
基于 eNSP 软件的 VLAN 实验指导书

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实验软件：

华为 eNSP

下载地址：<https://cloud.tsinghua.edu.cn/f/0b37e9b1abfd4291a6ee/>

注意：在关闭软件时，注意在命令行中输入 save 保存当前配置，否则关机后当前交换机配置消失。另外，软件可能会出现丢失配置的情况，实验尽量一次做完，不要反复重启软件。

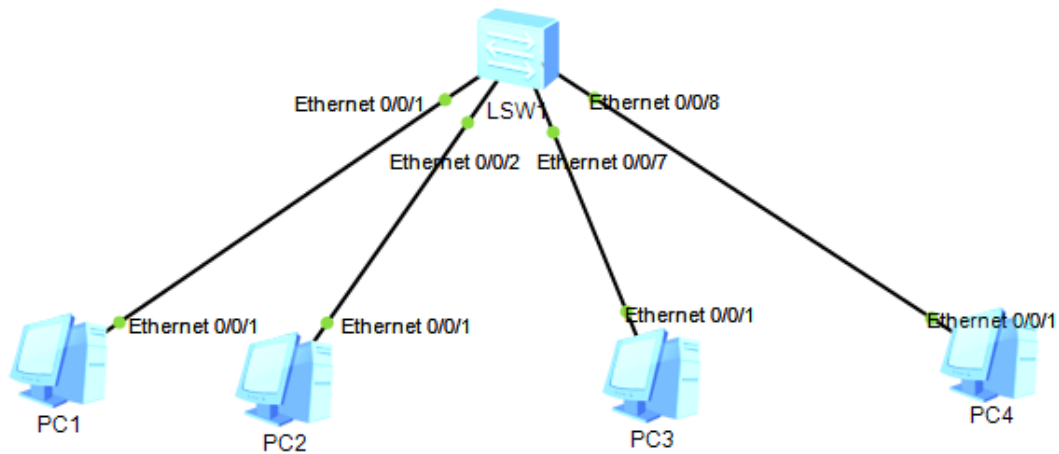
实验任务 1

在同一个交换机上进行相同 VLAN 之间的通信；

实验目的

在不同的 vlan 下不能通信、在相同的 vlan 下才可以通信。

实验拓扑：



实验配置

注意在进行配置时首先要启动主机与交换机

主机配置：

PC1、2、3、4 分别设置地址为

192.168.0.1-192.168.0.4

子网掩码为 24 位

交换机配置（右键 CLI 进入，注意，指令执行完会有如下提示，回车即可）：

Nov 23 2022 17:49:13-08:00 Huawei DS/4/DATASYNC_CFGCHANGE:OID 1.3.6.1.4.1.2011.5
.25.191.3.1 configurations have been changed. The current change number is 3, the
change loop count is 0, and the maximum number of records is 4095.

配置指令：

<Huawei>sys

首先将端口设置为 access

[Huawei]interface e0/0/1

[Huawei-Ethernet0/0/1]port link-type access

[Huawei]interface e0/0/2

[Huawei-Ethernet0/0/2]port link-type access

[Huawei]interface e0/0/3

[Huawei-Ethernet0/0/3]port link-type access

[Huawei]interface e0/0/4

[Huawei-Ethernet0/0/4]port link-type access

//创建并划分 vlan

[Huawei]vlan 2

说明：切换到 vlan2 设置

[Huawei-vlan2]port e0/0/1

说明：将端口 e0/0/1 加入 vlan2

[Huawei-vlan 2]port e0/0/2

[Huawei]vlan3

[Huawei-vlan3]port e0/0/3

[Huawei-vlan3]port e0/0/4

实验效果

以 PC1 为例：

```
PC1
基础配置 命令行 组播 UDP发包工具 串口
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 31/49/63 ms

PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe56:6e3c
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.0.1 VLAN2中的PC1
Subnet mask.....: 255.255.255.0
Gateway.....: 0.0.0.0
Physical address.....: 54-89-98-56-6E-3C
DNS server.....:

PC>ping 192.168.0.2 VLAN2中的PC2

Ping 192.168.0.2: 32 data bytes, Press Ctrl_C to break
From 192.168.0.2: bytes=32 seq=1 ttl=128 time=47 ms
From 192.168.0.2: bytes=32 seq=2 ttl=128 time=47 ms
From 192.168.0.2: bytes=32 seq=3 ttl=128 time=47 ms
From 192.168.0.2: bytes=32 seq=4 ttl=128 time=47 ms
From 192.168.0.2: bytes=32 seq=5 ttl=128 time=31 ms

--- 192.168.0.2 ping statistics ---
```

```
PC3
基础配置 命令行 组播 UDP发包工具 串口
PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe7c:474d
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.0.3 VLAN3中的PC3
Subnet mask.....: 255.255.255.0
Gateway.....: 0.0.0.0
Physical address.....: 54-89-98-7C-47-4D
DNS server.....:

PC>ping 192.168.0.4 VLAN3中的PC4

Ping 192.168.0.4: 32 data bytes, Press Ctrl_C to break
From 192.168.0.4: bytes=32 seq=1 ttl=128 time=63 ms
From 192.168.0.4: bytes=32 seq=2 ttl=128 time=47 ms
From 192.168.0.4: bytes=32 seq=3 ttl=128 time=47 ms
From 192.168.0.4: bytes=32 seq=4 ttl=128 time=63 ms
From 192.168.0.4: bytes=32 seq=5 ttl=128 time=47 ms

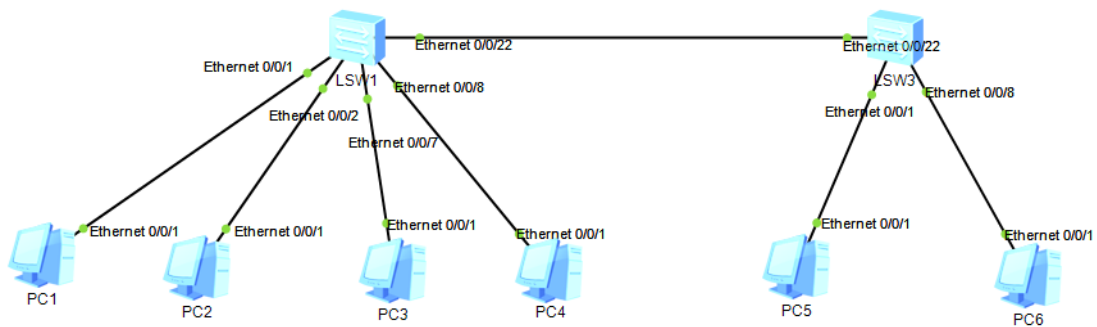
--- 192.168.0.4 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 47/53/63 ms
```

实验任务 2

实验目的

在两个不同交换机上的同一个 VLAN 之间（下列表述以 VLAN2 为例）分别进行通信；

实验拓扑



实验配置

注意在进行配置时首先要启动主机与交换机

主机配置：

PC1、2、3、4、5、6 分别设置地址为

192.168.0.1、192.168.0.2、192.168.0.3、192.168.0.4、192.168.0.5、192.168.0.6

子网掩码为 24 位

交换机 LSW1、LSW3 配置（两者配置方法相同）：

配置指令：

首先，为实验任务 1 配置

然后：

```
[Huawei]interface e0/0/22
```

```
[Huawei-Ethernet0/0/22]port link-type access
```

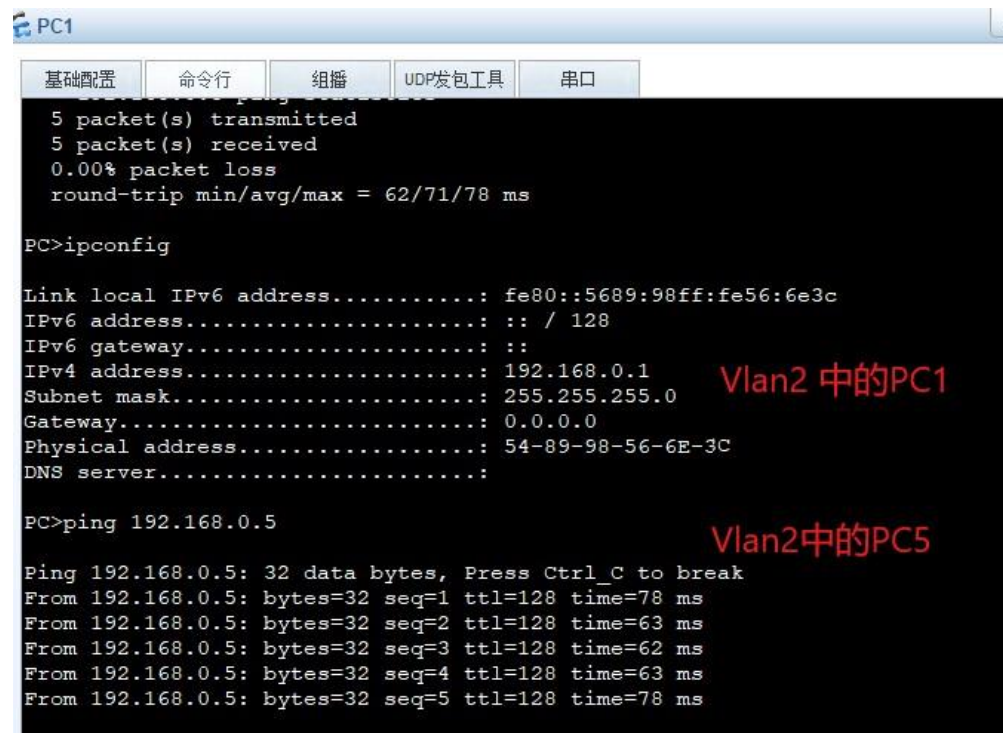
//创建并划分 vlan

```
[Huawei]vlan2
```

```
[Huawei-vlan2]port e0/0/22
```

将 port22 加入 vlan2

实验效果



The screenshot shows the configuration and ping results for PC1. The configuration window has tabs for '基础配置' (Basic Configuration), '命令行' (Command Line), '组播' (Multicast), 'UDP发包工具' (UDP Packet Tool), and '串口' (Serial Port). The '命令行' tab is active, showing the following commands and output:

```
PC>ping 192.168.0.5
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 62/71/78 ms

PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe56:6e3c
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.0.1
Subnet mask.....: 255.255.255.0
Gateway.....: 0.0.0.0
Physical address.....: 54-89-98-56-6E-3C
DNS server.....:

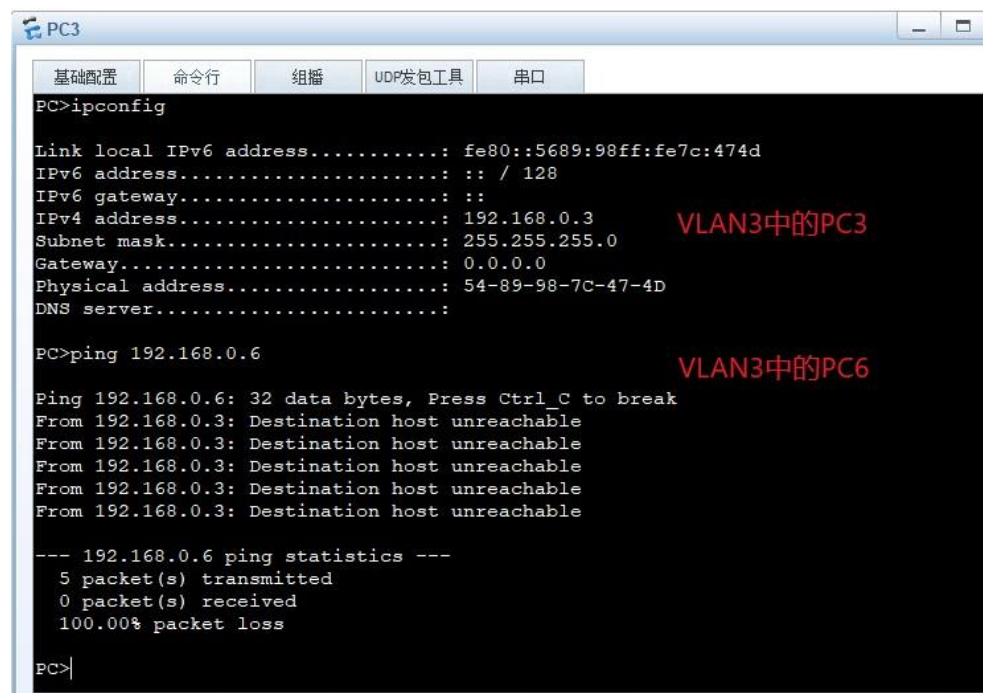
PC>ping 192.168.0.5

Ping 192.168.0.5: 32 data bytes, Press Ctrl_C to break
From 192.168.0.5: bytes=32 seq=1 ttl=128 time=78 ms
From 192.168.0.5: bytes=32 seq=2 ttl=128 time=63 ms
From 192.168.0.5: bytes=32 seq=3 ttl=128 time=62 ms
From 192.168.0.5: bytes=32 seq=4 ttl=128 time=63 ms
From 192.168.0.5: bytes=32 seq=5 ttl=128 time=78 ms
```

Red text annotations in the image identify the configuration as 'Vlan2 中的PC1' and the ping command as 'Vlan2中的PC5'.

实验思考

此时，交换机 LSW1 与交换机 LSW3 上的 VLAN3 能否通信？



The screenshot shows the configuration and ping results for PC3. The configuration window has tabs for '基础配置' (Basic Configuration), '命令行' (Command Line), '组播' (Multicast), 'UDP发包工具' (UDP Packet Tool), and '串口' (Serial Port). The '命令行' tab is active, showing the following commands and output:

```
PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe7c:474d
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.0.3
Subnet mask.....: 255.255.255.0
Gateway.....: 0.0.0.0
Physical address.....: 54-89-98-7C-47-4D
DNS server.....:

PC>ping 192.168.0.6

Ping 192.168.0.6: 32 data bytes, Press Ctrl_C to break
From 192.168.0.3: Destination host unreachable
From 192.168.0.3: Destination host unreachable
From 192.168.0.3: Destination host unreachable
From 192.168.0.3: Destination host unreachable
From 192.168.0.3: Destination host unreachable

--- 192.168.0.6 ping statistics ---
5 packet(s) transmitted
0 packet(s) received
100.00% packet loss

PC>
```

Red text annotations in the image identify the configuration as 'VLAN3中的PC3' and the ping command as 'VLAN3中的PC6'.

通讯测试界面

上图表明这样做不行。同理，必须像 VLAN2 通信时那样，将两个交换机上的 VLAN3 端口连

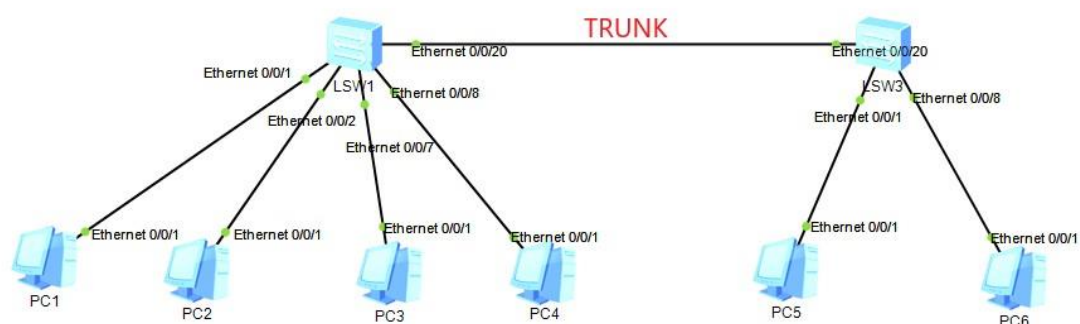
接起来，这样，势必会造成端口的浪费。（浪费的端口数取决于 VLAN 的数量），所以，为了解决这个问题，可以采用 VLAN 中继（TRUNK）的方式实现不同交换机上的相同 VLAN 之间的通信。这样就可以做到一条中继多条虚拟（逻辑）链路捆绑在一条物理链路上。Trunk 类型的端口可以属于多个 VLAN，可以接收和发送多个 VLAN 的报文。

实验任务 3

实验目的

分析内容（2）中实现方法的弊病，利用“中继”实现实验任务（2）；

实验拓扑



实验配置

交换机 LSW1、LSW3 配置（两者配置相同）：

配置指令：

首先，与实验任务 1 配置相同

然后

```
[Huawei]interface e0/0/20
```

```
[Huawei-Ethernet0/0/20]port link-type trunk
```

```
[Huawei-Ethernet0/0/20]port trunk allow-pass vlan all
```

作用：将端口 20 设置为标记端口（TRUNK）

实验效果

配置完成后：可以跨交换机实现相同 VLAN 之间的通信。

PC1

基础配置

命令行

组播

UDP发包工具

串口

```
0.00% packet loss
round-trip min/avg/max = 62/68/78 ms

PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe56:6e3c
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.0.1
Subnet mask.....: 255.255.255.0
Gateway.....: 0.0.0.0
Physical address.....: 54-89-98-56-6E-3C
DNS server.....:

PC>ping 192.168.0.5

Ping 192.168.0.5: 32 data bytes, Press Ctrl_C to break
From 192.168.0.5: bytes=32 seq=1 ttl=128 time=62 ms
From 192.168.0.5: bytes=32 seq=2 ttl=128 time=63 ms
From 192.168.0.5: bytes=32 seq=3 ttl=128 time=78 ms
From 192.168.0.5: bytes=32 seq=4 ttl=128 time=47 ms
From 192.168.0.5: bytes=32 seq=5 ttl=128 time=62 ms

--- 192.168.0.5 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
```

PC3

基础配置

命令行

组播

UDP发包工具

串口

```
PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe7c:474d
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.0.3
Subnet mask.....: 255.255.255.0
Gateway.....: 0.0.0.0
Physical address.....: 54-89-98-7C-47-4D
DNS server.....:

PC>ping 192.168.0.6

Ping 192.168.0.6: 32 data bytes, Press Ctrl_C to break
From 192.168.0.6: bytes=32 seq=1 ttl=128 time=62 ms
From 192.168.0.6: bytes=32 seq=2 ttl=128 time=63 ms
From 192.168.0.6: bytes=32 seq=3 ttl=128 time=78 ms
From 192.168.0.6: bytes=32 seq=4 ttl=128 time=79 ms
From 192.168.0.6: bytes=32 seq=5 ttl=128 time=62 ms

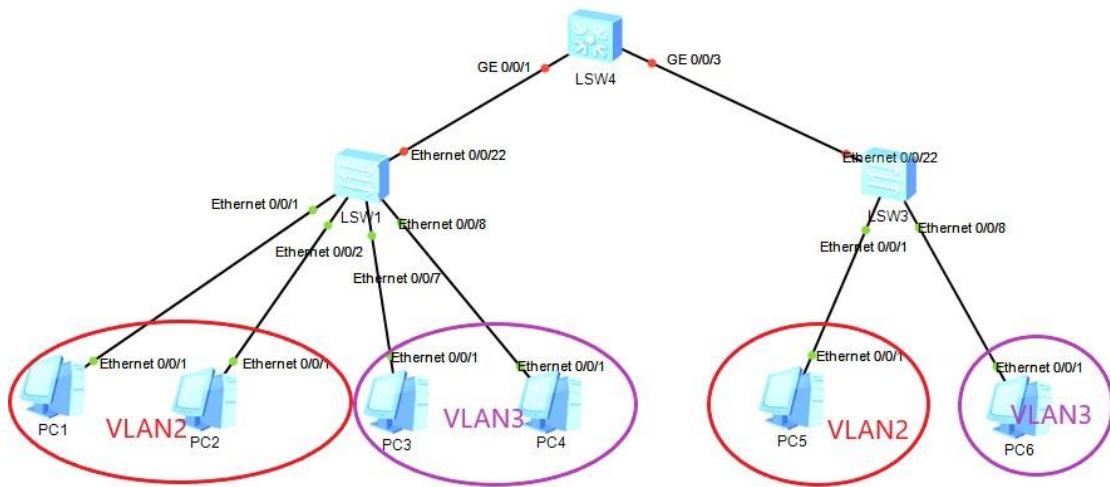
--- 192.168.0.6 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
round-trip min/avg/max = 62/68/79 ms
```


实验任务 4

实验目的

通过三层交换机实现不同 VLAN（如 VLAN2、VLAN3）之间的通信；

实验拓扑



实验配置

二层交换机与实验 3 配置方法相同

三层交换机 LSW4

```
<Huawei>sys
```

```
[Huawei]vlan 2
```

```
[Huawei-vlan2]vlan 3
```

创建两个 vlan

```
<Huawei>sys
```

Enter system view, return user view with Ctrl+Z.

```
[Huawei]interface GigabitEthernet 0/0/1
```

```
[Huawei-GigabitEthernet0/0/1]port link-type trunk
```

```
[Huawei-GigabitEthernet0/0/1]port trunk allow-pass vlan all
```

```
<Huawei>sys
```

Enter system view, return user view with Ctrl+Z.

```
[Huawei]interface GigabitEthernet 0/0/3
```

```
[Huawei-GigabitEthernet0/0/3]port link-type trunk
```

```
[Huawei-GigabitEthernet0/0/3]port trunk allow-pass vlan all
```

将端口设置为 trunk，同时允许所有 vlan 通过

```
<Huawei>sys
```

```
[Huawei]interface VLANif2
```

```
[Huawei-Vlanif2]ip address 192.168.1.1 24
```

```
<Huawei>sys
```

```
[Huawei]interface VLANif3
```

```
[Huawei-Vlanif3]ip address 192.168.8.1 24
```

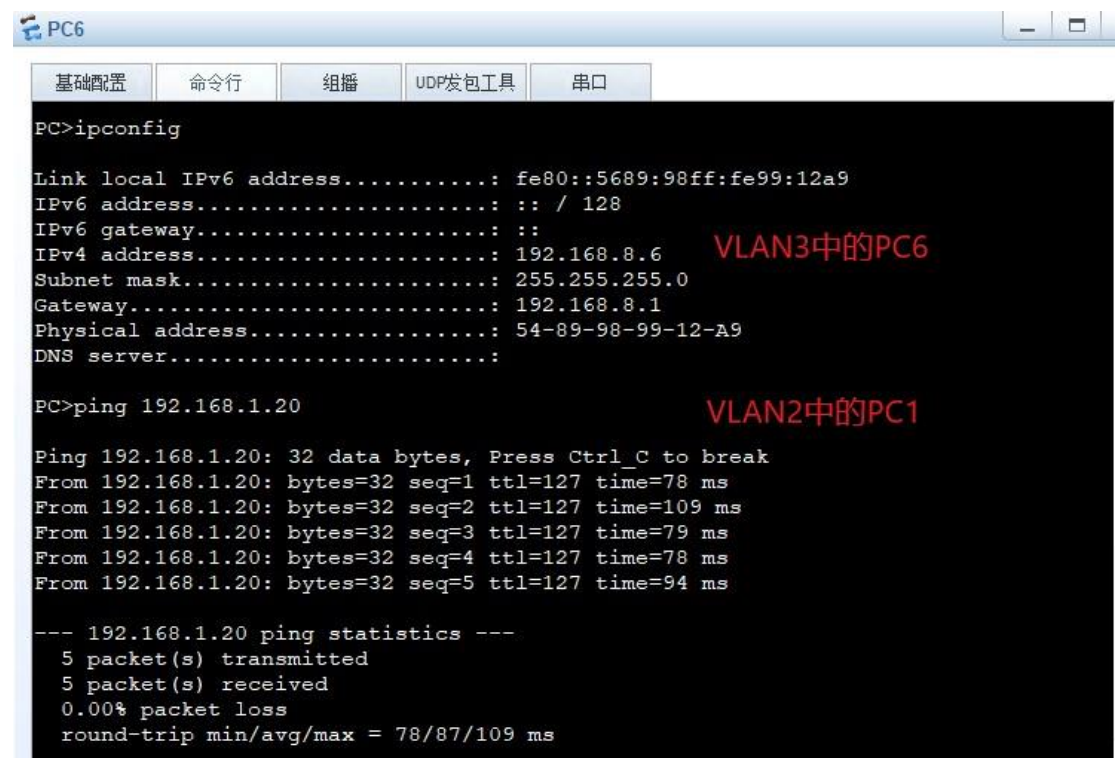
将 IP 地址与 vlan 绑定

主机地址设置

将主机 PC（1、2、5）的地址修改为 192.168.1.（20、2、5） 24 默认网关 192.168.1.1

将主机 PC（3、4、6）的地址修改为 192.168.8.（3、4、6） 24 默认网关 192.168.8.1

实验效果



The screenshot shows the configuration window for PC6. The '命令行' (Command Line) tab is active, displaying the following configuration and ping results:

```
PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe99:12a9
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.8.6
Subnet mask.....: 255.255.255.0
Gateway.....: 192.168.8.1
Physical address.....: 54-89-98-99-12-A9
DNS server.....:

PC>ping 192.168.1.20

Ping 192.168.1.20: 32 data bytes, Press Ctrl_C to break
From 192.168.1.20: bytes=32 seq=1 ttl=127 time=78 ms
From 192.168.1.20: bytes=32 seq=2 ttl=127 time=109 ms
From 192.168.1.20: bytes=32 seq=3 ttl=127 time=79 ms
From 192.168.1.20: bytes=32 seq=4 ttl=127 time=78 ms
From 192.168.1.20: bytes=32 seq=5 ttl=127 time=94 ms

--- 192.168.1.20 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 78/87/109 ms
```

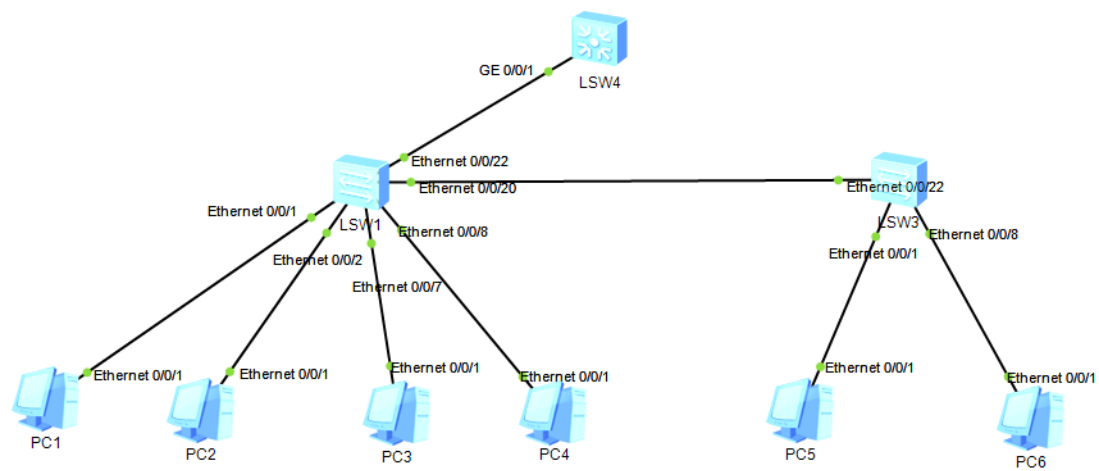
Red annotations in the image identify the configuration as being for 'VLAN3中的PC6' (PC6 in VLAN3) and the ping target as 'VLAN2中的PC1' (PC1 in VLAN2).

实验任务 5

实验目的

用“单臂路由”的方式来实现不同 VLAN 之间的通信

实验拓扑



实验配置

初始配置同实验任务 4

对交换机 LSW1

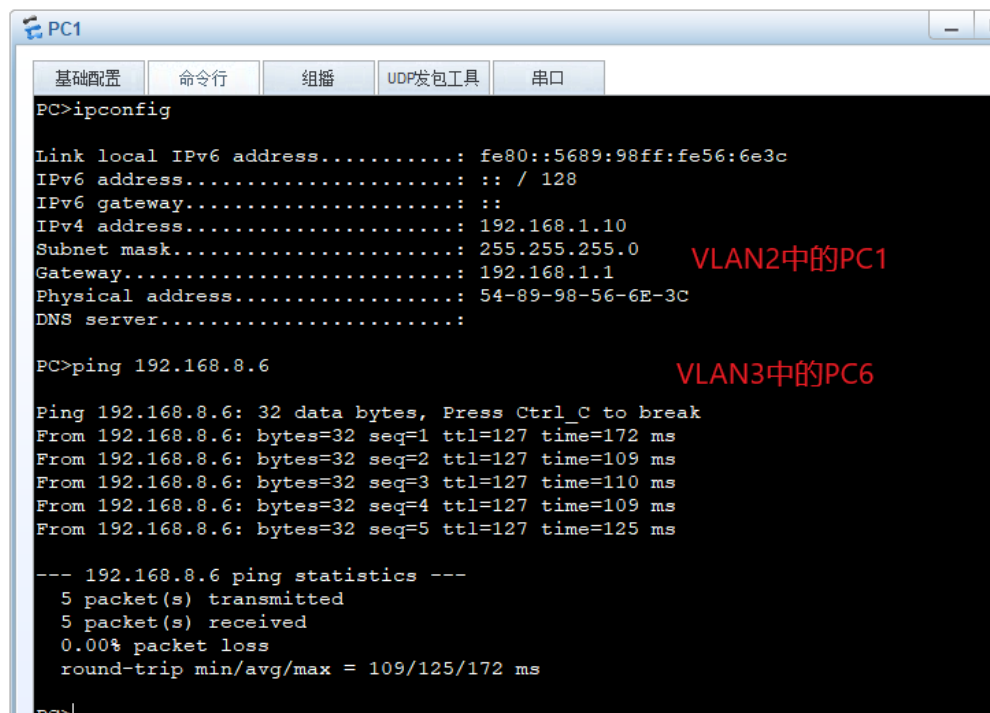
```
<Huawei>sys
```

```
[Huawei]interface e0/0/20
```

```
[Huawei-Ethernet0/0/20]port link-type trunk
```

```
[Huawei-Ethernet0/0/20]port trunk allow-pass vlan all
```

实验效果



The screenshot shows a PC terminal window with the following content:

```
PC1
基础配置 命令行 组播 UDP发包工具 串口
PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe56:6e3c
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 192.168.1.10
Subnet mask.....: 255.255.255.0
Gateway.....: 192.168.1.1
Physical address.....: 54-89-98-56-6E-3C
DNS server.....:

PC>ping 192.168.8.6

Ping 192.168.8.6: 32 data bytes, Press Ctrl_C to break
From 192.168.8.6: bytes=32 seq=1 ttl=127 time=172 ms
From 192.168.8.6: bytes=32 seq=2 ttl=127 time=109 ms
From 192.168.8.6: bytes=32 seq=3 ttl=127 time=110 ms
From 192.168.8.6: bytes=32 seq=4 ttl=127 time=109 ms
From 192.168.8.6: bytes=32 seq=5 ttl=127 time=125 ms

--- 192.168.8.6 ping statistics ---
 5 packet(s) transmitted
 5 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 109/125/172 ms

PC>
```

Red text annotations on the right side of the terminal output:

- VLAN2中的PC1 (next to the IP configuration)
- VLAN3中的PC6 (next to the ping command)

广播风暴

思考题:

1. 何为广播域? VLAN 如何隔离广播域?
2. 何为广播风暴? 产生广播风暴的原因?
3. 分析下图的拓扑结构, 何种情况下会出现广播风暴?
- 4.

