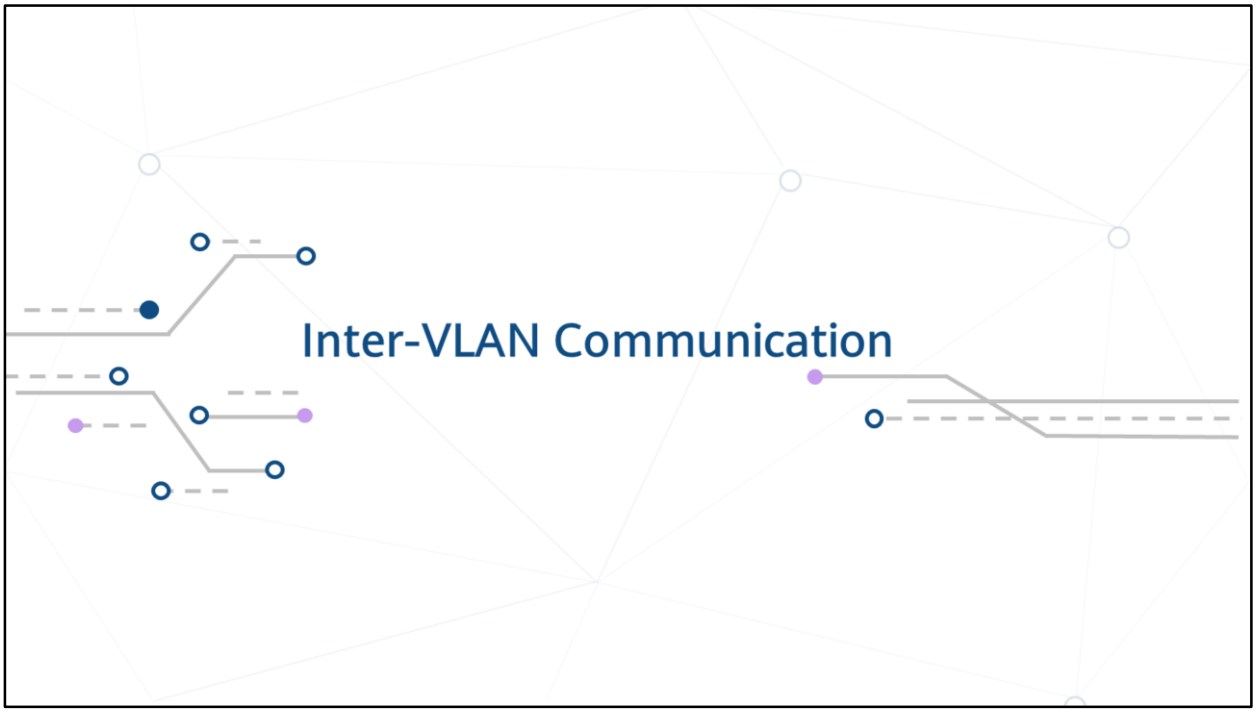
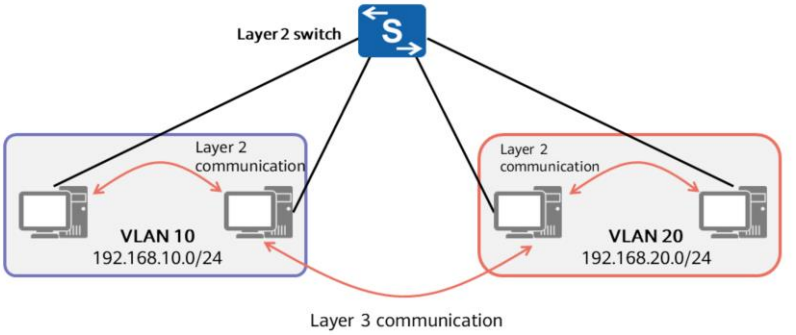

Inter-VLAN Communication

Contents

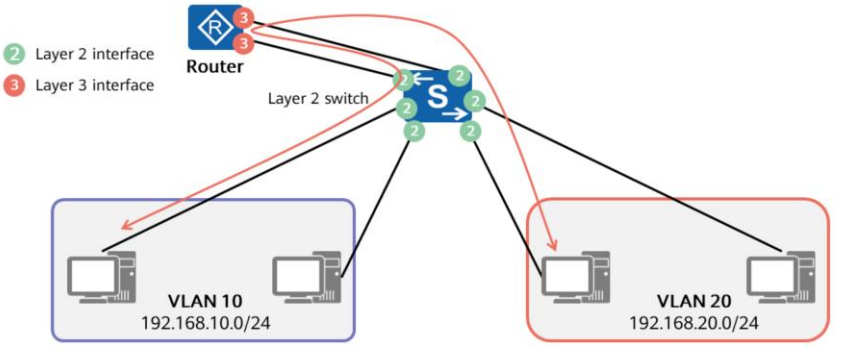
Inter-VLAN Communication (1)

- In real-world network deployments, different IP address segments are assigned to different VLANs.
- PCs on the same network segment in the same VLAN can directly communicate with each other without the need for Layer 3 forwarding devices. This communication mode is called Layer 2 communication.
- Inter-VLAN communication belongs to Layer 3 communication, which requires Layer 3 devices.



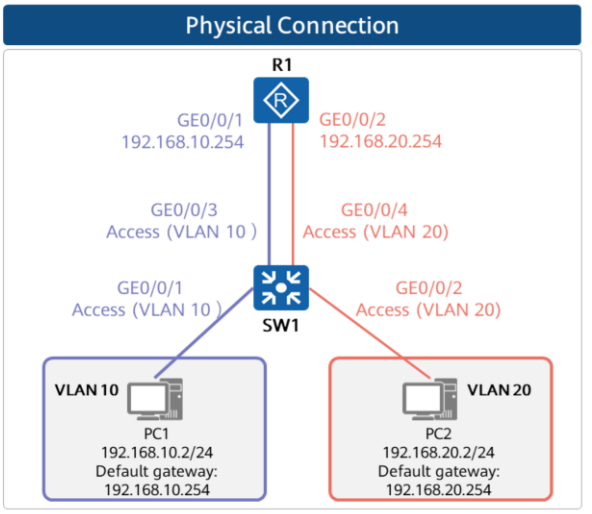
Inter-VLAN Communication (2)

- Common Layer 3 devices: routers, Layer 3 switches, firewalls, etc.
- Inter-VLAN communication is implemented by connecting a Layer 2 switch to a Layer 3 interface of a Layer 3 device. The communication packets are routed by the Layer 3 device.



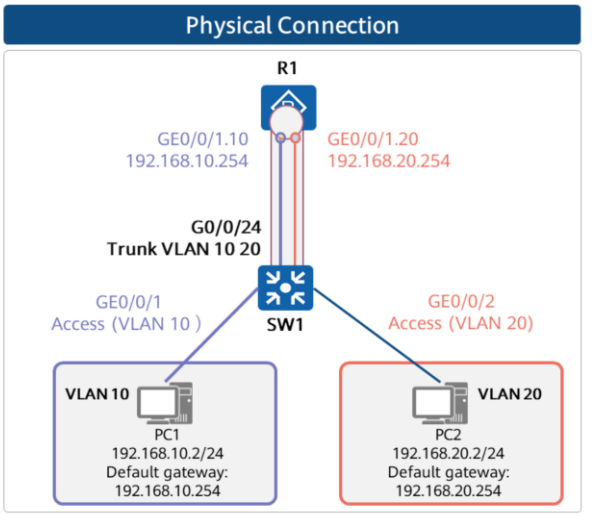
Contents

Using a Router's Physical Interfaces



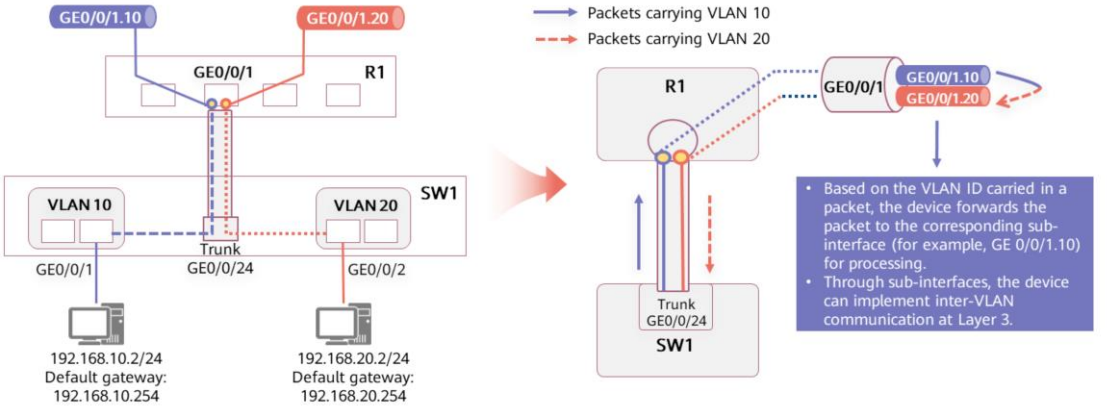
- Configure VLANs on the Layer 2 switch. Each VLAN uses an independent switch interface to connect to the router.
- The router provides two physical interfaces as the default gateways of PCs in VLAN 10 and VLAN 20, respectively, for the PCs to communicate with each other.

Using a Router's Sub-interfaces



- R1 connects to SW1 through a physical interface (GE 0/0/1). Two sub-interfaces (GE 0/0/1.10 and GE 0/0/1.20) are created on the physical interface and used as the default gateways of VLAN 10 and VLAN 20, respectively.
- Layer 3 sub-interfaces do not support VLAN packets and discard them once received. To prevent this issue, the VLAN tags need to be removed from the packets on the sub-interfaces. That is, VLAN tag termination is required.

Sub-Interface Processing



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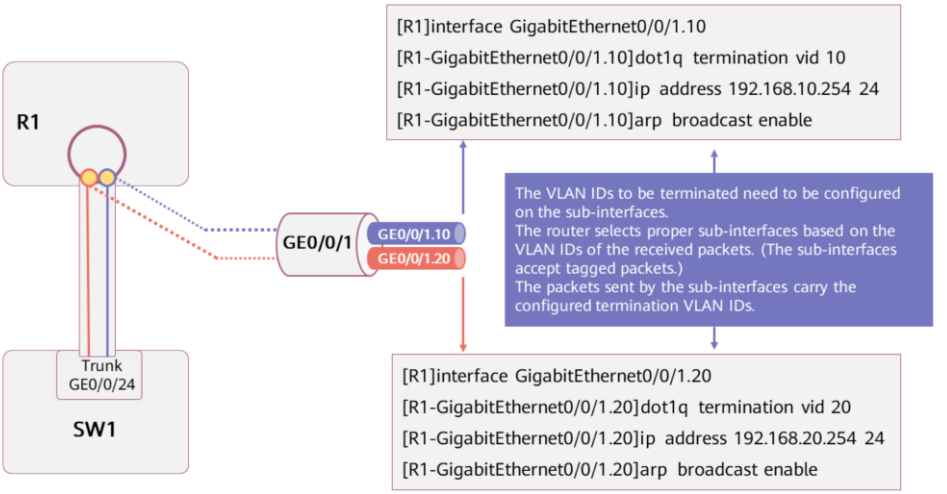
- A sub-interface implements VLAN tag termination as follows:
  - Removes VLAN tags from the received packets before forwarding or processing the packets.
  - Adds VLAN tags to the packets before forwarding the packets.

Example for Configuring Sub-interfaces



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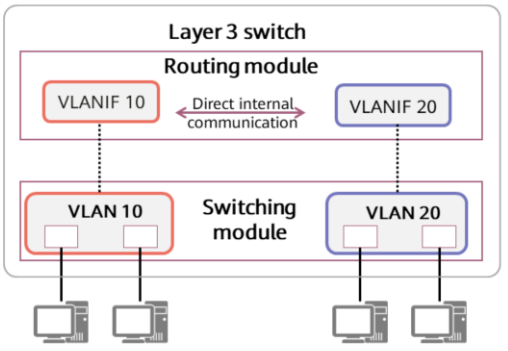
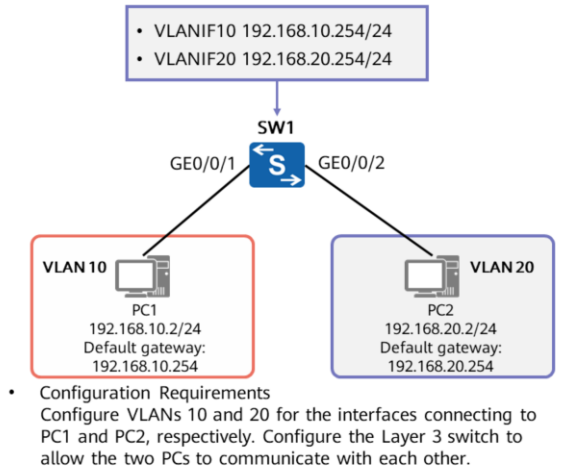
- The **interface** *interface-type interface-number.sub-interface number* command creates a sub-interface. *sub-interface number* specifies the number of a sub-interface on a physical interface. For easy memorization, a sub-interface number is generally the same as the VLAN ID to be terminated on the sub-interface.
- The **dot1q termination vid** command enables Dot1q VLAN tag termination for single-tagged packets on a sub-interface. By default, Dot1q VLAN tag termination for single-tagged packets is not enabled on sub-interfaces. The **arp broadcast enable** command enables ARP broadcast on a VLAN tag termination sub-interface. By default, ARP broadcast is not enabled on VLAN tag termination sub-interfaces. VLAN tag termination sub-interfaces cannot forward broadcast packets and automatically discard received ones. To allow a VLAN tag termination sub-interface to forward broadcast packets, run the **arp broadcast enable** command.

Contents

Layer 3 Switch and VLANIF Interfaces



Example for Configuring VLANIF Interfaces



- Configuration Requirements
  Configure VLANs 10 and 20 for the interfaces connecting to PC1 and PC2, respectively. Configure the Layer 3 switch to allow the two PCs to communicate with each other.

Basic configurations:

```
[SW1]vlan batch 10 20
[SW1] interface GigabitEthernet 0/0/1
[SW1-GigabitEthernet0/0/1] port link-type access
[SW1-GigabitEthernet0/0/1] port default vlan 10
[SW1] interface GigabitEthernet 0/0/2
[SW1-GigabitEthernet0/0/2] port link-type access
[SW1-GigabitEthernet0/0/2] port default vlan 20
```

Configure VLANIF interfaces:

```
[SW1]interface Vlanif 10
[SW1-Vlanif10]ip address 192.168.10.254 24
[SW1]interface Vlanif 20
[SW1-Vlanif20]ip address 192.168.20.254 24
```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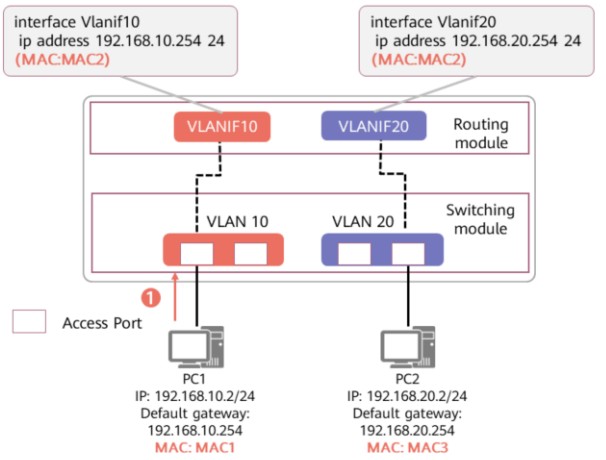
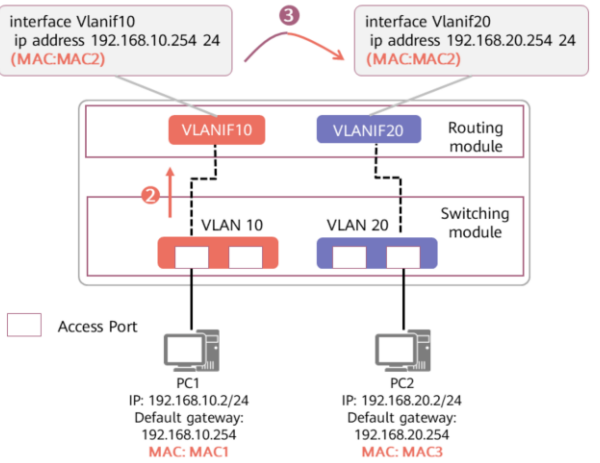
- The **interface vlanif** *vlan-id* command creates a VLANIF interface and displays the VLANIF interface view. *vlan-id* specifies the ID of the VLAN associated with the VLANIF interface. The IP address of a VLANIF interface is used as the gateway IP address of a PC and must be on the same network segment as the IP address of the PC.

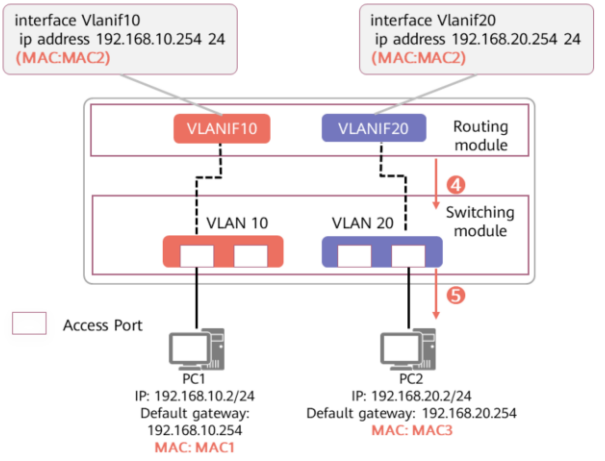
VLANIF Forwarding Process (1)



VLANIF Forwarding Process (2)

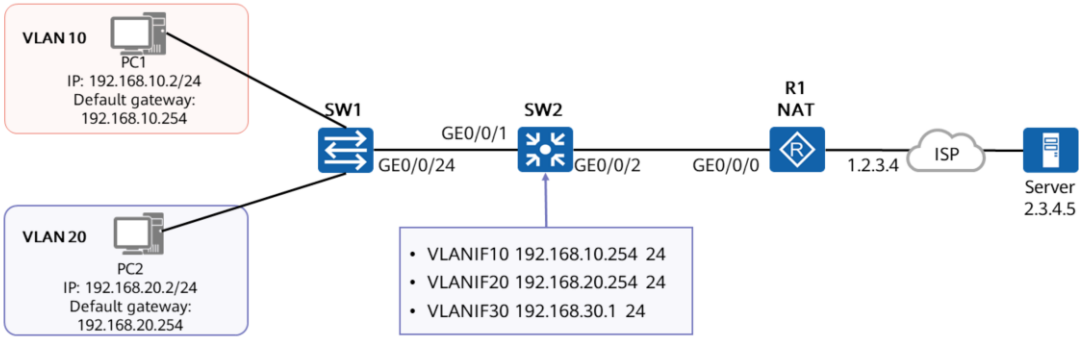


VLANIF Forwarding Process (3)

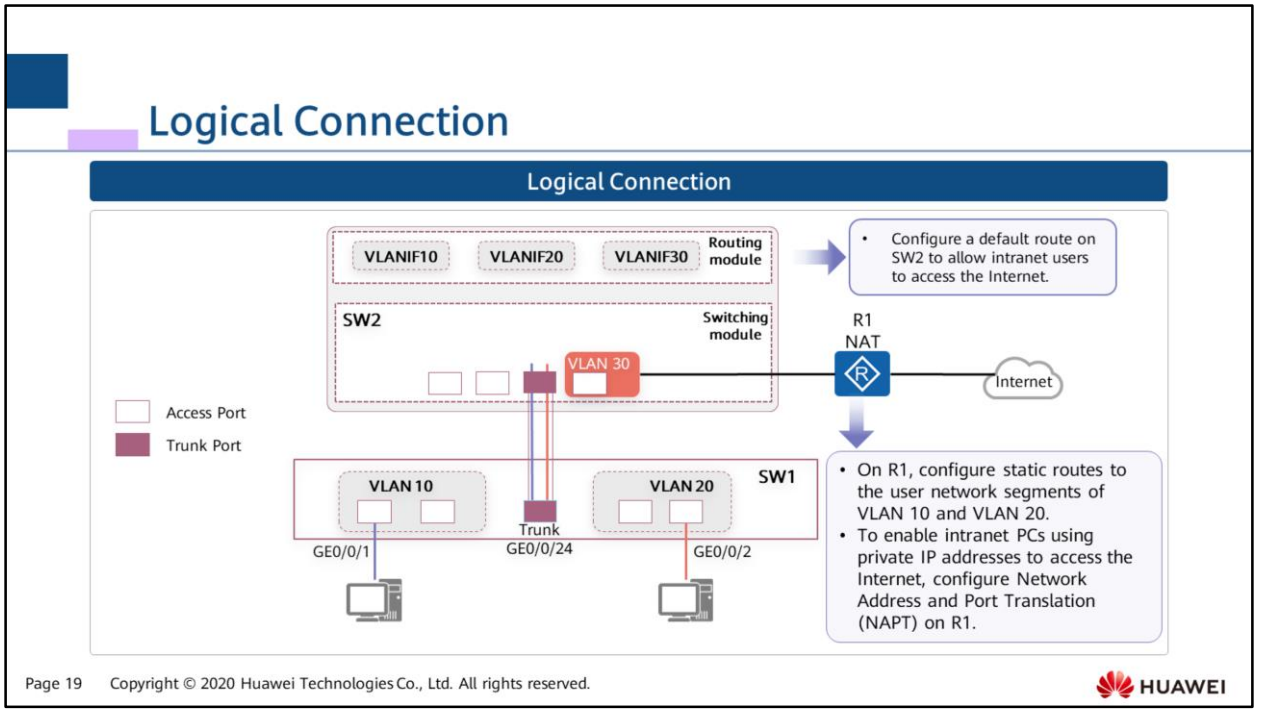


Contents

Network Topology

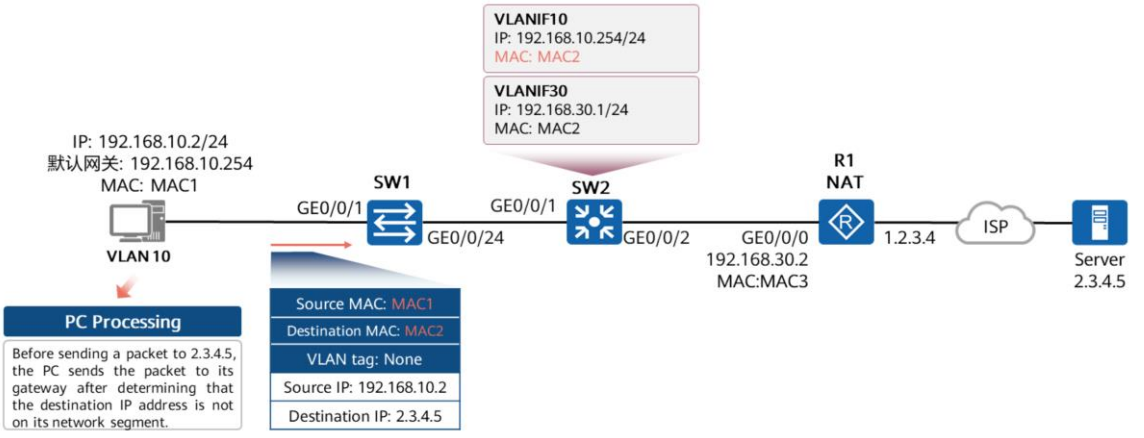


This topology is used as an example to describe the communication process from PC1 in VLAN 10 to the server (2.3.4.5) on the Internet.



- NAPT: translates the IP address and port number in an IP packet header to another IP address and port number. NAPT is mainly used to enable devices on an internal network (private IP addresses) to access an external network (public IP addresses). NAPT allows multiple private IP addresses to be mapped to the same public IP address. In this way, multiple private IP addresses can access the Internet at the same time using the same public IP address.

Communication Process (1)



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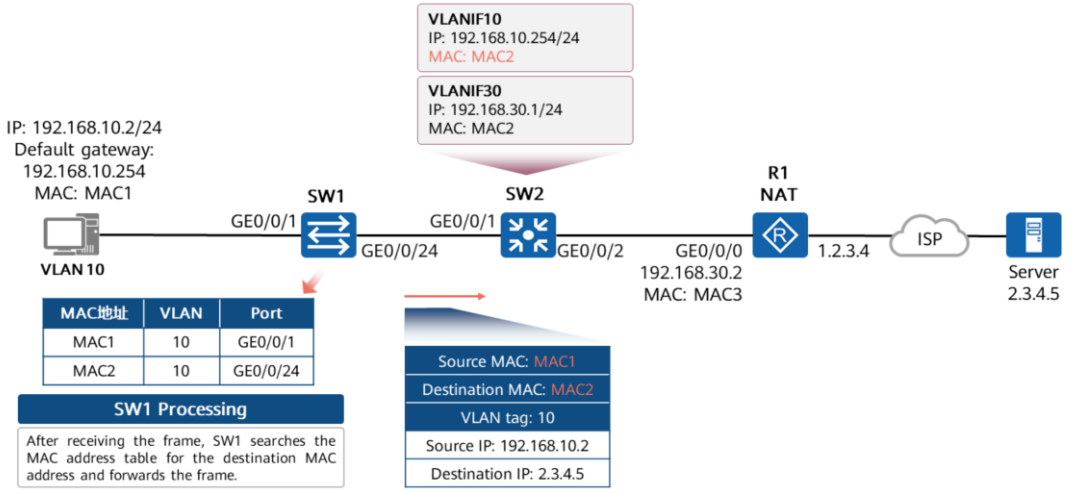
- This example assumes that the required ARP or MAC address entries already exist on all devices.

Communication Process (2)



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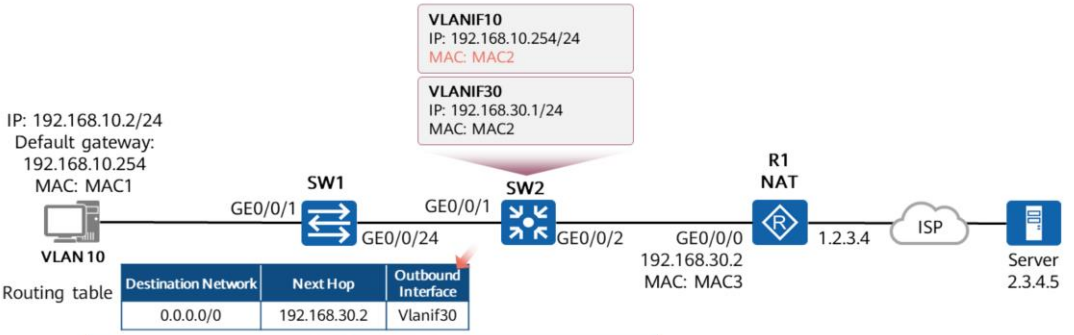
Communication Process (3)

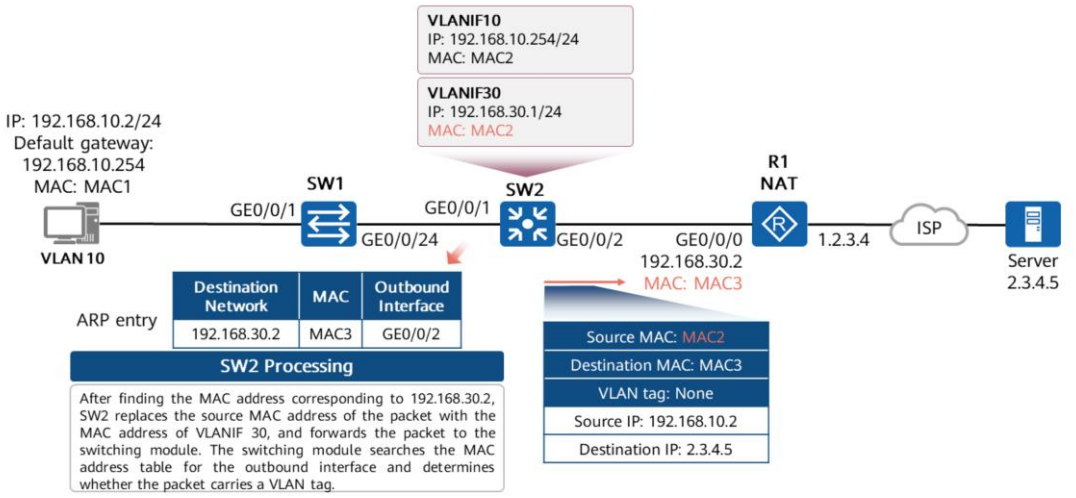


SW2 Processing

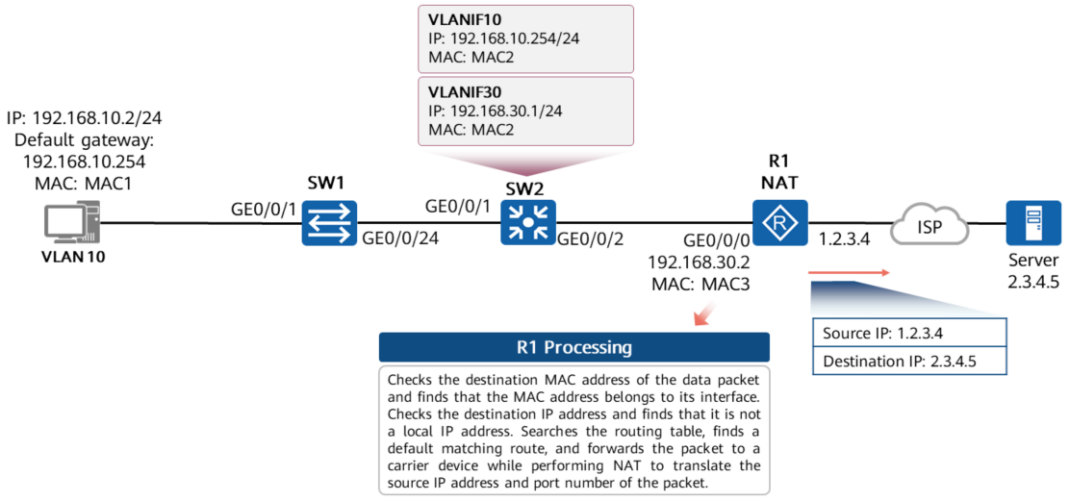
After SW2 receives the frame, it finds that the destination MAC address is the MAC address of its VLANIF 10 and sends the frame to the routing module, which then searches the routing table for a route matching the destination IP address 2.3.4.5.

After finding that the matching route is a default route, the outbound interface is VLANIF 30, and the next hop is 192.168.30.2, SW2 searches its ARP table to obtain the MAC address corresponding to 192.168.30.2.

Communication Process (4)



Communication Process (5)



- Network Address Translation (NAT) translates the IP addresses in IP packet headers to other IP addresses.

Summary

- This course describes three methods of implementing inter-VLAN communication: through physical interfaces, sub-interfaces, and VLANIF interfaces.
- It also elaborates the Layer 3 communication process, and device processing mechanism and packet header changes during the communication.

More Information

- Comparison between Layer 2 and Layer 3 interfaces

Layer2 Interface	Layer3 Interface
An IP address cannot be configured for a Layer 2 interface.	An IP address can be configured for a Layer 3 interface
A Layer 2 interface does not have a MAC address.	A Layer 3 interface has a MAC address.
After a Layer 2 interface receives a data frame, it searches its MAC address table for the destination MAC address of the frame. If a matching MAC address entry is found, it forwards the frame according to the entry. If no matching MAC address entry is found, it floods the frame.	After a Layer 3 interface receives a data frame, if the destination MAC address of the data frame is the same as the local MAC address, it decapsulates the data frame and looks up the destination IP address of the data packet in the routing table. If a matching route is found, it forwards the data frame according to the instruction of the route. If no matching route is found, it discards the packet.
A physical interface on a Layer 2 switch (has only Layer 2 switching capabilities) is a typical Layer 2 interface. By default, the physical interfaces of most Layer 3 switches (have both Layer 2 and Layer 3 switching capabilities) work at Layer 2.	A Layer 3 interface on a router is a typical Layer 3 interface. Physical interfaces on some Layer 3 switches can be switched to Layer 3 mode. In addition to Layer 3 physical interfaces, there are Layer 3 logical interfaces, such as VLANIF interfaces on switches or logical sub-interfaces on other network devices, such as GE 0/0/1.10.
Layer 2 interfaces do not isolate broadcast domains. They flood received broadcast frames.	Layer 3 interfaces isolate broadcast domains. They directly terminate received broadcast frames instead of flooding them.