VLAN Configuration

Content

Chapter 1   **VLAN Configuration**

1.1 **VLAN Overview**

Virtual Local Area Network (VLAN) groups the devices of a LAN logically but not physically into segments to implement the virtual workgroups. IEEE issued the IEEE 802.1Q in 1999, which was intended to standardize VLAN implementation solutions.

Through VLAN technology, network managers can logically divide the physical LAN into different broadcast domains. Every VLAN contains a group of workstations with the same demands. The workstations of a VLAN do not have to belong to the same physical LAN segment.

With VLAN technology, the broadcast and unicast traffic within a VLAN will not be forwarded to other VLANs, therefore, it is very helpful in controlling network traffic, saving device investment, simplifying network management and improving security.
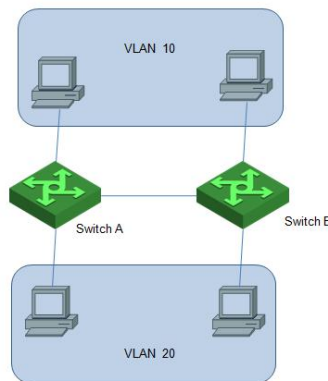

Figure 1-1 Vlan implementation

A VLAN can span across multiple switches, or even routers. This enables hosts in a VLAN to be dispersed in a looser way. That is, hosts in a VLAN can belong to different physical network segment.

Compared with the traditional Ethernet, VLAN enjoys the following advantages.

1)   Broadcasts are confined to VLANs.   This decreases bandwidth utilization and improves network performance.

2)   Network security is improved. VLANs cannot communicate with each other directly. That is, a host in a VLAN cannot access resources in another VLAN directly, unless routers or Layer 3 switches are used.

3) Network configuration workload for the host is reduced. VLAN can be used to group specific hosts. When the physical position of a host changes within the range of the VLAN, you need not change its network configuration.

1.2 **VLAN Principles**

VLAN tags in the packets are necessary for the switch to identify packets of different VLANs. The switch works at Layer 2 (Layer 3 switches are not discussed in this chapter) and it can identify the data link layer encapsulation of the packet only, so

you can add the VLAN tag field into only the data link layer encapsulation if necessary.

In 1999, IEEE issues the IEEE 802.1Q protocol to standardize VLAN implementation, defining the structure of VLAN-tagged packets.

IEEE 802.1Q protocol defines that a 4-byte VLAN tag is encapsulated after the destination MAC address and source MAC address to show the information about VLAN.
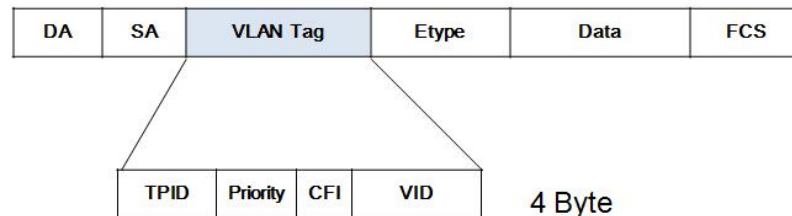

Figure 1-2 Format of VLAN tag

As shown in Figure 1-2, a VLAN tag contains four fields, including TPID (Tag Protocol Identifier), priority, CFI (Canonical Format Indicator), and VID (VLAN ID).

➢ **TPID** is a 16-bit field, indicating that this data frame is VLAN-tagged. By default, it is 0x8100.

➢ **Priority** is a 3-bit field, referring to 802.1p priority. Refer to section "QoS & QoS profile" for details.

➢ **CFI** is a 1-bit field, indicating whether the MAC address is encapsulated in the standard format in different transmission media. This field is not described in detail in this chapter.

➢ **VID (VLAN ID)** is a 12-bit field, indicating the ID of the VLAN to which this packet belongs. It is in the range of 0 to 4,095. Generally, 0 and 4,095 is not used, so the field is in the range of 1 to 4,094.

VLAN ID identifies the VLAN to which a packet belongs. When the switch receives an un-VLAN-tagged packet, it will encapsulate a VLAN tag with the default VLAN ID of the inbound port for the packet, and the packet will be assigned to the default VLAN of the inbound port for transmission. For the details about setting the default VLAN of a port, refer to section "02- Ethernet Port Configuration"

1.3   802.1Q VLAN

1.3.1   VLAN Link Type of Ethernet Ports

An Ethernet port can operate in one of the three link types:

➢ Access: An access port only belongs to one VLAN, normally used to connect user

device.

➢ Trunk: A trunk port can belong to more than one VLAN. It can receive/send packets from/to multiple VLANs and is generally used to connect another switch. The packet sent from this port can only be with tag label.

➢ Hybrid: A hybrid port can belong to multiple VLANs, can receive, or send packets for multiple VLANs, used to connect either user or network devices. It allows packets of multiple VLANs to be sent with or without the Tag label

1.3.2 Default VLAN

Details refer to 02- Ethernet Port Configuration.

1.3.3 Handling Packets

Different ports have different ways to handle the packet. Details are in Table 1-1

Table 1-1 Different port handles different packet

Port type	Ingress		Egress
	Untagged packet	Tagged packet	
Access port	Receive it and add a tag with VID being equal to PVID.	If VID of the packet is equal to the port permitted VID, receive it; if VID is different, discard it.	Strip the Tag and transmit the packet as the VID of the packet is equal to the port permitted VID
Hybrid port			If VID of the packet is equal to the port permitted untag VID, remove the tag and transmit it; If VID of the packet is equal to the port permitted tag VID, keep the tag and transmit it.
Trunk port			If VID of the packet is equal to the port permitted VID, keep the tag and transmit it.

Chapter 2   VLAN Configuration

2.1 Default VLAN Configuration

Table 2-1 Default VLAN configuration

Parameter	Default	Description
Existed VLAN	VLAN 1	The vlan-id argument ranges from 1 to 4,094. VLAN 1 is the default VLAN of all ports.
VLAN description	/	VLAN description is characters ranged from 1 to 32.
Port member of VLAN	All ports are the members of VLAN 1.	

2.2 Create and Modify VLAN

Switch supports 4094 VLANs.

Perform following commands in privilege mode.

Table 2-2 Create and modify VLAN

Operation	Command	Description
Enter global configuration mode	**configure terminal**	
Create a vlan and enter vlan configuration mode	**VLAN** *vlan-list*	If the VLAN to be created exists, enter the VLAN mode directly. Otherwise, create the VLAN first, and then enter the VLAN mode. Vlan-id allowed to configure is in the range of 1 to 4094. Vlan-list can be in the form of

		discrete number, a sequence number, or the combination of discrete and sequence number, discrete number of which is separate by comma, and sequence number of which is separate by subtraction sign, such as: 2, 5, 8, 10-20.
Add port member to a vlan	**switchport ethenet** *device-num/slot-num/port-num*	
Configure vlan description	**description** *vlan-name*	By default, vlan description is empty.
Display the related information about VLAN	**show vlan** *vlan-id / brief*	

2.2 Delete Port Members from a VLAN

Perform following commands in privilege mode.

Table 2-3 Delete port members from a VLAN

Operation	Command	Description
Enter global configuration mode	**configure terminal**	/
Enter vlan configuration mode	**vlan** *vlan-list*	/
Delete port member from VLAN	**no switchport** { **all | ethernet** *port*_list }	/
Display the related information about VLAN	**show vlan** *vlan-id / brief*	/

Note:

A port whose VLAN should not the default VLAN.

2.3 Delete VLAN

Perform following commands in privilege mode.

<p align="center">**Table 2-4 Delete vlan**</p>

Operation	Command	Description
Enter global configuration mode	**configure terminal**	
Delete VLAN	**no vlan** {*vlan-list* |*all*}	
Display the related information about VLAN	**show vlan** *vlan-id / brief*	

Note:

After perform no vlan all, system will delete all vlan except VLAN 1. In other words,

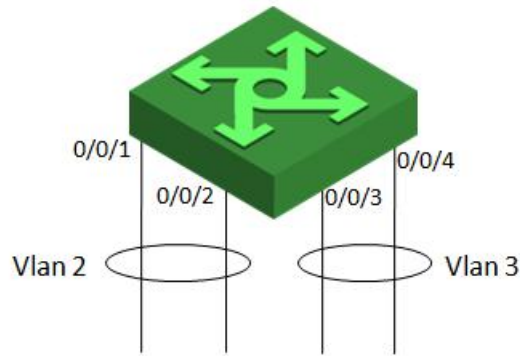VLAN 1 cannot be deleted.

The VLAN to be removed cannot exist in the multicast group. So please remove the

related multicast group first.

2.4 VLAN Configuration Example

i.   Networking Requirements

Create VLAN2 and VLAN3. Add port 0/0/1 and 0/0/2 to VLAN2 . Add port 0/0/3 and 0/0/4 to VLAN3. Delete port 0/0/1 to 0/0/4 from VLAN1.

ii.   Networking diagram

iii.   Networking configuration

```
! Create VLAN 2 and enter it.
Switch(config)# vlan 2
! Add Ethernet0/01 and Ethernet0/0/2 to VLAN2.
Switch(config-if-vlan)#switchport ethernet 0/0/1 ethernet 0/0/2
! Create VLAN 3 and enter it.
Switch(config)# vlan 3
! Add Ethernet0/0/3 and Ethernet0/0/4 to VLAN3.
Switch(config-if-vlan)#switchport ethernet 0/0/3 ethernet 0/0/4
! Set the default vlan of Ethernet0/0/1and Ethernet0/0/2
Switch(config)#interface range ethernet 0/0/1 to ethernet 0/0/2
Switch(config-if-range)# switchport default vlan 2
! Set the default vlan of Ethernet0/0/3 and Ethernet0/0/4
Switch(config)#interface range ethernet 0/0/3 to ethernet 0/0/4
Switch(config-if-range)# switchport default vlan 3
! Enter VLAN view and delete Ethernet0/0/1 to Ethernet0/0/4 from VLAN1.
Switch(config)#vlan 1
Switch(config-if-vlan)#no switchport ethernet 0/0/1 to ethernet 0/0/4
```