not forward GVRP BPDU frames with the destination MAC address 0180.c200.0006, no matter whether GVRP is enabled. If the device has GVRP enabled, it will use GVRP BPDU frames for GVRP calculation; otherwise, it will discard GVRP packets.

However, in specific applications, devices may be required to transparently transmit GVRP packets. For example, a device does not have GVRP enabled, but the device interconnected to it has GVRP enabled. To enable the devices at both ends to perform GVRP calculation normally, the local device needs to transparently transmit GVRP BPDU frames. In this case, the GVRP BPDU transparent transmission function can be enabled to allow the device to forward the packets with the destination MAC address of 0180.c200.0006.

1.5.2 Restrictions and Guidelines

The GVRP BPDU transparent transmission function takes effect only when GVRP is disabled. When the device has GVRP enabled, this function cannot be used to transparently transmit GVRP BPDU frames. For example, in the QinQ network, both the SP network device and the user network device have GVRP enabled. If the SP network device needs to forward GVRP packets of the user network but does not forward GVRP packets of the SP network, the GVRP BPDU tunnel function is needed.

1.5.3 Procedure

- (1) Enter the privileged EXEC mode.

enable

- (2) Enter the global configuration mode.

configure terminal

- (3) Enable the transparent transmission function of GVRP BPDU packets.

bridge-frame forwarding protocol gvrp

The transparent transmission function of GVRP BPDU packets is disabled by default.

1.6 Monitoring

Run the **show** commands to check the running status of a configured function to verify the configuration effect.

Run the **debug** command to output debugging information.

Caution

System resources are occupied when debugging information is output. Therefore, disable the debugging function immediately after use.

You can run the **clear** commands to clear information.

⚠ Caution

Running the **clear** commands may lose vital information and thus interrupt services.

Table 1-1 Monitoring

Command	Purpose
clear gvrp statistics { <i>interface-type</i> <i>interface-number</i> all }	Clears port statistics.
show gvrp statistics { <i>interface-type</i> <i>interface-number</i> all }	Displays port statistics.
show gvrp status	Displays the current GVRP status.
show gvrp configuration	Displays the current GVRP configuration.
show l2protocol-tunnel gvrp	Displays the GVRP BPDU tunnel information.
debug gvrp event	Enables the GVRP event debugging function.
debug gvrp timer	Enables the GVRP timer debugging function.

1.7 Configuration Examples

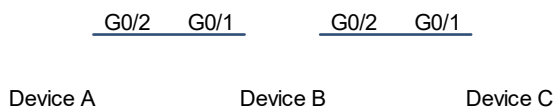
1.7.1 Configuring Basic Functions of GVRP

1. Requirements

The GVRP function is enabled in a topology to dynamically maintain the VLANs and the VLAN-port relationship.

2. Topology

Figure 1-1 Application Scenario of GVRP Basic Function



3. Notes

- On Devices A and C, configure VLANs used for communication on the user network.
- Enable GVRP on Devices A, B, and C, and enable the dynamic creation function of VLAN.
- Configure the ports connected between Devices A, B, and C as trunk ports, and ensure that the permitted VLAN lists of trunk ports include the communication VLANs.
- You are advised to enable STP to avoid loops.

4. Procedure

- (1) Create VLANs for user network communication.

Create VLANs 2 to 10 for user network communication on Device A.

```
DeviceA> enable
DeviceA# configure terminal
DeviceA(config)# vlan range 2-10
DeviceA(config-vlan)# exit
```

Create VLANs 11 to 20 for user network communication on Device C.

```
DeviceC> enable
DeviceC# configure terminal
DeviceC(config)# vlan range 11-20
DeviceC(config-vlan)# exit
```

- (2) Enable the dynamic creation function of VLAN.

Enable the dynamic creation function of VLAN on Device A.

```
DeviceA(config)# gvrp dynamic-vlan-creation enable
```

Enable the dynamic creation function of VLAN on Device B.

```
DeviceB> enable
DeviceB# configure terminal
DeviceB(config)# gvrp dynamic-vlan-creation enable
```

Enable the dynamic creation function of VLAN on Device C.

```
DeviceC(config)# gvrp dynamic-vlan-creation enable
```

- (3) Configure the ports for connecting to the devices as trunk ports.

Configure the ports for the interconnected devices as trunk ports on Device A.

```
DeviceA(config)# interface gigabitethernet 0/2
DeviceA(config-if-GigabitEthernet 0/2)# switchport
DeviceA(config-if-GigabitEthernet 0/2)# switchport mode trunk
DeviceA(config-if-GigabitEthernet 0/2)# exit
```

Configure the ports for the interconnected devices as trunk ports on Device B.

```
DeviceB(config)# interface range gigabitethernet 0/1-2
DeviceB(config-if-range)# switchport
DeviceB(config-if-range)# switchport mode trunk
DeviceB(config-if-range)# exit
```

Configure the ports for the interconnected devices as trunk ports on Device C.

```
DeviceC(config)# interface gigabitethernet 0/1
DeviceC(config-if-GigabitEthernet 0/1)# switchport
DeviceC(config-if-GigabitEthernet 0/1)# switchport mode trunk
DeviceC(config-if-GigabitEthernet 0/1)# exit
```

- (4) Enable the GVRP function.

Enable the GVRP function on Device A.

```
DeviceA(config)# gvrp enable
```

Enable the GVRP function on Device B.

```
DeviceB(config)# gvrp enable
```

Enable the GVRP function on Device C.

```
DeviceC(config)# gvrp enable
```

5. Verification

- (1) Before the GVRP function is enabled globally, check the static VLAN configuration of the device; check whether the interconnection ports are trunk ports and allow all VLANs to pass.

Only static VLANs exist on Device A; the interconnection port GigabitEthernet 0/2 is a trunk port and allows all VLANs to pass.

```
DeviceA# show vlan
VLAN          Name                Status             Ports
-----
          1  VLAN0001           STATIC             Gi0/1, Gi0/2, Gi0/3, Gi0/4
                                     Gi0/5, Gi0/6, Gi0/7, Gi0/8
          2-10  VLAN0002-VLAN0010  STATIC             Gi0/2
DeviceA# show interface gigabitethernet 0/2 switchport
Interface                Switchport Mode      Access Native Protected VLAN
lists
-----
GigabitEthernet 0/2      enabled   TRUNK    1      1      Disabled  ALL
```

Only a static VLAN exists on Device B; the interconnection ports GigabitEthernet 0/1 and GigabitEthernet 0/2 are trunk ports and allow all VLANs to pass.

```
DeviceB# show vlan
VLAN          Name                Status             Ports
-----
          1  VLAN0001           STATIC             Gi0/1, Gi0/2, Gi0/3, Gi0/4
                                     Gi0/5, Gi0/6, Gi0/7, Gi0/8
DeviceB# show interface switchport
Interface                Switchport Mode      Access Native Protected VLAN
lists
-----
GigabitEthernet 0/1      enabled   TRUNK    1      1      Disabled  ALL
GigabitEthernet 0/2      enabled   TRUNK    1      1      Disabled  ALL
```

Only static VLANs exist on Device C; the interconnection port GigabitEthernet 0/1 is a trunk port and allows all VLANs to pass.

```
DeviceC# show vlan
VLAN          Name                Status             Ports
-----
          1  VLAN0001           STATIC             Gi0/1, Gi0/2, Gi0/3, Gi0/4
                                     Gi0/5, Gi0/6, Gi0/7, Gi0/8
          11-20  VLAN0011-VLAN0020  STATIC             Gi0/1
```

```
DeviceA# show interface gigabitethernet 0/1 switchport
Interface                Switchport Mode      Access Native Protected VLAN
lists
-----
GigabitEthernet 0/1      enabled   TRUNK      1      1      Disabled  ALL
```

- (2) After the GVRP function is enabled globally, check the GVRP configuration of devices.

Check whether the GVRP function of Device A has been enabled, and the trunk port normally advertises the GVRP information and dynamically updates the VLAN information.

```
DeviceA# show gvrp configuration
Global GVRP Configuration:
GVRP Feature:enabled
GVRP dynamic VLAN creation:enabled
Join Timers(ms):200
Leave Timers(ms):600
Leaveall Timers(ms):1000
Port based GVRP Configuration:
      PORT                Applicant Status      Registration Mode
-----
GigabitEthernet 0/2                normal                normal
```

Check whether the GVRP function of Device B has been enabled, and the trunk port normally advertises the GVRP information and dynamically updates the VLAN information.

```
DeviceB# show gvrp configuration
Global GVRP Configuration:
GVRP Feature:enabled
GVRP dynamic VLAN creation:enabled
Join Timers(ms):200
Leave Timers(ms):600
Leaveall Timers(ms):1000
Port based GVRP Configuration:
      PORT                Applicant Status      Registration Mode
-----
GigabitEthernet 0/1                normal                normal
GigabitEthernet 0/2                normal                normal
```

Check whether the GVRP function of Device C has been enabled, and the trunk port normally advertises the GVRP information and dynamically updates the VLAN information.

```
DeviceC# show gvrp configuration
Global GVRP Configuration:
GVRP Feature:enabled
GVRP dynamic VLAN creation:enabled
Join Timers(ms):200
Leave Timers(ms):600
Leaveall Timers(ms):1000
Port based GVRP Configuration:
```


PORT	Applicant Status	Registration Mode
GigabitEthernet 0/1	normal	normal

- (3) After the GVRP function is enabled globally, check the VLANs dynamically created by devices and check whether the trunk ports join dynamic VLANs.

Dynamic VLANs 11 to 20 are created on Device A, and the trunk port Gigabit Ethernet 0/2 joins the dynamic VLANs 11 to 20.

```
DeviceA(config)# show vlan
```

VLAN	Name	Status	Ports
1	VLAN0001	STATIC	Gi0/1, Gi0/2, Gi0/3, Gi0/4 Gi0/5, Gi0/6, Gi0/7, Gi0/8
2-10	VLAN0002-VLAN0010	STATIC	Gi0/2
11-20	DVLAN0011-DVLAN0020	DYNAMIC	Gi0/2

Dynamic VLANs 2 to 20 are created on Device B, and the trunk ports GigabitEthernet 0/1 and GigabitEthernet 0/2 join the dynamic VLANs 2 to 20.

```
DeviceB(config)# show vlan
```

VLAN	Name	Status	Ports
1	VLAN0001	STATIC	Gi0/1, Gi0/2, Gi0/3, Gi0/4 Gi0/5, Gi0/6, Gi0/7, Gi0/8
2-20	DVLAN0002-DVLAN0020	DYNAMIC	Gi0/1, Gi0/2

Dynamic VLANs 2 to 10 are created on Device C, and the trunk port Gigabit Ethernet 0/1 joins the dynamic VLANs 2 to 10.

```
DeviceC(config)# show vlan
```

VLAN	Name	Status	Ports
1	VLAN0001	STATIC	Gi0/1, Gi0/2, Gi0/3, Gi0/4 Gi0/5, Gi0/6, Gi0/7, Gi0/8
2-10	DVLAN0002-DVLAN0010	DYNAMIC	Gi0/1
11-20	VLAN0011-VLAN0020	STATIC	Gi0/1

6. Configuration Files

- Device A configuration file

```
gvrp enable
gvrp dynamic-vlan-creation enable
!
vlan range 1-10
!
interface GigabitEthernet 0/2
 switchport mode trunk
```

- Device B configuration file

```
gvrp enable
```

```

gvrp dynamic-vlan-creation enable
!
vlan range 1
!
interface GigabitEthernet 0/1
  switchport mode trunk
!
interface GigabitEthernet 0/2
  switchport mode trunk

```

- Device C configuration file

```

gvrp enable
gvrp dynamic-vlan-creation enable
!
vlan range 1,11-20
!
interface GigabitEthernet 0/1
  switchport mode trunk

```

7. Common Errors

- The interconnection ports of devices are not in trunk mode.
- The permitted VLAN list of the interconnection ports of devices does not contain the user communication VLANs.
- The GVRP advertising mode and registration mode of trunk ports are not set to **Normal**.

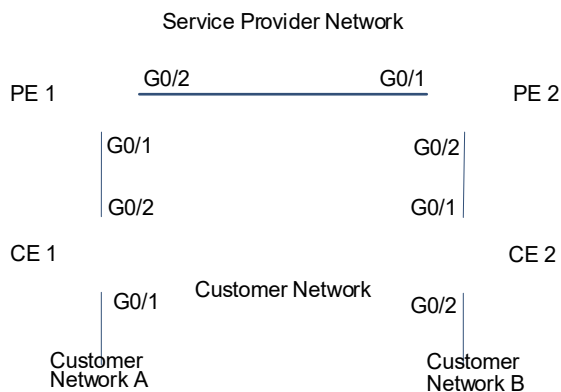
1.7.2 Configuring GVRP BPDU Tunnels

1. Requirements

The GVRP packets of the user network are transmitted through the tunnel of the SP network.

2. Topology

Figure 1-1 Application Scenario of GVRP BPDU Tunnel Function



3. Notes

- Configure the basic functions of GVRP on PE 1 and PE 2, including enabling the dynamic creation function of VLAN, configuring the interconnection port GigabitEthernet 0/5 as trunk port, and enabling the GVRP function globally.
- Enable the basic QinQ function on the ports connected to the user network on PE 1 and PE 2 so that data packets of the user network are transmitted within VLAN 200 on the SP network.
- Enable the GVRP tunnel function on the ports connected to the user network on PE 1 and PE 2 so that the SP network can transmit GVRP packets of the user network through the GVRP BPDU tunnel.

4. Procedure

- (1) Configure the basic functions of GVRP on the interconnection ports of SP devices.

Enable the GVRP function on PE 1 and Gigabit Ethernet 0/2 in turn.

```
PE1> enable
PE1# configure terminal
PE1(config)# vlan 251
PE1(config-vlan)# exit
PE1(config)# gvrp dynamic-vlan-creation enable
PE1(config)# interface gigabitethernet 0/2
PE1(config-if-GigabitEthernet 0/2)# switchport
PE1(config-if-GigabitEthernet 0/2)# switchport mode trunk
PE1(config-if-GigabitEthernet 0/2)# exit
PE1(config)# gvrp enable
```

Enable the GVRP function on PE 2 and Gigabit Ethernet 0/1 in turn.

```
PE2> enable
PE2# configure terminal
PE2(config)# vlan 252
PE2(config-vlan)# exit
PE2(config)# gvrp dynamic-vlan-creation enable
PE2(config)# interface gigabitethernet 0/1
PE2(config-if-GigabitEthernet 0/1)# switchport
PE2(config-if-GigabitEthernet 0/1)# switchport mode trunk
PE2(config-if-GigabitEthernet 0/1)# exit
PE2(config)# gvrp enable
```

- (2) Configure the basic QinQ function on SP devices. Use VLAN 250 to encapsulate the packets of users at two ends.

Configure the basic QinQ encapsulation on the port Gigabit Ethernet 0/1 connected to the user on PE 1.

```
PE1(config)# vlan 250
PE1(config-vlan)# exit
PE1(config)# interface gigabitethernet 0/1
PE1(config-if-GigabitEthernet 0/1)# switchport
PE1(config-if-GigabitEthernet 0/1)# switchport mode dot1q-tunnel
PE1(config-if-GigabitEthernet 0/1)# switchport dot1q-tunnel native vlan 250
```

```
PE1(config-if-GigabitEthernet 0/1)# switchport dot1q-tunnel allowed vlan add
untagged 250
```

Configure the basic QinQ encapsulation on the port Gigabit Ethernet 0/2 connected to the user on PE 2.

```
PE2(config)# vlan 250
PE2(config-vlan)# exit
PE2(config)# interface gigabitethernet 0/2
PE2(config-if-GigabitEthernet 0/2)# switchport
PE2(config-if-GigabitEthernet 0/2)# switchport mode dot1q-tunnel
PE2(config-if-GigabitEthernet 0/2)# switchport dot1q-tunnel native vlan 250
PE2(config-if-GigabitEthernet 0/2)# switchport dot1q-tunnel allowed vlan add
untagged 250
```

(3) Enable the GVRP tunnel on SP devices.

Enable the GVRP tunnel on port Gigabit Ethernet 0/1 of PE 1 and globally in turn.

```
PE1(config-if-GigabitEthernet 0/1)# l2protocol-tunnel gvrp enable
PE1(config-if-GigabitEthernet 0/1)# exit
PE1(config)# l2protocol-tunnel gvrp
```

Enable the GVRP tunnel on port Gigabit Ethernet 0/2 of PE 2 and globally in turn.

```
PE2(config-if-GigabitEthernet 0/2)# l2protocol-tunnel gvrp enable
PE2(config-if-GigabitEthernet 0/2)# exit
PE2(config)# l2protocol-tunnel gvrp
```

(4) Configure the basic functions of GVRP on user network devices.

Enable the GVRP function on CE 1 and port Gigabit Ethernet 0/2 in turn.

```
CE1> enable
CE1# configure terminal
CE1(config)# vlan range 60-69
CE1(config-vlan)# exit
CE1(config)# gvrp dynamic-vlan-creation enable
CE1(config)# interface gigabitethernet 0/2
CE1(config-if-GigabitEthernet 0/2)# switchport
CE1(config-if-GigabitEthernet 0/2)# switchport mode trunk
CE1(config-if-GigabitEthernet 0/2)# exit
CE1(config)# gvrp enable
```

Enable the GVRP function on CE 2 and port Gigabit Ethernet 0/1 in turn.

```
CE2> enable
CE2# configure terminal
CE2(config)# vlan range 70-79
CE2(config-vlan)# exit
CE2(config)# gvrp dynamic-vlan-creation enable
CE2(config)# interface gigabitethernet 0/1
CE2(config-if-GigabitEthernet 0/1)# switchport
CE2(config-if-GigabitEthernet 0/1)# switchport mode trunk
CE2(config-if-GigabitEthernet 0/1)# exit
CE2(config)# gvrp enable
```

5. Verification

- (1) Before the GVRP function is enabled globally, check the static VLAN configuration of the device; check whether the ports for advertising and processing GVRP packets are trunk ports and allow all VLANs to pass.

Only static VLANs exist on PE 1; the uplink port Gigabit Ethernet 0/2 is a trunk port and allows all VLANs to pass.

```

PE1# show vlan
VLAN          Name                Status    Ports
-----
1 VLAN0001    STATIC         Gi0/1, Gi0/2, Gi0/3,
Gi0/4
Gi0/5, Gi0/6, Gi0/7,
Gi0/8
250 VLAN0250  STATIC         Gi0/1, Gi0/2
251 VLAN0251  STATIC         Gi0/2
PE1# show interface switchport
Interface          Switchport Mode      Access Native Protected VLAN
lists
-----
GigabitEthernet 0/1  enabled  TUNNEL   1      250    Disabled  1,250
GigabitEthernet 0/2  enabled  TRUNK    1      1      Disabled  ALL
    
```

Only static VLANs exist on PE 2; the uplink port Gigabit Ethernet 0/1 is a trunk port and allows all VLANs to pass.

```

PE2# show vlan
VLAN          Name                Status    Ports
-----
1 VLAN0001    STATIC         Gi0/1, Gi0/2, Gi0/3,
Gi0/4
Gi0/5, Gi0/6, Gi0/7,
Gi0/8
250 VLAN0250  STATIC         Gi0/1, Gi0/2
252 VLAN0252  STATIC         Gi0/1
PE2# show interface switchport
Interface          Switchport Mode      Access Native Protected VLAN
lists
-----
GigabitEthernet 0/1  enabled  TRUNK    1      1      Disabled  ALL
GigabitEthernet 0/2  enabled  TUNNEL   1      250    Disabled  1,250
    
```

Only static VLANs exist on GE 1; the unlinK port Gigabit Ethernet 0/2 is a trunk port and allows all VLANs to pass.

```

CE1# show vlan
    
```

```

VLAN          Name                               Status      Ports
-----
1 VLAN0001    STATIC      Gi0/1,Gi0/2, Gi0/3,
Gi0/4
Gi0/5, Gi0/6, Gi0/7,
Gi0/8
60-69 VLAN0060-VLAN0069    STATIC      Gi0/2
CE1# show interface switchport
Interface          Switchport Mode      Access Native Protected VLAN
lists
-----
GigabitEthernet 0/2    enabled    TRUNK    1    1    Disabled    ALL

```

Only static VLANs exist on CE 2; the uplink port Gigabit Ethernet 0/1 is a trunk port and allows all VLANs to pass.

```

CE2# show vlan
VLAN          Name                               Status      Ports
-----
1 VLAN0001    STATIC      Gi0/1,Gi0/2, Gi0/3,
Gi0/4
Gi0/5, Gi0/6, Gi0/7,
Gi0/8
70-79 VLAN0070-VLAN0079    STATIC      Gi0/1
CE2# show interface switchport
Interface          Switchport Mode      Access Native Protected VLAN
lists
-----
GigabitEthernet 0/1    enabled    TRUNK    1    1    Disabled    ALL

```

- (2) Check whether the QinQ function is enabled, the SP device port connected to the user is the Dot1q-tunnel port, and the GVRP tunnel function is enabled.

Check the GVRP BPDU tunnel configuration on PE 1, and check whether the interface type is **Dot1q-tunnel**.

```

PE1# show interfaces dot1q-tunnel
=====Interface Gi0/1=====
Native vlan: 250
Allowed vlan list:1,250,
Tagged vlan list:

PE1# show l2protocol-tunnel gvrp
L2protocol-tunnel: Gvrp Enable
L2protocol-tunnel destination mac address: 01d0.f800.0006
GigabitEthernet 0/1 l2protocol-tunnel gvrp enable

```

Check the GVRP BPDU tunnel configuration on PE 2, and check whether the interface type is **Dot1q-tunnel**.

```
PE2# show interfaces dot1q-tunnel
=====Interface Gi0/2=====
Native vlan: 250
Allowed vlan list:1,250,
Tagged vlan list:

PE2# show l2protocol-tunnel gvrp
L2protocol-tunnel: Gvrp Enable
L2protocol-tunnel destination mac address:01d0.f800.0006
GigabitEthernet 0/2 l2protocol-tunnel gvrp enable
```

- (3) After the GVRP function is enabled globally using the **gvrp enable** command, check the GVRP configuration of devices.

Check whether the GVRP function of PE 1 has been enabled, and the trunk port normally advertises the GVRP information and dynamically updates the VLAN information.

```
PE1# show gvrp configuration
Global GVRP Configuration:
GVRP Feature:enabled
GVRP Dynamic VLAN Creation:enabled
Join Timers(ms):200
Leave Timers(ms):600
Leaveall Timers(ms):10000
Port based GVRP Configuration:
      PORT                Applicant Status          Registration Mode
-----
GigabitEthernet 0/2      normal                    normal
```

Check whether the GVRP function of PE 2 has been enabled, and the trunk port normally advertises the GVRP information and dynamically updates the VLAN information.

```
PE2# show gvrp configuration
Global GVRP Configuration:
GVRP Feature:enabled
GVRP Dynamic VLAN Creation:enabled
Join Timers(ms):200
Leave Timers(ms):600
Leaveall Timers(ms):10000
Port based GVRP Configuration:
      PORT                Applicant Status          Registration Mode
-----
GigabitEthernet 0/1      normal                    normal
```

Check whether the GVRP function of CE 1 has been enabled, and the trunk port normally advertises the GVRP information and dynamically updates the VLAN information.

```
CE1# show gvrp configuration
Global GVRP Configuration:
```

```
GVRP Feature:enabled
GVRP Dynamic VLAN Creation:enabled
Join Timers(ms):200
Leave Timers(ms):600
Leaveall Timers(ms):10000
Port based GVRP Configuration:
      PORT                Applicant Status      Registration Mode
-----
GigabitEthernet 0/2      normal                normal
```

Check whether the GVRP function of CE 2 has been enabled, and the trunk port normally advertises the GVRP information and dynamically updates the VLAN information.

```
CE2# show gvrp configuration
Global GVRP Configuration:
GVRP Feature:enabled
GVRP Dynamic VLAN Creation:enabled
Join Timers(ms):200
Leave Timers(ms):600
Leaveall Timers(ms):10000
Port based GVRP Configuration:
      PORT                Applicant Status      Registration Mode
-----
GigabitEthernet 0/1      normal                normal
```

- (4) After the GVRP function is enabled globally, check whether SP network devices can dynamically create VLANs on them; VLANs of user network will not be created dynamically. It indicates that the GVRP packets of user network do not affect the GVRP operation of SP devices.

Dynamic VLAN 252 has been created on PE 1, and the trunk port Gigabit Ethernet 0/2 joins the dynamic VLAN 252.

```
PE1(config)# show vlan
VLAN      Name                Status      Ports
-----
          1 VLAN0001          STATIC     Gi0/1, Gi0/2, Gi0/3,
          Gi0/4
          Gi0/5, Gi0/6, Gi0/7,
          Gi0/8
          250 VLAN0250       STATIC     Gi0/1, Gi0/2
          251 VLAN0251       STATIC     Gi0/2
          252 DVLAN0252      DYNAMIC    Gi0/2
```

Dynamic VLAN 251 has been created on PE 2, and the trunk port Gigabit Ethernet 0/1 joins the dynamic VLAN 251.

```
PE2(config)# show vlan
VLAN      Name                Status      Ports
-----
          251 VLAN0251       DYNAMIC    Gi0/1, Gi0/2
```



```

1 VLAN0001          STATIC   Gi0/1, Gi0/2, Gi0/3,
Gi0/4
                   Gi0/5, Gi0/6, Gi0/7,
Gi0/8
250 VLAN0250       STATIC   Gi0/1, Gi0/2
251 DVLAN0251      DYNAMIC  Gi0/1
252 VLAN0252       STATIC   Gi0/1

```

- (5) After the GVRP function is enabled globally, check whether user network devices dynamically create VLANs of user network. It indicates that the GVRP packets of user network are transmitted through the tunnels of SP devices.

Dynamic VLANs 70 to 79 have been created on CE 1, and the trunk port Gigabit Ethernet 0/2 joins the dynamic VLANs 70 to 79.

```

CE1(config)# show vlan
VLAN      Name                               Status   Ports
-----
1 VLAN0001          STATIC   Gi0/1,Gi0/2, Gi0/3,
Gi0/4
                   Gi0/5, Gi0/6, Gi0/7,
Gi0/8
60-69  VLAN0060-VLAN0069      STATIC   Gi0/2
70-79  DVLAN0070-DVLAN0079    DYNAMIC  Gi0/2

```

Dynamic VLANs 60 to 69 have been created on CE 2, and the trunk port Gigabit Ethernet 0/1 joins the dynamic VLANs 60 to 69.

```

CE2(config)# show vlan
VLAN      Name                               Status   Ports
-----
1 VLAN0001          STATIC   Gi0/1,Gi0/2, Gi0/3,
Gi0/4
                   Gi0/5, Gi0/6, Gi0/7,
Gi0/8
60-69  DVLAN0060-DVLAN0069    DYNAMIC  Gi0/1
70-79  VLAN0070-VLAN0079      STATIC   Gi0/1

```

6. Configuration Files

- PE 1 configuration file

```

l2protocol-tunnel gvrp
gvrp enable
gvrp dynamic-vlan-creation enable
!
vlan range 1,250-251
!
interface GigabitEthernet 0/1
 switchport mode dot1q-tunnel

```

```
switchport dot1q-tunnel allowed vlan add untagged 250
switchport dot1q-tunnel native vlan 250
l2protocol-tunnel gvrp enable
!
interface GigabitEthernet 0/2
switchport mode trunk
```

- PE 2 configuration file

```
l2protocol-tunnel gvrp
gvrp enable
gvrp dynamic-vlan-creation enable
!
vlan range 1,250,252
!
interface GigabitEthernet 0/1
switchport mode trunk
!
interface GigabitEthernet 0/2
switchport mode dot1q-tunnel
switchport dot1q-tunnel allowed vlan add untagged 250
switchport dot1q-tunnel native vlan 250
l2protocol-tunnel gvrp enable
```

- CE 1 configuration file

```
gvrp enable
gvrp dynamic-vlan-creation enable
!
vlan range 1,60-69
!
interface GigabitEthernet 0/2
switchport mode trunk
```

- CE 2 configuration file

```
gvrp enable
gvrp dynamic-vlan-creation enable
!
vlan range 1,70-79
!
interface GigabitEthernet 0/1
switchport mode trunk
```

7. Common Errors

On the SP network, the configured GVRP BPDU tunnel addresses are inconsistent at two ends, causing that GVRP BPDU frames cannot be correctly transmitted.