

四川大學

《计算机网络》实验报告（3）



以太交换

专业 软件工程

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成绩分数 _____

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以太交换

一、实验目的

1. 掌握二层转发相关流程
2. 掌握 VLAN 的部署和配置流程。

二、实验要求

将实验的拓扑、实验结果及验证写入实验报告

三、广播转发实验过程

(一) 新建拓扑, 实验组网

按照实验手册要求组织如下网络, 将 PC 机配置同一网段 IP 地址

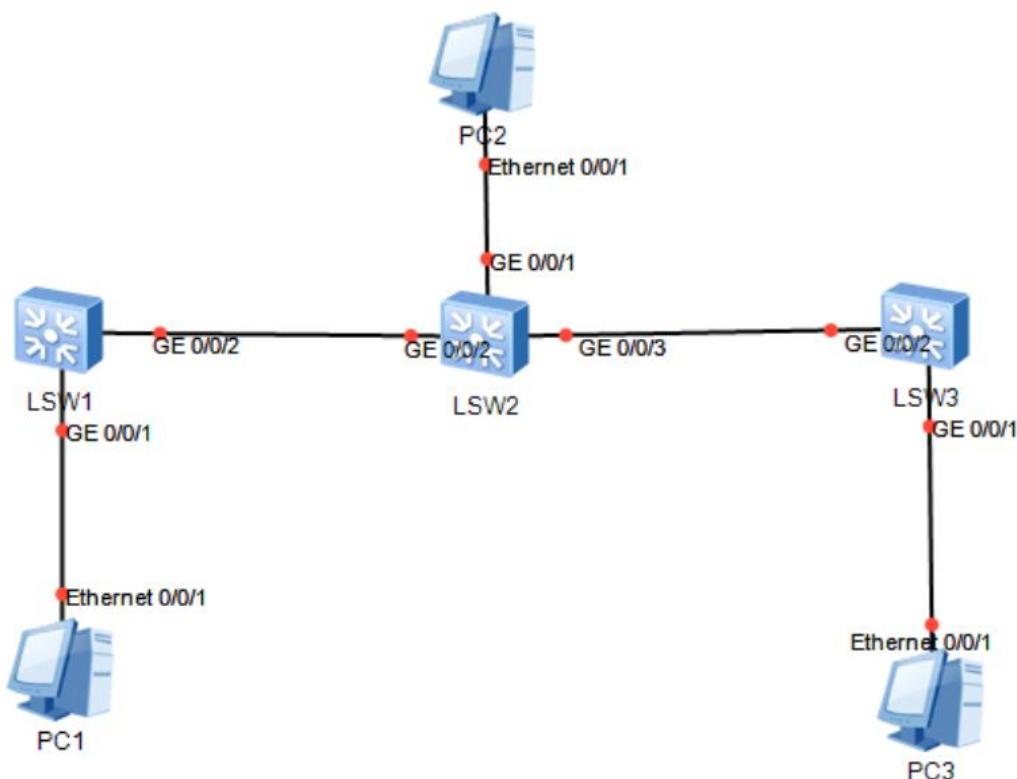


图 1 组织出的网络的拓扑结构

我将 PC1、PC2、PC3 主机的 IP 地址、子网掩码和网关设置如下:

PC1: IP 地址 192.168.3.1, 子网掩码 255.255.255.0

PC2: IP 地址 192.168.3.2, 子网掩码 255.255.255.0

PC3: IP 地址 192.168.3.3, 子网掩码 255.255.255.0



图 2 三台主机的 IP 地址配置

(二) 组网验证

(1) 启动设备，执行 Ping 命令

在 PC1 上，执行 ping 192.168.1.2 和 ping 192.168.1.3

在 PC2 上, 执行 ping 192.168.1.1 和 ping 192.168.1.3

在 PC3 上, 执行 ping 192.168.1.1 和 ping 192.168.1.2

The figure consists of three vertically stacked windows, each titled with the computer name (PC1, PC2, or PC3) and showing a terminal-like interface with tabs for '基础配置', '命令行' (selected), '组播', 'UDP发包工具', and '串口'. Each window displays the results of a ping command.

PC1 Window:

```
PC>ping 192.168.3.2
Ping 192.168.3.2: 32 data bytes, Press Ctrl_C to break
From 192.168.3.2: bytes=32 seq=1 ttl=128 time=62 ms
From 192.168.3.2: bytes=32 seq=2 ttl=128 time=78 ms
From 192.168.3.2: bytes=32 seq=3 ttl=128 time=78 ms
From 192.168.3.2: bytes=32 seq=4 ttl=128 time=63 ms
From 192.168.3.2: bytes=32 seq=5 ttl=128 time=63 ms

--- 192.168.3.2 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 62/68/78 ms

PC>ping 192.168.3.3
Ping 192.168.3.3: 32 data bytes, Press Ctrl_C to break
From 192.168.3.3: bytes=32 seq=1 ttl=128 time=94 ms
From 192.168.3.3: bytes=32 seq=2 ttl=128 time=93 ms
From 192.168.3.3: bytes=32 seq=3 ttl=128 time=110 ms
From 192.168.3.3: bytes=32 seq=4 ttl=128 time=125 ms
From 192.168.3.3: bytes=32 seq=5 ttl=128 time=94 ms

--- 192.168.3.3 ping statistics ---
```

PC2 Window:

```
PC>ping 192.168.3.1
Ping 192.168.3.1: 32 data bytes, Press Ctrl_C to break
From 192.168.3.1: bytes=32 seq=1 ttl=128 time=47 ms
From 192.168.3.1: bytes=32 seq=2 ttl=128 time=94 ms
From 192.168.3.1: bytes=32 seq=3 ttl=128 time=78 ms
From 192.168.3.1: bytes=32 seq=4 ttl=128 time=78 ms
From 192.168.3.1: bytes=32 seq=5 ttl=128 time=78 ms

--- 192.168.3.1 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 47/75/94 ms

PC>ping 192.168.3.3
Ping 192.168.3.3: 32 data bytes, Press Ctrl_C to break
From 192.168.3.3: bytes=32 seq=1 ttl=128 time=63 ms
From 192.168.3.3: bytes=32 seq=2 ttl=128 time=62 ms
From 192.168.3.3: bytes=32 seq=3 ttl=128 time=62 ms
From 192.168.3.3: bytes=32 seq=4 ttl=128 time=78 ms
From 192.168.3.3: bytes=32 seq=5 ttl=128 time=62 ms

--- 192.168.3.3 ping statistics ---
5 packet(s) transmitted
```

PC3 Window:

```
Welcome to use PC Simulator!
PC>ping 192.168.3.1
Ping 192.168.3.1: 32 data bytes, Press Ctrl_C to break
From 192.168.3.1: bytes=32 seq=1 ttl=128 time=94 ms
From 192.168.3.1: bytes=32 seq=2 ttl=128 time=125 ms
From 192.168.3.1: bytes=32 seq=3 ttl=128 time=78 ms
From 192.168.3.1: bytes=32 seq=4 ttl=128 time=94 ms
From 192.168.3.1: bytes=32 seq=5 ttl=128 time=109 ms

--- 192.168.3.1 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 78/100/125 ms

PC>ping 192.168.3.2
Ping 192.168.3.2: 32 data bytes, Press Ctrl_C to break
From 192.168.3.2: bytes=32 seq=1 ttl=128 time=63 ms
From 192.168.3.2: bytes=32 seq=2 ttl=128 time=78 ms
From 192.168.3.2: bytes=32 seq=3 ttl=128 time=63 ms
From 192.168.3.2: bytes=32 seq=4 ttl=128 time=78 ms
From 192.168.3.2: bytes=32 seq=5 ttl=128 time=78 ms

--- 192.168.3.2 ping statistics ---
```

图 3 Ping 命令部分截图

(2) 检查 MAC 地址, 执行 display mac-address

MAC Address	VLAN/ VSI/SI	PEVLAN CEVLAN	Port	Type	LSP/LSR-ID MAC-Tunnel
5489-98bb-48ea 1	-	-	GE0/0/2	dynamic	0/-
5489-9829-19e3 1	-	-	GE0/0/1	dynamic	0/-
5489-9802-805b 1	-	-	GE0/0/2	dynamic	0/-

MAC Address	VLAN/ VSI/SI	PEVLAN CEVLAN	Port	Type	LSP/LSR-ID MAC-Tunnel
5489-98bb-48ea 1	-	-	GE0/0/1	dynamic	0/-
5489-9829-19e3 1	-	-	GE0/0/2	dynamic	0/-
5489-9802-805b 1	-	-	GE0/0/3	dynamic	0/-

MAC Address	VLAN/ VSI/SI	PEVLAN CEVLAN	Port	Type	LSP/LSR-ID MAC-Tunnel
5489-98bb-48ea 1	-	-	GE0/0/2	dynamic	0/-
5489-9802-805b 1	-	-	GE0/0/1	dynamic	0/-
5489-9829-19e3 1	-	-	GE0/0/2	dynamic	0/-

图 4 三台交换机的 MAC 地址信息

(三) VLAN 隔离/互通

参考 eNSP 帮助——快速入门实验, 按照“数据实验”的步骤实现两个主机的通信。

1 号交换机配置: 接入端口 VLAN 配置为 VLAN 10, Trunk 口配置 10 VLAN;

2 号交换机配置: 接入端口 VLAN 配置为 VLAN 20, Trunk 口配置 20 VLAN

3 号交换机配置: 接入端口 VLAN 配置为 VLAN 30, Trunk 口配置 30 VLAN

具体配置的信息如下图所示:

The figure consists of three vertically stacked windows, each titled with the switch model (LSW1, LSW2, or LSW3). Each window displays a command-line interface (CLI) session. The sessions show the configuration of VLANs and port types (Access or Trunk) on various Gigabit Ethernet ports. The configurations involve creating VLANs (e.g., vlan batch 10 20 30), setting port link types (access or trunk), and defining port trunk allow-pass VLANs. The output also includes informational messages from the switch, such as 'Info: This operation may take a few seconds. Please wait for a moment...' and 'done.'.

```
<Huawei>sys
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]vlan batch 10 20 30
Info: This operation may take a few seconds. Please wait for a moment...
[Huawei]
Apr 24 2025 15:24:51-08:00 Huawei DS/4/DATASYNC_CFGCHANGE:OID 1.3.6.1.4.
.25.191.3.1 configurations have been changed. The current change number
e change loop count is 0, and the maximum number of records is 4095. int
igabitether 0/0/1
[Huawei-GigabitEthernet0/0/1]port link-type access
[Huawei-GigabitEthernet0/0/1] port default vlan 10
[Huawei-GigabitEthernet0/0/1]quit
[Huawei]interface gigabitether 0/0/2
[Huawei-GigabitEthernet0/0/2] port link-type trunk
[Huawei-GigabitEthernet0/0/2] port trunk allow-pass vlan 10
[Huawei-GigabitEthernet0/0/2]quit
[Huawei]
```



```
[Huawei]vlan batch 10 20 30
Info: This operation may take a few seconds. Please wait for a moment...done.
[Huawei] interface gigabitether 0/0/1
[Huawei-GigabitEthernet0/0/1] port link-type access
[Huawei-GigabitEthernet0/0/1] port default vlan 20
[Huawei-GigabitEthernet0/0/1]quit
[Huawei]interface gigabitether 0/0/2
[Huawei-GigabitEthernet0/0/2] port link-type trunk
[Huawei-GigabitEthernet0/0/2]port trunk allow-pass vlan 20
[Huawei-GigabitEthernet0/0/2]quit
[Huawei]interface gigabitether 0/0/3
[Huawei-GigabitEthernet0/0/3]port link-type trunk
[Huawei-GigabitEthernet0/0/3]port trunk allow-pass vlan 20
[Huawei-GigabitEthernet0/0/3]quit
[Huawei]
[Huawei]
[Huawei]display vlan
The total number of vlans is : 4
-----
U: Up;          D: Down;          TG: Tagged;          UT: Untagged;
MP: Vlan-mapping;      ST: Vlan-stacking;
#: ProtocolTransparent-vlan;    *: Management-vlan;
-----
VID  Type      Ports
```



```
<Huawei>sys
<Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei] vlan batch 10 20 30
Info: This operation may take a few seconds. Please wait for a moment...done.
[Huawei] interface gigabitether 0/0/1
[Huawei-GigabitEthernet0/0/1] port link-type access
[Huawei-GigabitEthernet0/0/1] port default vlan 30
[Huawei-GigabitEthernet0/0/1]quit
[Huawei] interface gigabitether 0/0/2
[Huawei-GigabitEthernet0/0/2] port link-type trunk
[Huawei-GigabitEthernet0/0/2] port trunk allow-pass vlan 30
[Huawei-GigabitEthernet0/0/2] quit
[Huawei]
```

图 5 三台交换机的配置信息

得到如下配置结果:

```

LSW1
#
<Huawei>display vlan
The total number of vlans is : 4
-----
U: Up;          D: Down;          TG: Tagged;          UT: Untagged;
MP: Vlan-mapping;      ST: Vlan-stacking;
#: ProtocolTransparent-vlan;  *: Management-vlan;
-----

VID  Type     Ports
-----
1    common   UT:GE0/0/2(U)      GE0/0/3(D)      GE0/0/4(D)      GE0/0/5(D)
                  GE0/0/6(D)      GE0/0/7(D)      GE0/0/8(D)      GE0/0/9(D)
                  GE0/0/10(D)     GE0/0/11(D)     GE0/0/12(D)     GE0/0/13(D)
                  GE0/0/14(D)     GE0/0/15(D)     GE0/0/16(D)     GE0/0/17(D)
                  GE0/0/18(D)     GE0/0/19(D)     GE0/0/20(D)     GE0/0/21(D)
                  GE0/0/22(D)     GE0/0/23(D)     GE0/0/24(D)

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

20   common
30   common

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
30   enable   default       enable  disable   VLAN 0030
<Huawei>

```

```

LSW2
[Huawei]display vlan
The total number of vlans is : 4
-----
U: Up;          D: Down;          TG: Tagged;          UT: Untagged;
MP: Vlan-mapping;      ST: Vlan-stacking;
#: ProtocolTransparent-vlan;  *: Management-vlan;
-----

VID  Type     Ports
-----
1    common   UT:GE0/0/2(U)      GE0/0/3(U)      GE0/0/4(D)      GE0/0/5(D)
                  GE0/0/6(D)      GE0/0/7(D)      GE0/0/8(D)      GE0/0/9(D)
                  GE0/0/10(D)     GE0/0/11(D)     GE0/0/12(D)     GE0/0/13(D)
                  GE0/0/14(D)     GE0/0/15(D)     GE0/0/16(D)     GE0/0/17(D)
                  GE0/0/18(D)     GE0/0/19(D)     GE0/0/20(D)     GE0/0/21(D)
                  GE0/0/22(D)     GE0/0/23(D)     GE0/0/24(D)

10   common
20   common   UT:GE0/0/1(U)
                  TG:GE0/0/2(U)      GE0/0/3(U)

30   common

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
30   enable   default       enable  disable   VLAN 0030

```

```

Huawei>system-view
Enter system view, return user view with Ctrl+Z.
[Huawei]display vlan
The total number of vlans is : 4

U: Up; D: Down; TG: Tagged; UT: Untagged;
MP: Vlan-mapping; ST: Vlan-stacking;
#: ProtocolTransparent-vlan; *: Management-vlan;

VID Type Ports
-----
1 common UT:GE0/0/2(U) GE0/0/3(D) GE0/0/4(D) GE0/0/5(D)
          GE0/0/6(D) GE0/0/7(D) GE0/0/8(D) GE0/0/9(D)
          GE0/0/10(D) GE0/0/11(D) GE0/0/12(D) GE0/0/13(D)
          GE0/0/14(D) GE0/0/15(D) GE0/0/16(D) GE0/0/17(D)
          GE0/0/18(D) GE0/0/19(D) GE0/0/20(D) GE0/0/21(D)
          GE0/0/22(D) GE0/0/23(D) GE0/0/24(D)

10 common
20 common
30 common UT:GE0/0/1(U)

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
30 enable default enable disable VLAN 0030

```

图 6 三台交换机的配置结果

(三) VLAN 互通

PC1 在 VLAN10，接在 1 号交换机上。

PC3 在 VLAN30，接在 3 号交换机上。

1 号交换机 GigabitEthernet0/0/1 配置为 Access 口，绑定 VLAN10。

2 号交换机 GigabitEthernet0/0/2 配置 Trunk，允许通过 VLAN10。

3 号交换机 Access 口绑定 VLAN30，Trunk 允许 VLAN30。

PC1 和 PC3 由于在不同 VLAN (10 和 30)，不能互通。

```

PC>ping 192.168.3.3

Ping 192.168.3.3: 32 data bytes, Press Ctrl_C to break
From 192.168.3.1: Destination host unreachable

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

```

图 6 PC1 ping PC3 不能互通

在上个测试项中, 变更 2 号交换机 access VLAN 配置, 分别变化为 VLAN 10 和 VLAN30, 测试 PC1 和 PC2 是否可以互通, PC2 和 PC3 是否可以互通。

当 PC2 和 PC1 都在 VLAN10 时, PC1 和 PC2 可以互通。

当 PC2 和 PC3 都在 VLAN30 时, PC2 和 PC3 可以互通。

The image shows two terminal windows, PC1 and PC2, displaying ping results.

PC1 Terminal:

```
PC>ping 192.168.3.2

Ping 192.168.3.2: 32 data bytes, Press Ctrl_C to break
From 192.168.3.2: bytes=32 seq=1 ttl=128 time=63 ms
From 192.168.3.2: bytes=32 seq=2 ttl=128 time=78 ms
From 192.168.3.2: bytes=32 seq=3 ttl=128 time=78 ms
From 192.168.3.2: bytes=32 seq=4 ttl=128 time=62 ms
From 192.168.3.2: bytes=32 seq=5 ttl=128 time=63 ms

--- 192.168.3.2 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 62/68/78 ms
```

PC2 Terminal:

```
5 packet(s) transmitted
0 packet(s) received
100.00% packet loss

PC>ping 192.168.3.3

Ping 192.168.3.3: 32 data bytes, Press Ctrl_C to break
From 192.168.3.3: bytes=32 seq=1 ttl=128 time=78 ms
From 192.168.3.3: bytes=32 seq=2 ttl=128 time=78 ms
From 192.168.3.3: bytes=32 seq=3 ttl=128 time=62 ms
From 192.168.3.3: bytes=32 seq=4 ttl=128 time=78 ms
From 192.168.3.3: bytes=32 seq=5 ttl=128 time=78 ms

--- 192.168.3.3 ping statistics ---
5 packet(s) transmitted
5 packet(s) received
0.00% packet loss
round-trip min/avg/max = 62/74/78 ms
```

图 7 PC1 ping PC2、PC2 ping PC3 的屏幕信息截图 (示例)

实验到此完成。