

## 交换阶段 - 中小型局域网 ( 交换机：链路层 L2 )

### 一、实验目的

1. 学习中小型局域网的组网
2. 学习数据链路层设备交换机的使用
3. 学习划分 VLAN

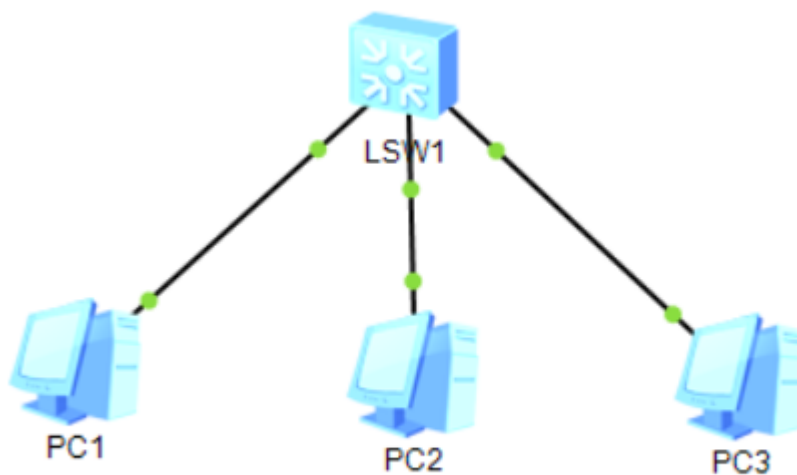
### 二、实验内容

1. 多 PC 通过 1 台交换机组网 (L2 Switch 转发)
2. 多 PC 通过多台交换机组网
3. 使用交换机 + VLAN 组网

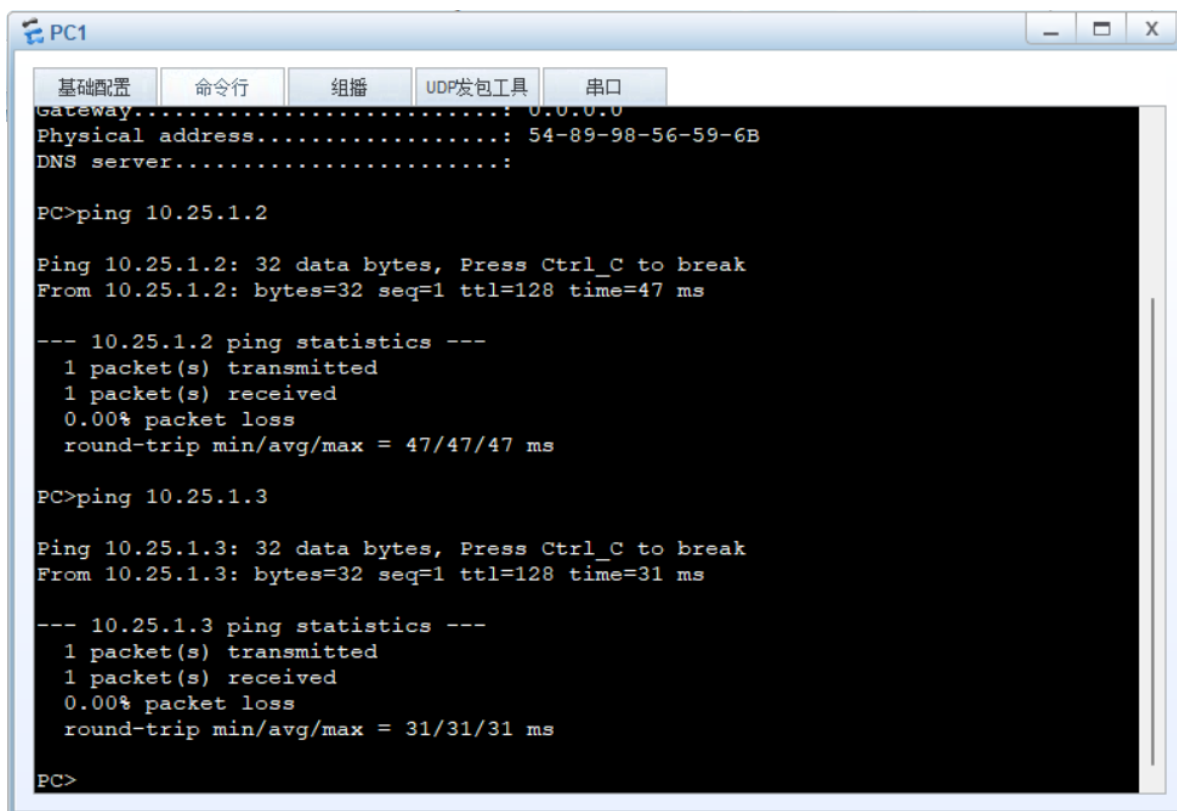
### 三、实验步骤

#### 2.1 多 PC 通过 1 台交换机组网 (L2 Switch 转发)

##### 0. 网络拓扑



1. PC 机可以互 ping  
PC1 ping PC2, PC3



The screenshot shows the PC1 configuration window in a network simulator. The '基础配置' (Basic Configuration) tab is active. The configuration shows the Gateway as 0.0.0.0, Physical address as 54-89-98-56-59-6B, and DNS server as blank. Below the configuration, the command line shows two ping commands: 'PC>ping 10.25.1.2' and 'PC>ping 10.25.1.3'. Both pings are successful, showing 0.00% packet loss and round-trip times of 47ms and 31ms respectively.

```
PC1
基础配置 命令行 组播 UDP发包工具 串口
Gateway.....: 0.0.0.0
Physical address.....: 54-89-98-56-59-6B
DNS server.....:

PC>ping 10.25.1.2

Ping 10.25.1.2: 32 data bytes, Press Ctrl_C to break
From 10.25.1.2: bytes=32 seq=1 ttl=128 time=47 ms

--- 10.25.1.2 ping statistics ---
 1 packet(s) transmitted
 1 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 47/47/47 ms

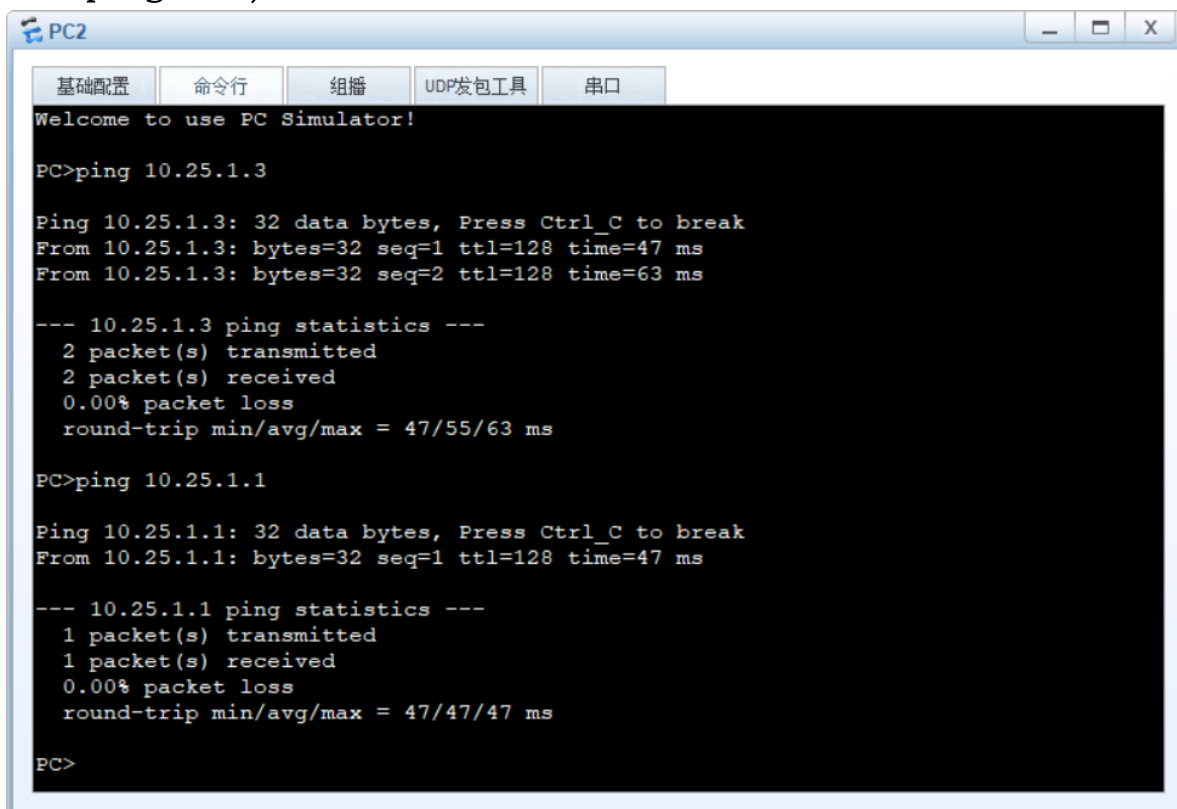
PC>ping 10.25.1.3

Ping 10.25.1.3: 32 data bytes, Press Ctrl_C to break
From 10.25.1.3: bytes=32 seq=1 ttl=128 time=31 ms

--- 10.25.1.3 ping statistics ---
 1 packet(s) transmitted
 1 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 31/31/31 ms

PC>
```

PC2 ping PC1, PC3



The screenshot shows the PC2 configuration window in a network simulator. The '基础配置' (Basic Configuration) tab is active. The configuration shows the Gateway as 0.0.0.0, Physical address as 54-89-98-56-59-6B, and DNS server as blank. Below the configuration, the command line shows two ping commands: 'PC>ping 10.25.1.3' and 'PC>ping 10.25.1.1'. Both pings are successful, showing 0.00% packet loss and round-trip times of 47ms and 47ms respectively.

```
PC2
基础配置 命令行 组播 UDP发包工具 串口
Welcome to use PC Simulator!

PC>ping 10.25.1.3

Ping 10.25.1.3: 32 data bytes, Press Ctrl_C to break
From 10.25.1.3: bytes=32 seq=1 ttl=128 time=47 ms
From 10.25.1.3: bytes=32 seq=2 ttl=128 time=63 ms

--- 10.25.1.3 ping statistics ---
 2 packet(s) transmitted
 2 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 47/55/63 ms

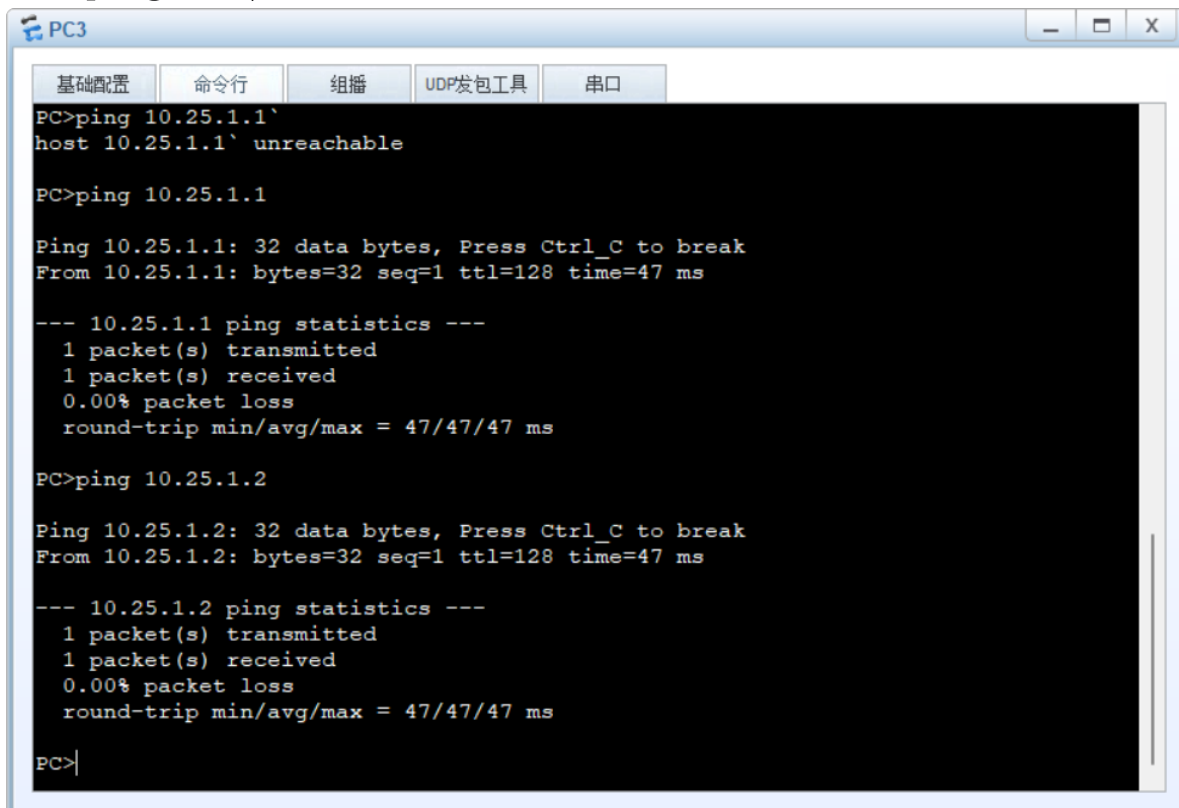
PC>ping 10.25.1.1

Ping 10.25.1.1: 32 data bytes, Press Ctrl_C to break
From 10.25.1.1: bytes=32 seq=1 ttl=128 time=47 ms

--- 10.25.1.1 ping statistics ---
 1 packet(s) transmitted
 1 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 47/47/47 ms

PC>
```

## PC3 ping PC1, PC2



The screenshot shows the command prompt of PC3. It has tabs for '基础配置', '命令行', '组播', 'UDP发包工具', and '串口'. The '命令行' tab is active. The user has entered the following commands and received the following output:

```
PC>ping 10.25.1.1`
host 10.25.1.1` unreachable

PC>ping 10.25.1.1

Ping 10.25.1.1: 32 data bytes, Press Ctrl_C to break
From 10.25.1.1: bytes=32 seq=1 ttl=128 time=47 ms

--- 10.25.1.1 ping statistics ---
 1 packet(s) transmitted
 1 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 47/47/47 ms

PC>ping 10.25.1.2

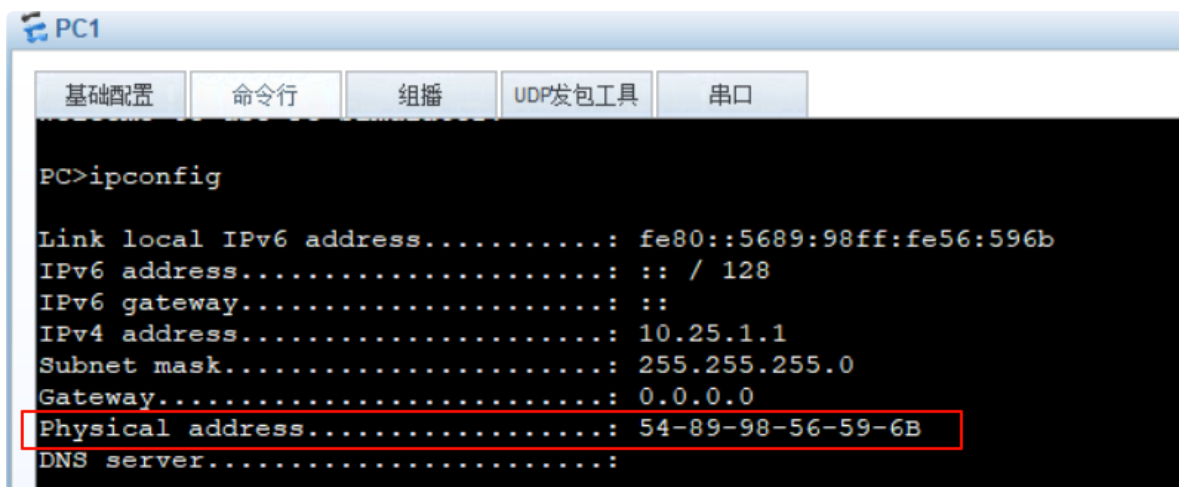
Ping 10.25.1.2: 32 data bytes, Press Ctrl_C to break
From 10.25.1.2: bytes=32 seq=1 ttl=128 time=47 ms

--- 10.25.1.2 ping statistics ---
 1 packet(s) transmitted
 1 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 47/47/47 ms

PC>|
```

## 2. 查看 PC 机网卡的 MAC 地址

## PC1



The screenshot shows the command prompt of PC1. It has tabs for '基础配置', '命令行', '组播', 'UDP发包工具', and '串口'. The '命令行' tab is active. The user has entered the command 'ipconfig' and received the following output:

```
PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe56:596b
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 10.25.1.1
Subnet mask.....: 255.255.255.0
Gateway.....: 0.0.0.0
Physical address.....: 54-89-98-56-59-6B
DNS server.....:
```

The 'Physical address' line is highlighted with a red rectangle.

## PC2



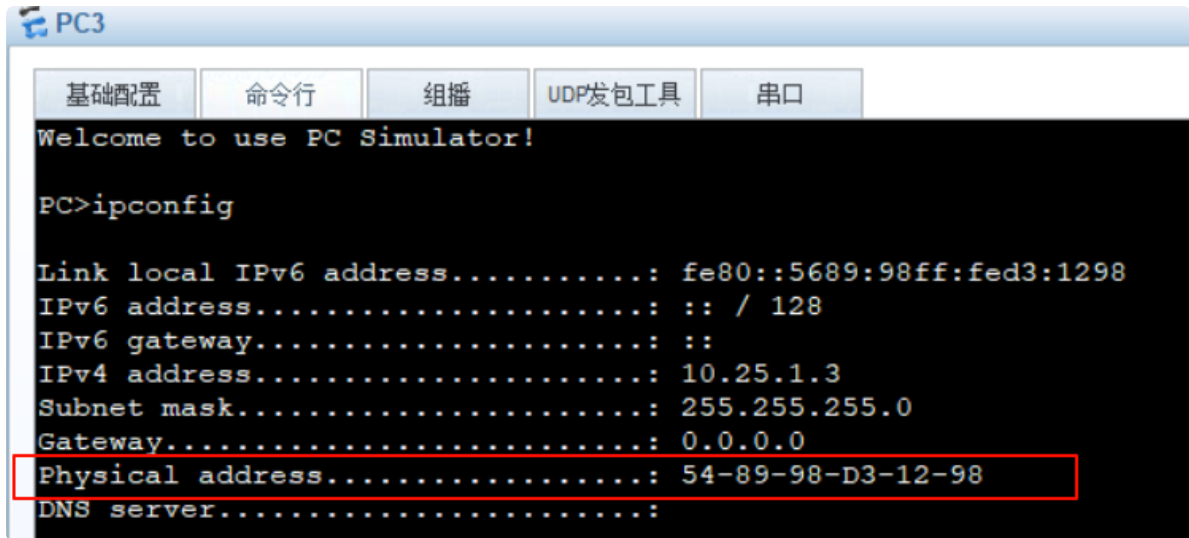
The screenshot shows the command prompt of PC2. It has tabs for '基础配置', '命令行', '组播', 'UDP发包工具', and '串口'. The '命令行' tab is active. The user has entered the command 'ipconfig' and received the following output:

```
PC>ipconfig

Link local IPv6 address.....: fe80::5689:98ff:fe95:b23
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 10.25.1.2
Subnet mask.....: 255.255.255.0
Gateway.....: 0.0.0.0
Physical address.....: 54-89-98-95-0B-23
DNS server.....:
```

The 'Physical address' line is highlighted with a red rectangle.

## PC3



PC3

基础配置 命令行 组播 UDP发包工具 串口

Welcome to use PC Simulator!

PC>ipconfig

```
Link local IPv6 address.....: fe80::5689:98ff:fed3:1298
IPv6 address.....: :: / 128
IPv6 gateway.....: ::
IPv4 address.....: 10.25.1.3
Subnet mask.....: 255.255.255.0
Gateway.....: 0.0.0.0
Physical address.....: 54-89-98-D3-12-98
DNS server.....:
```

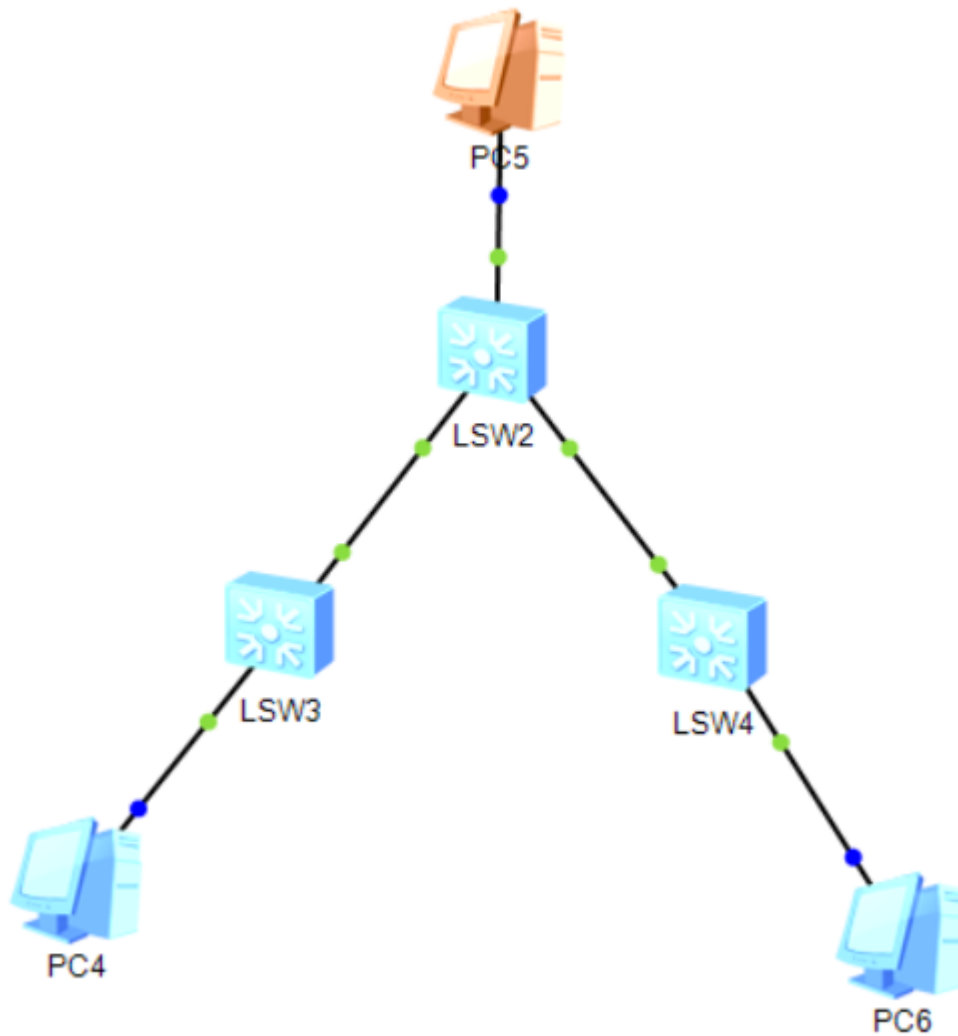
## 3. 查看交换机 MAC 学习情况

```
<Huawei>dis mac-address
MAC address table of slot 0:
-----
MAC Address      VLAN/      PEVLAN CEVLAN Port      Type      LSP/LSR-ID
                  VSI/SI
-----
5489-9856-596b 1          -      -      GE0/0/1      dynamic  0/-
5489-9895-0b23 1          -      -      GE0/0/2      dynamic  0/-
5489-98d3-1298 1          -      -      GE0/0/3      dynamic  0/-
-----
Total matching items on slot 0 displayed = 3
```

各 PC MAC 地址被正确学习到 🚀

## 2.2 多 PC 通过多台交换机组网

## 0. 网络拓扑



## 1. PC 机可以互 ping

- PC1 ping PC2

```
PC4
基础配置 命令行 组播 UDP发包工具 串口
From 10.25.1.2: bytes=32 seq=3 ttl=128 time=94 ms
From 10.25.1.2: bytes=32 seq=4 ttl=128 time=109 ms
From 10.25.1.2: bytes=32 seq=5 ttl=128 time=78 ms

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

- PC2 ping PC1

```

PC5
基础配置 命令行 组播 UDP发包工具 串口
Welcome to use PC Simulator!

PC>ping 10.25.1.1

Ping 10.25.1.1: 32 data bytes, Press Ctrl_C to break
From 10.25.1.1: bytes=32 seq=1 ttl=128 time=109 ms
From 10.25.1.1: bytes=32 seq=2 ttl=128 time=110 ms

--- 10.25.1.1 ping statistics ---
 2 packet(s) transmitted
 2 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 109/109/110 ms
    
```

- ping PC3

```

PC>ping 10.25.1.3

Ping 10.25.1.3: 32 data bytes, Press Ctrl_C to break
From 10.25.1.3: bytes=32 seq=1 ttl=128 time=109 ms
From 10.25.1.3: bytes=32 seq=2 ttl=128 time=140 ms
From 10.25.1.3: bytes=32 seq=3 ttl=128 time=109 ms
    
```

## 2. 抓包分析

初次 ping, 路由器发送 ARP 请求, 进行 MAC 地址学习

20 40.562000	HuaweiTechno_5d:76:...	Broadcast	ARP	60 Who has 10.25.1.2? Tell 10.25.1.1
21 40.625000	HuaweiTechno_93:3f:...	HuaweiTechno_5d:76:...	ARP	60 10.25.1.2 is at 54:89:98:93:3f:01
22 40.656000	10.25.1.1	10.25.1.2	ICMP	74 Echo (ping) request id=0xddbf, seq=1/256, ttl=128 (reply in 23)
23 40.719000	10.25.1.2	10.25.1.1	ICMP	74 Echo (ping) reply id=0xddbf, seq=1/256, ttl=128 (request in 22)
24 41.734000	10.25.1.1	10.25.1.2	ICMP	74 Echo (ping) request id=0xdefb, seq=2/512, ttl=128 (reply in 25)
25 41.797000	10.25.1.2	10.25.1.1	ICMP	74 Echo (ping) reply id=0xdefb, seq=2/512, ttl=128 (request in 24)

后续 ping 无 ARP 请求 (老化前)

45 71.594000	HuaweiTechno_2a:06:...	Spanning-tree-(for-...	STP	119 MST. Root = 32768/0/4c:1f:cc:0b:21:ba Cost = 40000 Port = 0x8003
46 73.844000	HuaweiTechno_2a:06:...	Spanning-tree-(for-...	STP	119 MST. Root = 32768/0/4c:1f:cc:0b:21:ba Cost = 40000 Port = 0x8003
47 76.094000	HuaweiTechno_2a:06:...	Spanning-tree-(for-...	STP	119 MST. Root = 32768/0/4c:1f:cc:0b:21:ba Cost = 40000 Port = 0x8003
48 77.453000	10.25.1.1	10.25.1.2	ICMP	74 Echo (ping) request id=0x02c0, seq=1/256, ttl=128 (reply in 49)
49 77.547000	10.25.1.2	10.25.1.1	ICMP	74 Echo (ping) reply id=0x02c0, seq=1/256, ttl=128 (request in 48)

## 3. 交换机 MAC 地址学习情况

```

LSW3
<Huawei>dis mac-address
MAC address table of slot 0:

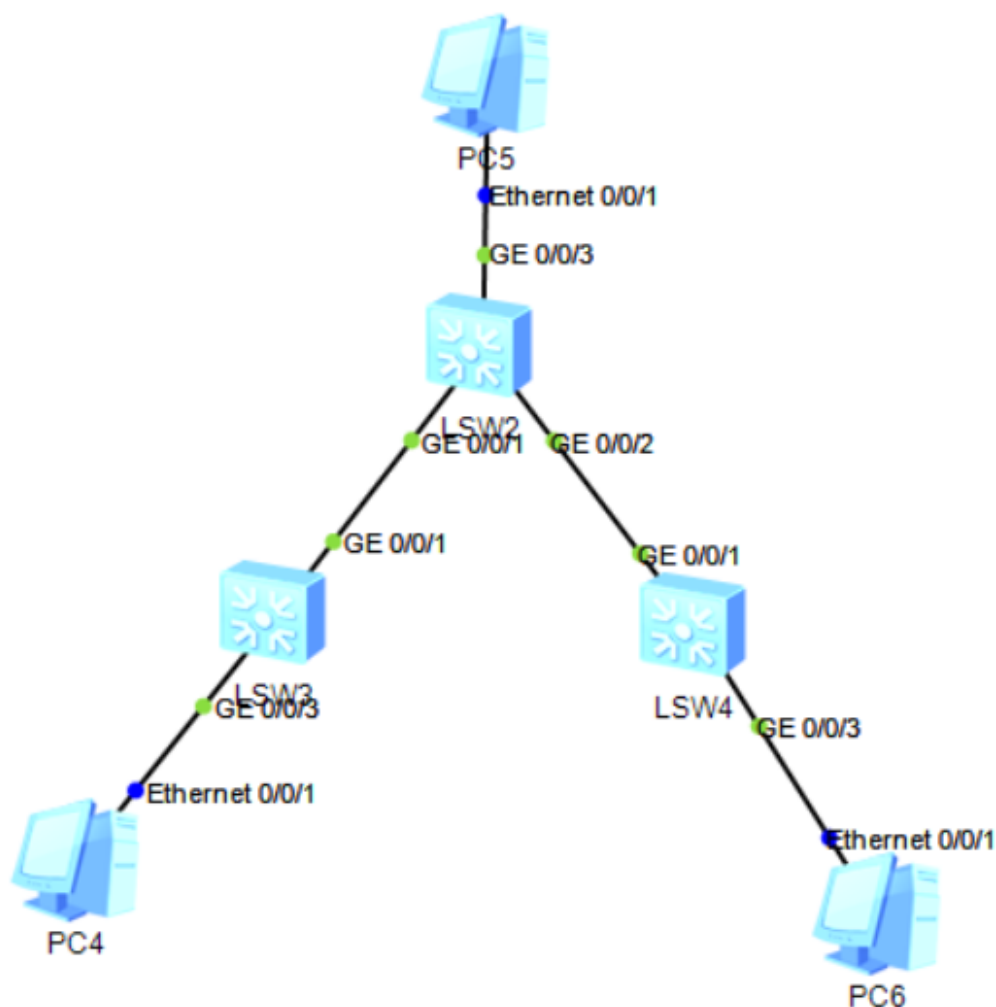
-----
MAC Address      VLAN/      PEVLAN CEVLAN Port          Type      LSP/LSR-ID
                  VSI/SI
-----
5489-985d-769b 1          -      -      GE0/0/3      dynamic   0/-
5489-9893-3f01 1          -      -      GE0/0/1      dynamic   0/-
5489-98d2-7b79 1          -      -      GE0/0/1      dynamic   0/-
-----
Total matching items on slot 0 displayed = 3
    
```

LSW2						
<Huawei>dis mac-address						
MAC address table of slot 0:						
MAC Address	VLAN/ VSI/SI	PEVLAN	CEVLAN	Port	Type	LSP/LSR-ID MAC-Tunnel
5489-985d-769b	1	-	-	GE0/0/1	dynamic	0/-
5489-9893-3f01	1	-	-	GE0/0/3	dynamic	0/-
5489-98d2-7b79	1	-	-	GE0/0/2	dynamic	0/-
Total matching items on slot 0 displayed = 3						

LSW4						
<Huawei>display mac-address						
MAC address table of slot 0:						
MAC Address	VLAN/ VSI/SI	PEVLAN	CEVLAN	Port	Type	LSP/LSR-ID MAC-Tunnel
5489-98d2-7b79	1	-	-	GE0/0/3	dynamic	0/-
5489-985d-769b	1	-	-	GE0/0/1	dynamic	0/-
5489-9893-3f01	1	-	-	GE0/0/1	dynamic	0/-
Total matching items on slot 0 displayed = 3						

各接口对应情况:



## 2.3 使用交换机 + VLAN 组网

## 交换机之间接口划分 Vlan

```
[Huawei] interface Ethernet0/0/2
[Huawei-Ethernet0/0/2] port link-type trunk
[Huawei-Ethernet0/0/2] port trunk allow-pass vlan 10 20
[Huawei-Ethernet0/0/2] quit
```

## 交换机与 PC 之间接口划分 Vlan

```
[Huawei] interface Ethernet0/0/1
[Huawei-Ethernet0/0/1] port link-type access
[Huawei-Ethernet0/0/1] port default vlan 10
[Huawei-Ethernet0/0/1] quit
```

## • Switch1

```
10    common    UT:GE0/0/3 (U)
          TG:GE0/0/1 (U)

VID    Status    Property          MAC-LRN Statistics Description
-----
1      enable    default          enable  disable  VLAN 0001
10     enable    default          enable  disable  VLAN 0010
```

## • Switch2

```
10    common    TG:GE0/0/1 (U)      GE0/0/2 (U)
20    common    TG:GE0/0/2 (U)

VID    Status    Property          MAC-LRN Statistics Description
-----
1      enable    default          enable  disable  VLAN 0001
10     enable    default          enable  disable  VLAN 0010
20     enable    default          enable  disable  VLAN 0020
```



- Switch3

```

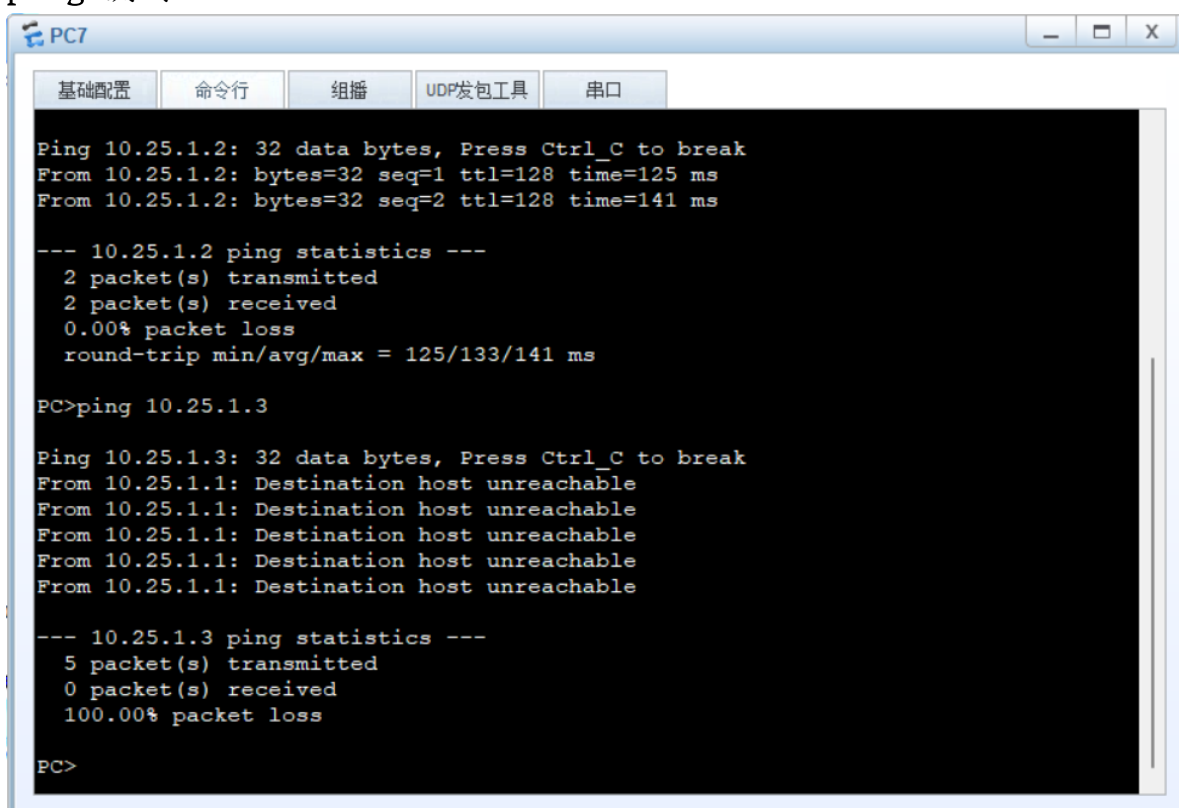
10    common    UT:GE0/0/3(U)
          TG:GE0/0/1(U)

20    common    UT:GE0/0/4(U)
          TG:GE0/0/1(U)

VID   Status   Property      MAC-LRN Statistics Description
-----
1     enable    default      enable  disable  VLAN 0001
10    enable    default      enable  disable  VLAN 0010
20    enable    default      enable  disable  VLAN 0020
<Huawei>

```

## 1. ping 测试



The screenshot shows a terminal window titled 'PC7' with tabs for '基础配置', '命令行', '组播', 'UDP发包工具', and '串口'. The '命令行' tab is active, displaying the following text:

```

Ping 10.25.1.2: 32 data bytes, Press Ctrl_C to break
From 10.25.1.2: bytes=32 seq=1 ttl=128 time=125 ms
From 10.25.1.2: bytes=32 seq=2 ttl=128 time=141 ms

--- 10.25.1.2 ping statistics ---
 2 packet(s) transmitted
 2 packet(s) received
 0.00% packet loss
 round-trip min/avg/max = 125/133/141 ms

PC>ping 10.25.1.3

Ping 10.25.1.3: 32 data bytes, Press Ctrl_C to break
From 10.25.1.1: Destination host unreachable
From 10.25.1.1: Destination host unreachable
From 10.25.1.1: Destination host unreachable
From 10.25.1.1: Destination host unreachable
From 10.25.1.1: Destination host unreachable

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

PC>

```

- PC7 是研发部 PC: 10.25.1.1
- 能够 ping 通研发部 PC: 10.25.1.2

- 不能 ping 通财务部 PC: 10.25.1.3

```

PC9
基础配置 命令行 组播 UDP发包工具 串口

PC>ping 10.25.1.1

Ping 10.25.1.1: 32 data bytes, Press Ctrl_C to break
From 10.25.1.3: Destination host unreachable
From 10.25.1.3: Destination host unreachable
From 10.25.1.3: Destination host unreachable

--- 10.25.1.1 ping statistics ---
 3 packet(s) transmitted
 0 packet(s) received
100.00% packet loss

PC>ping 10.25.1.2

Ping 10.25.1.2: 32 data bytes, Press Ctrl_C to break
From 10.25.1.3: Destination host unreachable
From 10.25.1.3: Destination host unreachable
From 10.25.1.3: Destination host unreachable

--- 10.25.1.2 ping statistics ---
 3 packet(s) transmitted
 0 packet(s) received
100.00% packet loss
    
```

- PC9 是财务部 PC
- 无法 ping 通研发部 PC

## 2. 查看各交换机 MAC 学习情况

Switch1

```

<Huawei>dis mac-address
MAC address table of slot 0:
-----
MAC Address      VLAN/      PEVLAN CEVLAN Port          Type      LSP/LSR-ID
                  VSI/SI
-----
5489-9807-4f2f 10          -      -      GE0/0/3      dynamic   0/-
5489-98eb-539d 10          -      -      GE0/0/1      dynamic   0/-
-----
Total matching items on slot 0 displayed = 2
    
```

Swich2

```

LSW7

TG:GE0/0/1(U)

VID  Status  Property      MAC-LRN Statistics Description
-----
1     enable  default      enable  disable  VLAN 0001
10    enable  default      enable  disable  VLAN 0010
20    enable  default      enable  disable  VLAN 0020
<Huawei>dis mac
<Huawei>dis mac-add
<Huawei>dis mac-address
MAC address table of slot 0:
-----
MAC Address      VLAN/      PEVLAN CEVLAN Port      Type      LSP/LSR-ID
                  VSI/SI
-----
5489-9807-4f2f 10          -      -      GE0/0/1      dynamic  0/-
5489-98eb-539d 10          -      -      GE0/0/3      dynamic  0/-
-----
Total matching items on slot 0 displayed = 2

```

## Switch3

```

<Huawei>dis mac-address
MAC address table of slot 0:
-----
MAC Address      VLAN/      PEVLAN CEVLAN Port      Type      LSP/LSR-ID
                  VSI/SI
-----
5489-9807-4f2f 10          -      -      GE0/0/1      dynamic  0/-
5489-98eb-539d 10          -      -      GE0/0/2      dynamic  0/-
-----
Total matching items on slot 0 displayed = 2

```

可以发现各交换机仅学习到处于 vlan 10 下的主机的 MAC 地址

- 为 Switch3 增加一台位于 Vlan 20 的主机, 使得 Switch2 与 Switch3 能够学到属于 Vlan 20 的主机的 MAC 地址

```

<Huawei>dis mac-address
MAC address table of slot 0:
-----
MAC Address      VLAN/      PEVLAN CEVLAN Port      Type      LSP/LSR-ID
                  VSI/SI
-----
5489-989b-010b 20          -      -      GE0/0/2      dynamic  0/-
5489-987c-0aa6 20          -      -      GE0/0/3      dynamic  0/-
5489-9807-4f2f 10          -      -      GE0/0/1      dynamic  0/-
5489-98eb-539d 10          -      -      GE0/0/2      dynamic  0/-
-----
Total matching items on slot 0 displayed = 4

```

如上图所示, 位于 Vlan 20 的主机互 ping 后, Switch2 与 Switch3 学习到对应主机的 MAC 地址 🐱

```
<Huawei>dis mac-address
MAC address table of slot 0:
-----
MAC Address      VLAN/      PEVLAN CEVLAN Port      Type      LSP/LSR-ID
                  VSI/SI
-----
5489-98eb-539d 10          -      -      GE0/0/1    dynamic   0/-
5489-9807-4f2f 10          -      -      GE0/0/3    dynamic   0/-
-----
Total matching items on slot 0 displayed = 2
```

如上图所示, 此时 Switch1 由于不位于 Vlan 20 下, 故仍无法学习到上述 MAC 地址 😊

## 四、实验体会

### 2.1 多 PC 通过 1 台交换机组网 (L2 Switch 转发)

#### 1. 抓包时报文与 1.3 相比有哪些变化?

- 路由器 MAC 地址表中不存在目的 IP 对应的表项时, 会发送 ARP 请求:

10 17.562000	HuaweiTechno_56:59:...	Broadcast	ARP	60 Who has 10.25.1.2? Tell 10.25.1.1
11 17.594000	HuaweiTechno_95:0b:...	HuaweiTechno_56:59:...	ARP	60 10.25.1.2 is at 54:89:98:95:0b:23
12 17.609000	10.25.1.1	10.25.1.2	ICMP	74 Echo (ping) request id=0x01bb, seq=1/256, ttl=128 (reply in 13)
13 17.656000	10.25.1.2	10.25.1.1	ICMP	74 Echo (ping) reply id=0x01bb, seq=1/256, ttl=128 (request in 12)

- MAC 地址表已经学习到目的 IP 对应的 MAC 地址时, ARP 报文消失, 即不会重复发送 ARP 请求:

34 47.328000	HuaweiTechno_3d:6e:...	Spanning-tree-(for-...	STP	119 MST. Root = 32768/0/4c:1f:cc:3d:6e:57 Cost = 0 Port = 0x8002
35 49.578000	HuaweiTechno_3d:6e:...	Spanning-tree-(for-...	STP	119 MST. Root = 32768/0/4c:1f:cc:3d:6e:57 Cost = 0 Port = 0x8002
36 51.187000	10.25.1.1	10.25.1.2	ICMP	74 Echo (ping) request id=0x2bbb, seq=1/256, ttl=128 (reply in 37)
37 51.203000	10.25.1.2	10.25.1.1	ICMP	74 Echo (ping) reply id=0x2bbb, seq=1/256, ttl=128 (request in 36)
38 51.703000	HuaweiTechno_3d:6e:...	Spanning-tree-(for-...	STP	119 MST. Root = 32768/0/4c:1f:cc:3d:6e:57 Cost = 0 Port = 0x8002
39 52.250000	10.25.1.1	10.25.1.2	ICMP	74 Echo (ping) request id=0x2cbb, seq=2/512, ttl=128 (reply in 40)
40 52.250000	10.25.1.2	10.25.1.1	ICMP	74 Echo (ping) reply id=0x2cbb, seq=2/512, ttl=128 (request in 39)

#### 2. MAC 学习会学习哪几个关键 Key?

MAC 地址学习是交换机用于构建和维护其 MAC 地址表的过程。这个过程的关键元素包括以下几个:

- **源 MAC 地址:**  
每当交换机收到一个帧时, 它会读取帧中的源 MAC 地址, 并将其记录在 MAC 地址表中。
- **接口 (Port):**  
交换机会记录接收到该帧的接口。这样, 当需要将帧发送到特定MAC地址时, 交换机知道应该从哪个接口发送。
- **VLAN ID:**  
在具有 VLAN 支持的交换机中, MAC 地址表项还包括 VLAN ID。这是因为相同的 MAC 地址可以在不同的 VLAN 中出现, 因此需要区分它们。

综上所述, 交换机学习到的 MAC 地址表条目的关键字段包括:

- 源 MAC 地址
- 接口 (Port)
- VLAN ID

### 3. 为什么学习到的 MAC 地址会消失?

交换机中的 MAC 地址表并不是永久存储的, 学习到的 MAC 地址可能会由于以下原因而消失:

- 老化时间 (Aging Time) :

每个 MAC 地址表条目都有一个老化时间。如果在这个时间段内没有收到来自该 MAC 地址的新帧, 交换机将从 MAC 地址表中删除该条目。这样可以防止表中的陈旧或无效条目。

## 2.2 多 PC 通过多台交换机组网

### 1. 100 台 PC 时, 每台 PC 仍然会收到大量广播报文, 有什么影响?

- 网络带宽的浪费:

广播报文会占用网络带宽。随着设备数量的增加, 广播流量也会增加, 导致网络带宽被浪费在广播通信上, 影响正常的单播通信。

- 主机处理能力的消耗:

每台PC都需要处理所有的广播报文, 即使这些报文对它不相关。这会消耗PC的CPU和内存资源, 影响其正常工作和性能。

- 网络延迟增加:

广播风暴 (Broadcast Storm) 可能会导致网络延迟增加。如果广播流量非常高, 网络设备如交换机可能会变得过载, 导致网络延迟和抖动增加。

## 2.3 使用交换机 + VLAN 组网

### 1. Access 和 Trunk 两种 Link Type 的差别

Access 模式

- 用途:

- 主要用于连接终端设备 (如 PC、打印机等) 。
- 每个 Access 接口只能属于一个 VLAN。

- 数据帧处理:

- 当数据帧进入 Access 接口时, 交换机会将该帧打上该接口所属的 VLAN 标签。
- 当数据帧离开 Access 接口时, 交换机会去掉该帧的 VLAN 标签。

Trunk 模式

- 用途:

- 主要用于连接交换机之间或连接交换机与路由器。
- Trunk 接口可以允许多个 VLAN 通过。

- 数据帧处理:

- 当数据帧进入 Trunk 接口时, 交换机会根据帧的 VLAN 标签进行转发。

- 当数据帧离开 **Trunk** 接口时, 交换机会保留帧的 **VLAN** 标签 (除非帧属于 **Native VLAN**, 具体到某些厂商实现)。

## 2. VLAN 与物理接口的关系

**VLAN** (虚拟局域网) 通过逻辑划分物理网络中的设备, 使得网络中不同 **VLAN** 的设备相互隔离, 即使它们共享同一个物理交换机。这种划分方式有助于提高网络的安全性和管理性。

关系说明:

- **Access** 接口:
  - 一个物理接口只能属于一个 **VLAN**。
  - 连接的终端设备只能和同一 **VLAN** 中的其他设备通信。
- **Trunk** 接口:
  - 一个物理接口可以允许多个 **VLAN** 通过。
  - 适用于连接多个 **VLAN** 的设备 (如交换机或路由器)。
  - 可以在交换机之间传输来自多个 **VLAN** 的流量。

## 3. 若所有接口都设置为 **Access** 接口会怎么样?

如果交换机上的所有接口都设置为 **Access** 接口, 可能会出现以下情况:

### 1. 无法跨 **VLAN** 通信:

- 由于 **Access** 接口只能属于一个 **VLAN**, 所有设备只能和同一 **VLAN** 中的其他设备通信。跨 **VLAN** 的通信将无法进行。

### 2. 网络设计受限:

- 这样的配置适用于小型网络或简单的网络环境, 但不适用于需要复杂 **VLAN** 配置的大型网络。
- 交换机之间无法通过 **Trunk** 链路传输多个 **VLAN** 的数据流量, 限制了网络的扩展性和灵活性。

### 3. 广播域较大:

- 如果所有设备都在同一个 **VLAN** 中, 广播流量会在整个 **VLAN** 中传播, 可能会导致广播风暴, 影响网络性能。