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Application of Routing Communication Between VLANs in A Layer 3 Switch

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Abstract: With the rapid development of the economy and the continuous improvement of the level of science and technology, China's network communication has made great progress, and both have achieved a qualitative leap in communication quality and transmission rate, and these depend on the data processing speed. In the current era, people put forward higher requirements for data processing speed. As a LAN technology, VLAN is widely used in enterprises or campuses. Its main function is to isolate the broadcast domain. At present, the common method of implementing communication between VLANs is to use a single-arm router, but the one-arm router has the disadvantages of slow transmission speed and poor applicability. In recent years, the three-layer switch has played an increasingly important role in the routing and communication between VLANs. Its features of high scalability, strong applicability and good economy have been favored by people. This paper studies and analyzes the application of routing communication between VLANs in Layer 3 switches.

1. Advantage Analysis of VLAN

VLAN is virtual LAN, which is based on the logical network above the switching LAN. Under the construction of network management software, VLAN can achieve effective span between different network segments and networks. In the current situation, VLANs are widely used in enterprises or campuses, and their main role is to isolate the broadcast domain. In a virtual local area network environment, different ports of the same switch can be isolated from each other, which can reduce the occurrence of broadcast storms. The advantages of VLAN are mainly as follows: ① Prevention of broadcast storm: By dividing the network to a certain extent, it becomes multiple VLANs. In this case, the number of participation in broadcast storms is limited. In addition, through the application of reasonable and effective planning of VLANs, a switching port can be assigned to a specific VLAN group. This VLAN group can be implemented in multiple switches based on the switching network, in a specific VLAN. Broadcasts are not transmitted outside this VLAN [3]. As a result, it has played a very good role in preventing broadcast storms. ② It has good economic benefits: in the VLAN environment, the existing broadband and uplink have higher utilization efficiency, and the demand for network upgrade will be reduced to a certain extent, thereby effectively reducing the cost. control. Through the VLAN, the Layer 2 planar network can be reasonably divided into multiple logical working groups, so that unnecessary traffic on the network can be reasonably controlled to improve performance, so the VLAN has good economy. ③ Improve network security: Network security issues have existed since the beginning of network technology development. Under certain conditions, users can access and monitor the services that the network flows through. By effectively using VLAN technology, this phenomenon can be effectively contained. Unauthorized users' access to broadcast packets will be limited, which improves network security. ④ Optimize network management: VLAN can effectively aggregate users and network devices, and perform reasonable functional division on



this basis, which will make network management and maintenance more convenient and efficient. In addition, VLAN technology can build a virtual network environment. Even if the location, network and users are different, the process will be more flexible and efficient. Therefore, VLAN technology can optimize network management and improve the flexibility and convenience of its' usage.

2. Comparison Analysis Between One-arm Router and Three-layer Switch

The one-arm route, that is, the router-on-a-stick, is based on the configuration of the sub-interfaces on the interface of the router, so that different VLANs that are originally isolated from each other can be interconnected. Through the configuration of the one-arm router, communication between VLANs can be realized. However, the one-arm router also has certain defects, mainly in the following aspects: ① Using a one-arm router to implement inter-VLAN communication and interworking, need to be replaced. The three-layer switch is used instead of the router, which puts higher requirements on the connection line and has certain deficiencies in the applicability. ② When the router transmits data, it will occupy and consume the router CPU. And the memory resources, which will affect the network transmission, so that the speed of data transmission will be reduced to a certain extent, and the data operation will be slower, so the resource consumption of the one-arm router is larger; ③ The router is based on the one-arm. In the VLAN communication, the originally divided VLAN will be destroyed. This will not only have a negative impact on performance, but also affect network security to a certain extent.

For a three-layer switch, it can effectively compensate for the defects of the one-arm router. In the Layer 3 switch environment, the data stream will generate a corresponding MAC address and IP address mapping table. When the same data flows, there is no need to perform routing again, but pass through the Layer 2 according to the mapping table. In this way, the network delay will be reduced to a certain extent, thereby increasing the rate of data transmission. The characteristics of three-layer switch are mainly as follows: ① Scalability is strong: unlike a one-arm router, when a Layer 3 switch connects to multiple subnets, it mainly connects to the Layer 3 module. The port is increased to effectively reduce the network investment under the premise of satisfying the user's demand. Therefore, the three-layer switch has high scalability [2]; ② High security: in terms of functions, there is not a big difference between the three-layer switch and the ordinary router, it can also effectively access the list, which can be set to achieve the purpose of user behavior limitation, network security is guaranteed, so the three-layer switch has built in security mechanism; ③ Good economy Benefits: For three-layer switches, it has both routing and switching capabilities to enable efficient connections to large networks. It can be said that the functions of the traditional router are all available, and have better data transmission speed and data running speed, and have higher cost performance; ④ Billing function: the three-layer switch can count and record the online time of the computer, and at the same time It can effectively identify the IP address of the data packet and count the data traffic. Based on this function, the three-layer switch can charge according to the online time and data traffic usage of the computer. ⑤ Applicability: three-layer switches have strong applicability. For different applications, three-layer switches can provide different broadband. For example, for video transmission, the three-layer switch can realize the development of a dedicated channel for dedicated video transmission, and specifically reserve a certain dedicated broadband for it, and this dedicated broadband other application cannot be applied, which greatly improves the stability of the video transmission. In addition, the three-layer switch also has a multicast function. The unicast mode will occupy a large amount of bandwidth in the process of spanning the network segment, and multicast solves this problem well, thereby improving the stability of data transmission. [1].

3. Specific Application of Routing Communication Between VLANs in A Three-layer Switch

Take Company A as an example, its LAN structure is shown in Figure 1:

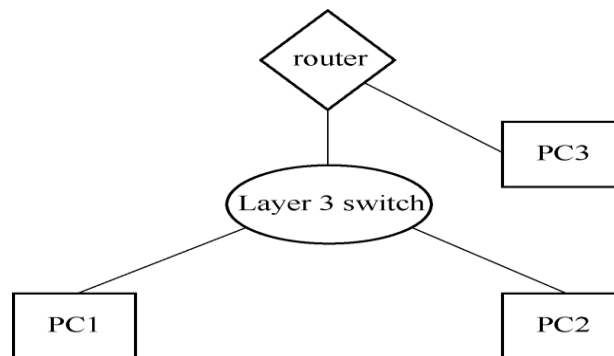


Figure 1: A company's LAN Structure

Under this LAN structure, if the company does not carry out scientific and reasonable VLAN division, then all users will be concentrated on the ports of network devices, and broadcast storms are likely to occur.

3.1 WLAN Design

For the company's local area network, in order to prevent the occurrence of broadcast storms, the following solutions are proposed: combined with the current actual situation of the company and related daily services, the VLANs are reasonably divided into VLAN 20, VLAN 30, and VLAN 40. Based on the address assignment, see Table 1:

Table 1: A company's Layer 3 switch implements inter-VLAN routing address allocation table

Device	Interface	IPV4 Address	Subnet Mask	Default Gateway
Three-layer Switch	VLAN20	192.168.20.1	255.255.255.0	Not applicable
	VLAN20	192.168.30.1	255.255.255.0	Not applicable
	Fa0/24	10.1.1.2	255.255.255.252	Not applicable
router	Fa0/0	10.1.1.1	255.255.255.252	Not applicable
PC1	NIC	192.168.20.20	255.255.255.0	192.168.20.1
PC2	NIC	192.168.30.10	255.255.255.0	192.168.30.1
PC3	NIC	172.16.20.20	255.255.255.0	172.16.20.1

3.2 VLAN Creation and Access

The instructions are as follows:

```

Switch(config)#vlan 20
Switch(config-vlan)#name sc//name sc
Switch(config-vlan)#vlan 30
Switch(config-vlan)#name scc//name scc
Switch(config-vlan)#vlan 40
Switch(config-vlan)#name si
Switch(config-vlan)#int range f0/1-10//Enter port f0-10
Switch(config-if-range)#switchport access vlan 20
Switch(config-if-range)#int range f0/11-22
Switch(config-if-range)#switchport access vlan 30
Switch(config-if-range)#int range f0/23-24
Switch(config-if-range)#switchport access vlan 40
Switch(config-if-range)#end
  
```

3.3 Setting the SVI Interface

The instructions are as follows:

```

Switch(config)#ip routing
  
```

```

Switch(config)#int vlan 20
Switch(config-if)#ip add 192.168.20.1 255.255.255.0//Set the vlan interface
address
Switch(config-if)#int vlan 30
Switch(config-if)#ip add 192.168.30.1 255.255.255.0
Switch(config-if)#ip add 10.1.1.2 255.255.255.0
Switch(config-if)#exit

```

3.4 Static Route Configuration

The instructions are as follows:

First, configure the router [4]:

```

Router(config)#int f0/0//Enter port f0/0
Router(config-if)#ip add 10.1.1.1 255.255.255.252
Router(config-if)#no shut
Router(config-if)#int f0/1
Router(config-if)#ip add 172.16.20.1 255.255.255.0
Router(config-if)#no shut
Router(config-if)#exit
Router(config)#ip route 192.168.0.0 255.255.0.0 f0/0
Second, add a static route for the Layer 3 switch [5]:
Switch(config)#ip route 172.16.10.0 255.255.255.0 10.1.1.1//
Finally, add a static route to the Layer 3 switch MS:
Switch(config)#end

```

4. Conclusion

This paper mainly studies and analyzes the application of routing communication between VLANs in Layer 3 switches. Firstly, the VLAN is explained to a certain extent, and the advantages of VLAN in broadcast storm prevention, economic benefit improvement, network security performance improvement and network management optimization are pointed out. Then, the one-arm router is compared and analyzed on this basis. The three-layer switch illustrates the drawbacks of the one-arm router, and clarifies that the three-layer switch has strong scalability, high security, good economic efficiency, strong applicability, and billing function. Finally, combined with the company's local area network structure, the routing and communication configuration between VLANs in the three-layer switch is designed from three aspects: VLAN creation and access, setting SVI interface and static route configuration. All in all, using the advantages of the three-layer switch, it can be scientifically and effectively configured and designed to effectively realize the routing communication between VLANs.

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