计算机网络实验报告

警示

1. 实验报告如有雷同，雷同各方当次实验成绩均以 0 分计。
2. 当次小组成员成绩只计学号、姓名登录在下表中的。
3. 在规定时间内未上交实验报告的，不得以其他方式补交，当次成绩按 0 分计。
4. 实验报告文件以 PDF 格式提交。

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郑卓民	共同协助完成每部分				
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实验 3 跨交换机实现 VLAN

实验名称

跨交换机实现 VLAN。

实验目的

理解跨交换机之间 VLAN 的特点。使在同一 VLAN 里的计算机系统能跨交换机进行相互通信、而在不同 VLAN 里的计算机系统不能进行相互通信。。

实验要求

(1)完成实验教材第 6 章实验 6-2 的实验(p172)。

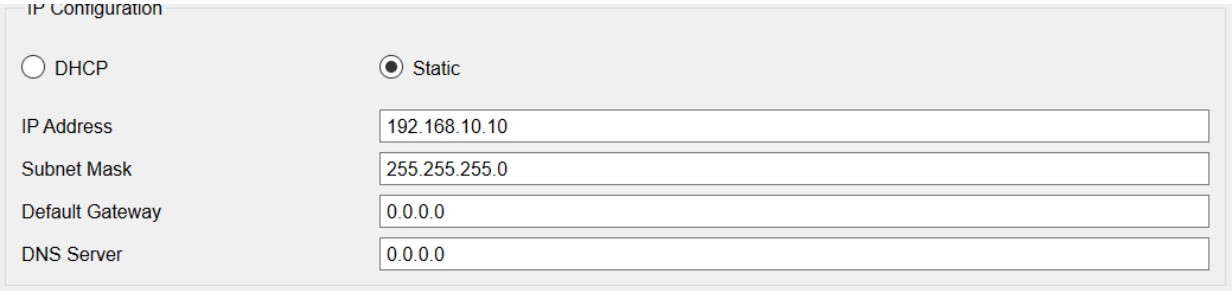
(2)完成本章习题 6 的练习 9(p217)，分析实验结果。

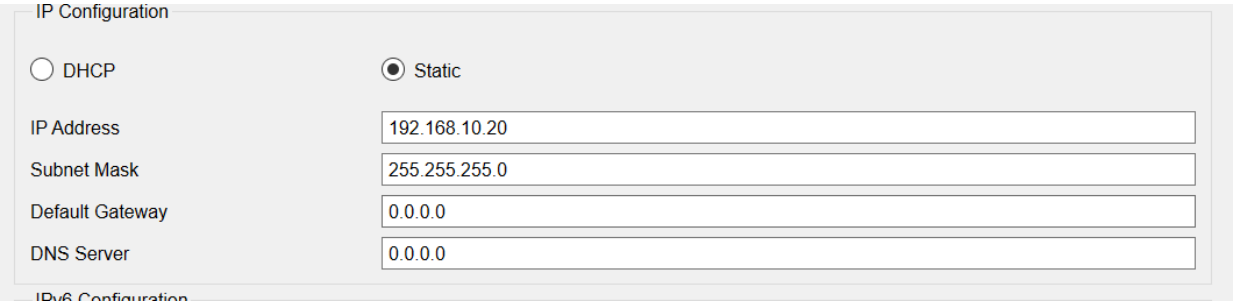
(3) 跨交换机实现 VLAN 通信时，思考不用 Trunk 模式且也能进行跨交换机 VLAN 通信的替代方法，并进行实验验证。

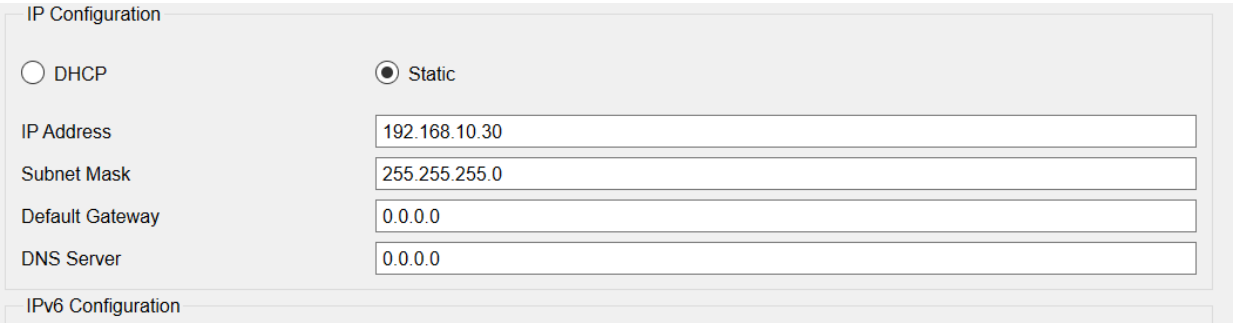
实验过程

（1）完成实验教材第 6 章实验 6-2 的实验：

步骤 1：配置 PC0、PC1、PC2，并验证 3 台主机是否可以两两互通







PC1 ping PC2、PC3

```
C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Reply from 192.168.10.30: bytes=32 time=1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

PC2 ping PC1、PC3：

```
C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Reply from 192.168.10.10: bytes=32 time<1ms TTL=128
Reply from 192.168.10.10: bytes=32 time<1ms TTL=128
Reply from 192.168.10.10: bytes=32 time<1ms TTL=128
Reply from 192.168.10.10: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Reply from 192.168.10.30: bytes=32 time=1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

PC3 ping PC1、PC2：

```
C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Reply from 192.168.10.10: bytes=32 time=1ms TTL=128
Reply from 192.168.10.10: bytes=32 time<1ms TTL=128
Reply from 192.168.10.10: bytes=32 time<1ms TTL=128
Reply from 192.168.10.10: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time=1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

步骤 2：在交换机 1 配置 vlan 10，并检查 3 台主机的连接状况

```
Switch>en
Switch#enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#name sales
Switch(config-vlan)#exit
Switch(config)#interface fastethernet 0/5
Switch(config-if)#switchport access vlan 10
Switch(config-if)#exit
Switch(config)#exit
Switch#
```

```
Switch#show vlan id 10

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
10   sales                             active    Fa0/5

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
10   enet  100010     1500  -      -      -        -    -        0      0
```

PC1 ping PC2、PC3：

```
C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

PC2 ping PC3、PC1

```
C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

PC3 ping PC1、PC2：

```
C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Reply from 192.168.10.20: bytes=32 time=1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms
```

步骤 3：在交换机 1 配置 vlan20 并检查 3 台主机的连接状况：

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 20
Switch(config-vlan)#name technical
Switch(config-vlan)#exit
Switch(config)#interface fastethernet 0/15
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config)#exit
Switch#
```

```
Switch#show vlan id 20

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
20   technical                        active    Fa0/15

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
20   enet  100020     1500  -      -      -        -    -        0      0
```

PC1 ping PC2、PC3：

```
C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

PC2 ping PC1、PC3：

```
C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

PC3 ping PC1、PC2：

```
C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

步骤 4：将交换机 1 与交换机 2 相连的端口定义为 Tag VLAN 模式：

```
Switch#show interfaces fastethernet 0/24 switchport
Name: Fa0/24
Switchport: Enabled
Administrative Mode: trunk
Operational Mode: trunk
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: dot1q
Negotiation of Trunking: On
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: All
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL
Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none
```

步骤 5：在交换机 2 上配置 vlan20，并检查 3 台主机的连接状况：

```
Switch>en
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 20
Switch(config-vlan)#name technical
Switch(config-vlan)#exit
Switch(config)#interface fastethernet 0/5
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config)#exit

Switch#show vlan id 20

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
20   technical                        active    Fa0/5

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
20   enet  100020     1500  -      -      -        -    -        0      0
```

PC1 ping PC2、PC3：

```
C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

PC2 ping PC1、PC3：

```
C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

PC3 ping PC1、PC2：

```
C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

步骤 6：将交换机 2 与交换 1 相连的端口定义为 Tag VLAN 模式：

步骤 7：验证 PC1 与 PC2 能互相通信，但 PC0 与 PC2 不能互相通信：

PC1 ping PC2、PC3：

```
C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

PC2 ping PC1、PC3：

```
C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time=2ms TTL=128

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 2ms, Average = 0ms
```

PC3 ping PC1、PC2：

```
C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128
Reply from 192.168.10.20: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

进行以下观察：

1. 主机之间能否互相通信：PC2 与 PC3 能互相通信，其余不行。

PC1 ping PC2、PC3 截图：

```
C:\>ping 192.168.10.20

Pinging 192.168.10.20 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.20:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

```
C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

PC2 ping PC3 截图：

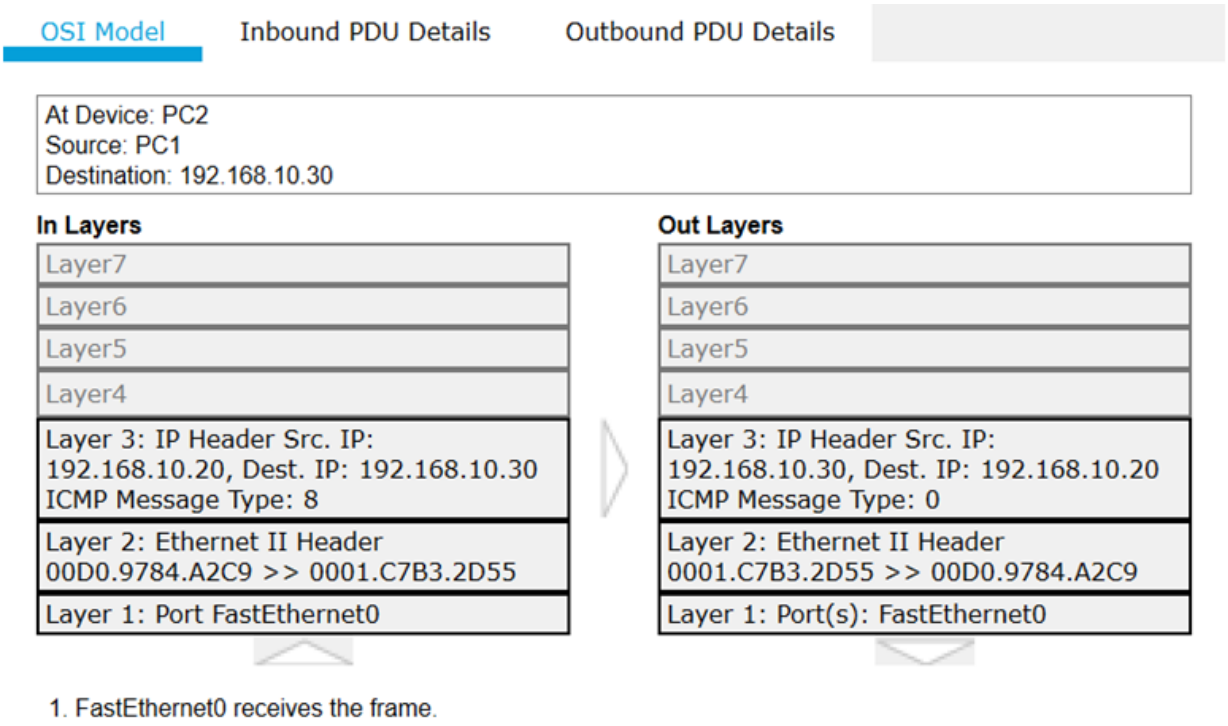
```
C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Reply from 192.168.10.30: bytes=32 time=12ms TTL=128
Reply from 192.168.10.30: bytes=32 time=6ms TTL=128
Reply from 192.168.10.30: bytes=32 time=6ms TTL=128
Reply from 192.168.10.30: bytes=32 time=6ms TTL=128

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 12ms, Average = 7ms
```

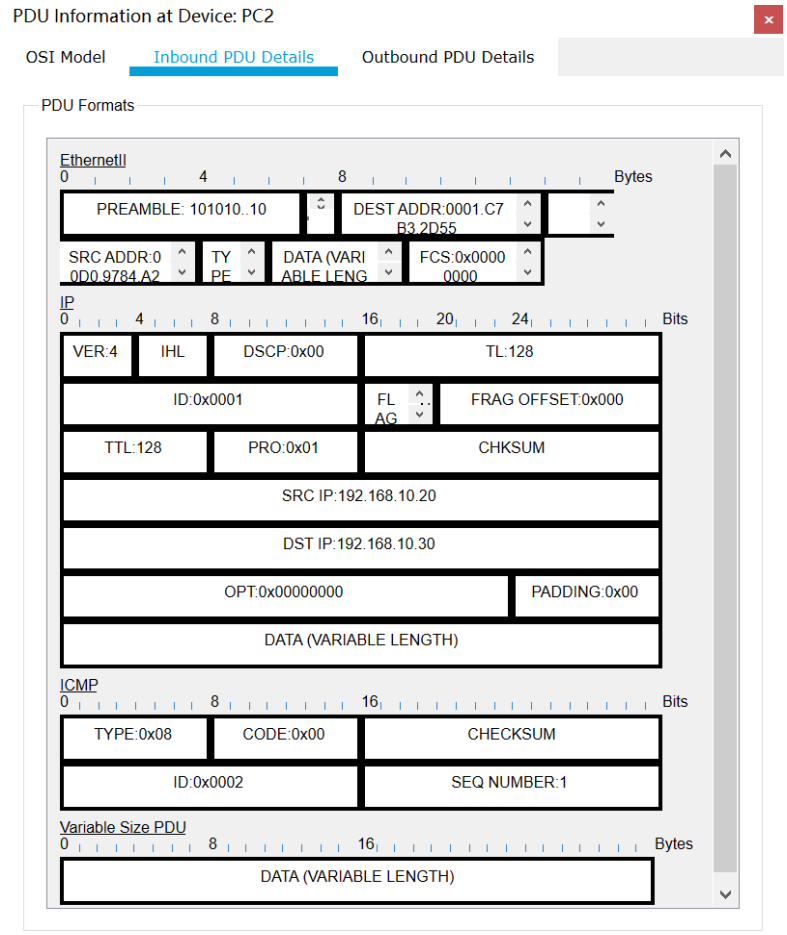
2. 能够监测到 PC0、PC1、PC2 的 ICMP 包：可以监测到。

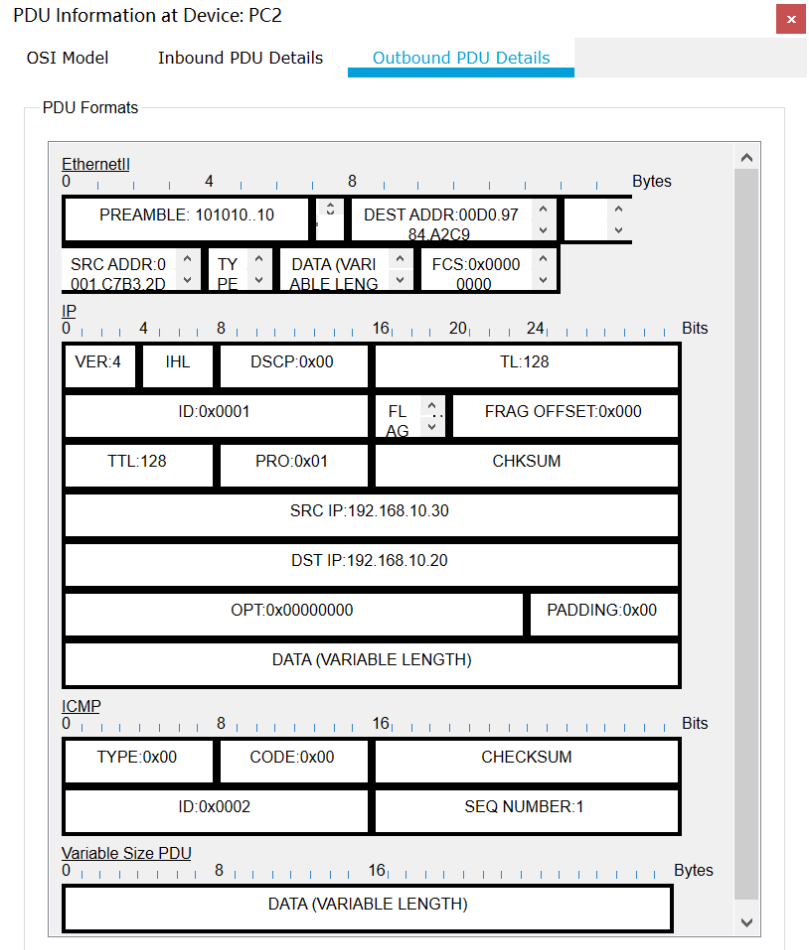
0.000	--	PC0	ICMP
0.000	--	PC0	ARP
0.001	PC0	Switch0	ARP
1.985	--	Switch0	STP
1.985	--	Switch0	STP
1.986	Switch0	Switch1	STP
1.986	Switch0	PC0	STP
1.986	Switch0	PC1	STP
1.986	--	Switch0	STP
1.987	--	Switch0	STP
1.987	Switch0	Switch1	STP
1.987	--	Switch0	STP
1.988	Switch0	Switch1	STP

48.045	--	PC1	ICMP
48.045	--	PC1	ARP
48.046	Switch0	Switch1	STP
48.046	Switch0	PC0	STP
48.046	PC1	Switch0	ARP
48.047	Switch0	Switch1	ARP
48.048	Switch1	PC2	ARP
48.049	PC2	Switch1	ARP
48.050	Switch1	Switch0	ARP
48.051	Switch0	PC1	ARP
48.054	Switch1	PC2	ICMP
48.055	PC2	Switch1	ICMP
48.056	Switch1	Switch0	ICMP
48.057	Switch0	PC1	ICMP
49.057	--	PC1	ICMP
49.058	PC1	Switch0	ICMP
49.059	Switch0	Switch1	ICMP
49.060	Switch1	PC2	ICMP
49.061	PC2	Switch1	ICMP
49.062	Switch1	Switch0	ICMP
49.063	Switch0	PC1	ICMP

3. 能否捕获到 Trunk 链路上的 VLAN ID：不能，因为 access 端口在发出 ICMP 包之前就将上面的 VLAN TAG 删除，所以无法捕获到。




PDU Information at Device: PC2
OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
EthernetII
0 4 8 Bytes
PREAMBLE: 101010..10
DEST ADDR:0001.C7B3.2D55
SRC ADDR:00D0.9784.A2C9
TYPE
DATA (VARIABLE LENG
FCS:0x00000000
IP
0 4 8 16 20 24 Bits
VER:4
IHL
DSCP:0x00
TL:128
ID:0x0001
FLAG
FRAG OFFSET:0x000
TTL:128
PRO:0x01
CHKSUM
SRC IP:192.168.10.20
DST IP:192.168.10.30
OPT:0x00000000
PADDING:0x00
DATA (VARIABLE LENGTH)
ICMP
0 8 16 Bits
TYPE:0x08
CODE:0x00
CHECKSUM
ID:0x0002
SEQ NUMBER:1
Variable Size PDU
0 8 16 Bytes
DATA (VARIABLE LENGTH)


PDU Information at Device: PC2
OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
EthernetII
0 4 8 Bytes
PREAMBLE: 101010..10
DEST ADDR:00D0.9784.A2C9
SRC ADDR:0001.C7B3.2D
TYPE
DATA (VARIABLE LENG
FCS:0x00000000
IP
0 4 8 16 20 24 Bits
VER:4
IHL
DSCP:0x00
TL:128
ID:0x0001
FLAG
FRAG OFFSET:0x000
TTL:128
PRO:0x01
CHKSUM
SRC IP:192.168.10.30
DST IP:192.168.10.20
OPT:0x00000000
PADDING:0x00
DATA (VARIABLE LENGTH)
ICMP
0 8 16 Bits
TYPE:0x00
CODE:0x00
CHECKSUM
ID:0x0002
SEQ NUMBER:1
Variable Size PDU
0 8 16 Bytes
DATA (VARIABLE LENGTH)

4. 查看交换机的地址表。交换机中存在着一张记录着 MAC 地址的表，为了完成数据的快速转发，该表具有自动学习机制。交换机用 MAC 表来转发数据包，若表里没有目的 MAC，就不能转发，而用洪泛。在不知道交换路径的情况下，洪泛能把数据包很快的送到目的地。同时，洪泛的副作用也有不同的手段来节制。

两台交换机分别查看地址表：show mac address-table 命令和单独 ipconfig/all 显示的 MAC 地址相同。

```
Switch>enable                                    Switch>en
Switch#show mac ad                               Switch#show mac ad
          Mac Address Table                                Mac Address Table
------------------------------------------       ------------------------------------------

Vlan    Mac Address       Type        Ports      Vlan    Mac Address       Type        Ports
----    -----------       --------    -----      ----    -----------       --------    -----

   1    00e0.a38b.0918    DYNAMIC     Fa0/24       1    0030.f213.c718    DYNAMIC     Fa0/24
  10    0000.0cba.7993    DYNAMIC     Fa0/5       20    0001.c7b3.2d55    DYNAMIC     Fa0/5
  20    0001.c7b3.2d55    DYNAMIC     Fa0/24      20    0030.f213.c718    DYNAMIC     Fa0/24
  20    00d0.9784.a2c9    DYNAMIC     Fa0/15      20    00d0.9784.a2c9    DYNAMIC     Fa0/24
Switch#show mac address-table                    Switch#show mac address-table
          Mac Address Table                                Mac Address Table
------------------------------------------       ------------------------------------------

Vlan    Mac Address       Type        Ports      Vlan    Mac Address       Type        Ports
----    -----------       --------    -----      ----    -----------       --------    -----

   1    00e0.a38b.0918    DYNAMIC     Fa0/24       1    0030.f213.c718    DYNAMIC     Fa0/24
  10    0000.0cba.7993    DYNAMIC     Fa0/5       20    0001.c7b3.2d55    DYNAMIC     Fa0/5
  20    0001.c7b3.2d55    DYNAMIC     Fa0/24      20    0030.f213.c718    DYNAMIC     Fa0/24
  20    00d0.9784.a2c9    DYNAMIC     Fa0/15      20    00d0.9784.a2c9    DYNAMIC     Fa0/24
```

```
C:\>ipconfig /all

FastEthernet0 Connection:(default port)

   Connection-specific DNS Suffix..:
   Physical Address................: 0000.0CBA.7993
   Link-local IPv6 Address.........: FE80::200:CFF:FEBA:7993
   IP Address......................: 192.168.10.10
   Subnet Mask.....................: 255.255.255.0
   Default Gateway.................: 0.0.0.0
   DNS Servers.....................: 0.0.0.0
   DHCP Servers....................: 0.0.0.0
   DHCPv6 Client DUID..............: 00-01-00-01-B6-95-4B-B7-00-00-0C-BA-79-93

Bluetooth Connection:

   Connection-specific DNS Suffix..:
   Physical Address................: 0005.5E20.ECC3
   Link-local IPv6 Address.........: ::
   IP Address......................: 0.0.0.0
   Subnet Mask.....................: 0.0.0.0
   Default Gateway.................: 0.0.0.0
   DNS Servers.....................: 0.0.0.0
```

```
C:\>ipconfig /all

FastEthernet0 Connection:(default port)

   Connection-specific DNS Suffix..:
   Physical Address................: 00D0.9784.A2C9
   Link-local IPv6 Address.........: FE80::2D0:97FF:FE84:A2C9
   IP Address......................: 192.168.10.20
   Subnet Mask.....................: 255.255.255.0
   Default Gateway.................: 0.0.0.0
   DNS Servers.....................: 0.0.0.0
   DHCP Servers....................: 0.0.0.0
   DHCPv6 Client DUID..............: 00-01-00-01-95-44-9A-BC-00-D0-97-84-A2-C9

Bluetooth Connection:

   Connection-specific DNS Suffix..:
   Physical Address................: 00D0.5856.9212
   Link-local IPv6 Address.........: ::
   IP Address......................: 0.0.0.0
   Subnet Mask.....................: 0.0.0.0
   Default Gateway.................: 0.0.0.0
   DNS Servers.....................: 0.0.0.0
```

```
C:\>ipconfig /all

FastEthernet0 Connection:(default port)

   Connection-specific DNS Suffix..:
   Physical Address................: 0001.C7B3.2D55
   Link-local IPv6 Address.........: FE80::201:C7FF:FEB3:2D55
   IP Address......................: 192.168.10.30
   Subnet Mask.....................: 255.255.255.0
   Default Gateway.................: 0.0.0.0
   DNS Servers.....................: 0.0.0.0
   DHCP Servers....................: 0.0.0.0
   DHCPv6 Client DUID..............: 00-01-00-01-22-58-A3-3E-00-01-C7-B3-2D-55

Bluetooth Connection:

   Connection-specific DNS Suffix..:
   Physical Address................: 00D0.FF03.6908
   Link-local IPv6 Address.........: ::
   IP Address......................: 0.0.0.0
   Subnet Mask.....................: 0.0.0.0
   Default Gateway.................: 0.0.0.0
   DNS Servers.....................: 0.0.0.0
```

5. 判断实验是否达到预期目标：实验达到预期目标。

实验思考：

1. 为什么不同的 VLAN 之间不能通信？

答：因为 LAN 通信过程中会使用到 ARP 解析，通过 ARP 来解析 MAC 地址，而 ARP 解析的形式就是通过广播，不同的 VLAN 在不同的广播区域，所以不能通信。

2. 说明 VLAN 技术中 Trunk 模式端口的用途和特点：

答：Trunk 模式端口可以允许多个 VLAN 通过,可以接收和发送多个 VLAN 报文,
一般用于交换机与交换机相关的接口。

3. 如何查看 Trunk 端口允许哪些 VLAN 通过？

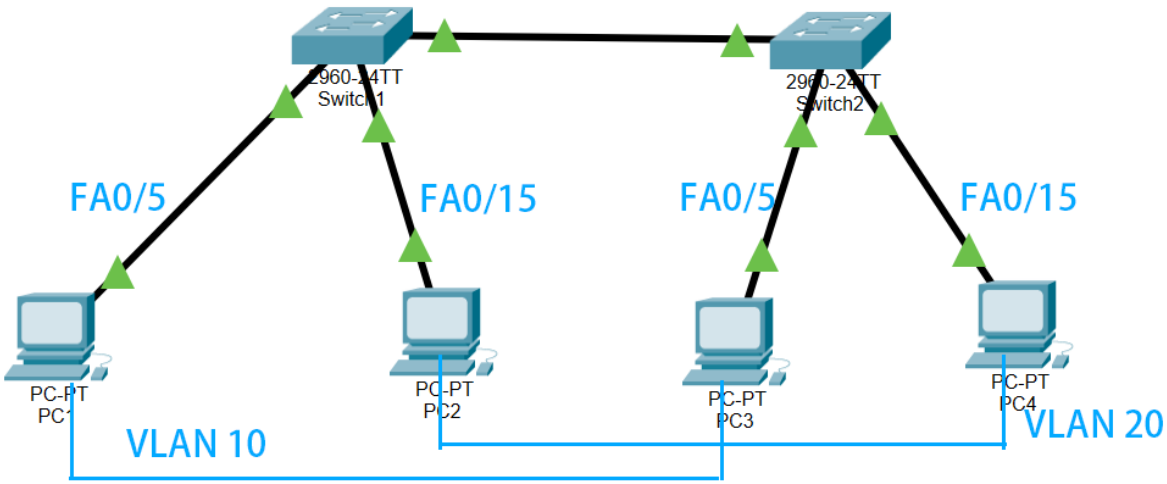
答：使用命令“show interface f0/24 switchport”来查看

4. 实验开始前要先确定 3 台主机处于同一个网段内，为什么要这样限定？

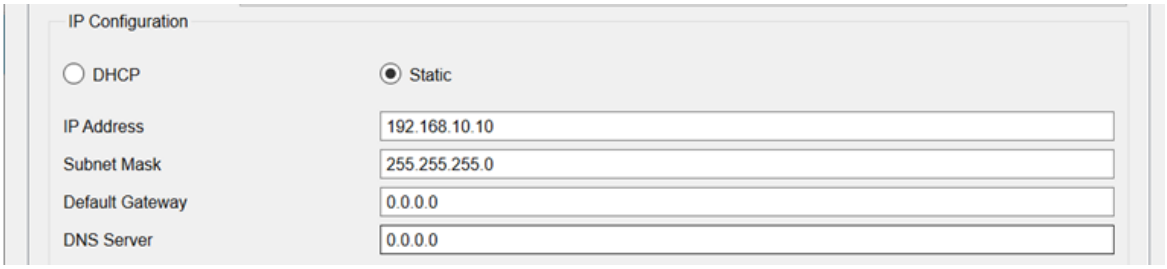
答：假如不在同一个网段，主机之间就无法 ping 通，这样我们就无法知道划分 VLAN 是否成功，所以必须处于同一个网段内。

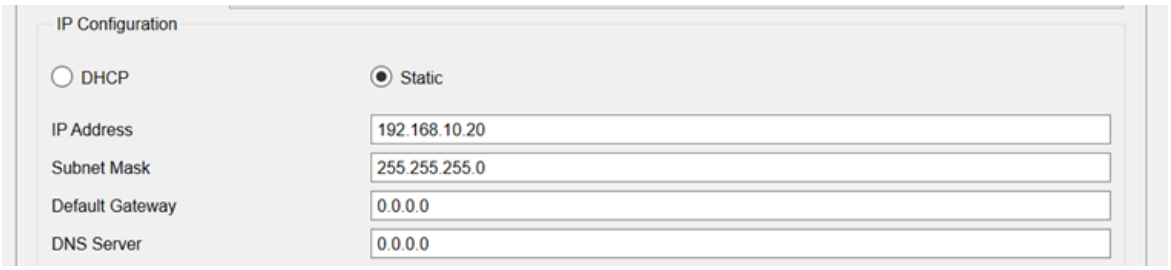
(2) 完成本章习题 6 的练习 9(p217)，分析实验结果：

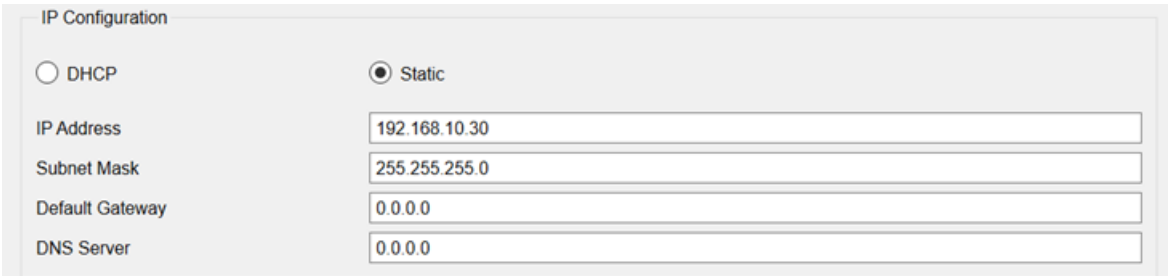
1. 画出拓扑图，并标明 VLAN 以及相关端口：

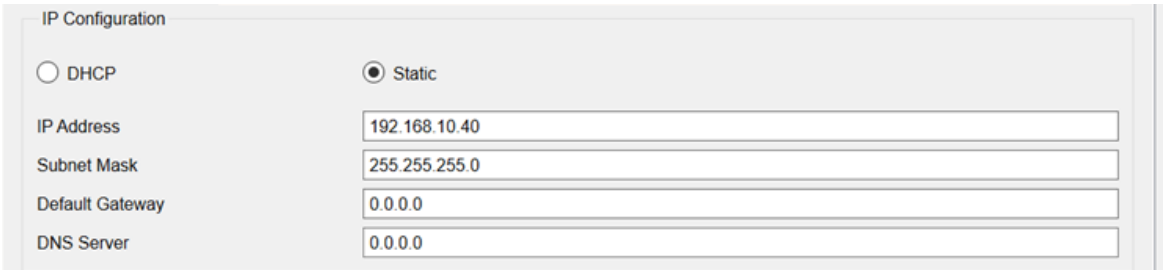


2. 完成“跨交换机实现 VLAN”实验并测试实验网联通性：







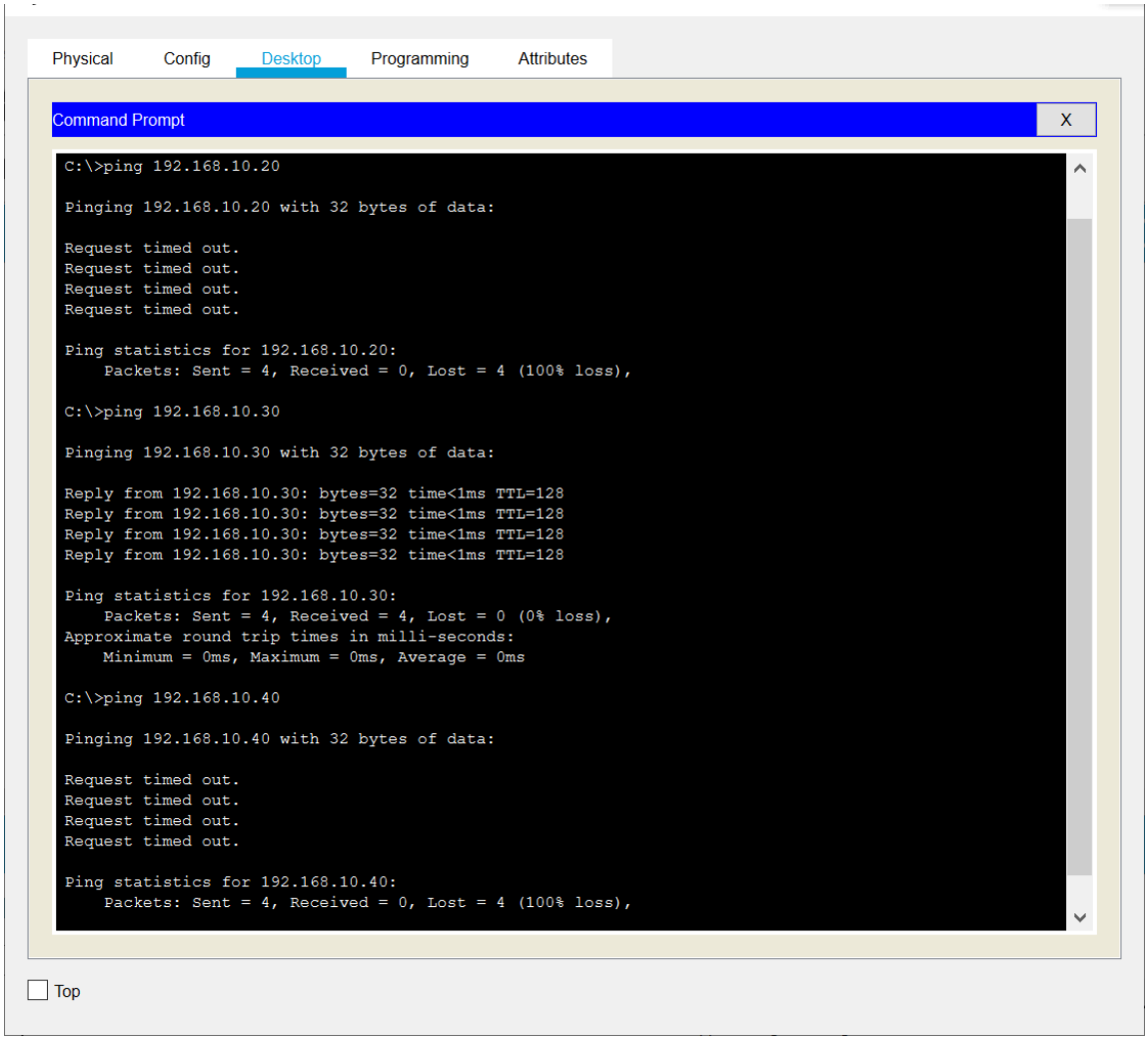



```
Switch>en
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 10
Switch(config-vlan)#name sales
Switch(config-vlan)#exit
Switch(config)#interface fastethernet 0/5
Switch(config-if)#switchport access vlan 10
Switch(config-if)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name technical
Switch(config-vlan)#exit
Switch(config)#interface fastethernet 0/15
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config)#interface fastethernet 0/24
Switch(config-if)#switchport mode trunk

Switch(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to down

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/24, changed state to up
```

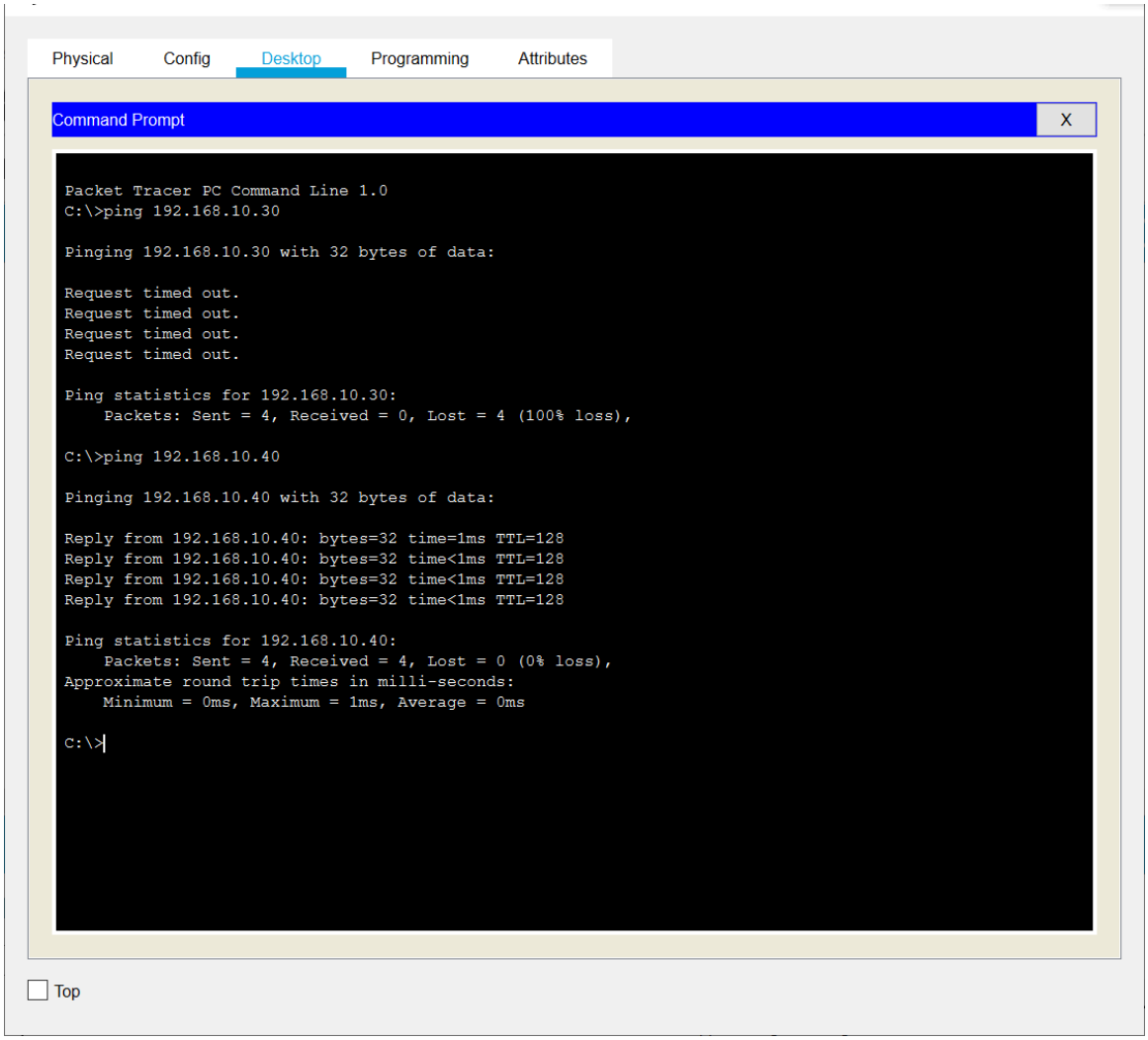
```
Switch#show vlan

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                 Fa0/6, Fa0/7, Fa0/8, Fa0/9
                                                 Fa0/10, Fa0/11, Fa0/12, Fa0/13
                                                 Fa0/14, Fa0/16, Fa0/17, Fa0/18
                                                 Fa0/19, Fa0/20, Fa0/21, Fa0/22
                                                 Fa0/23, Gig0/1, Gig0/2
10   sales                             active    Fa0/5
20   technical                         active    Fa0/15
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
10   enet  100010     1500  -      -      -        -    -        0      0
20   enet  100020     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0

Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fastethernet 0/5
Switch(config-if)#name sales
                  ^
% Invalid input detected at '^' marker.

Switch(config-if)#name sales
                  ^
% Invalid input detected at '^' marker.

Switch(config-if)#vlan 10
Switch(config-vlan)#name sales
Switch(config-vlan)#exit
Switch(config)#vlan 20
Switch(config-vlan)#name technical
Switch(config-vlan)#exit
Switch(config)#interface fastethernet 0/5
Switch(config-if)#switchport access vlan 10
Switch(config-if)#exit
Switch(config)#interface fastethernet 0/15
Switch(config-if)#switchport access vlan 20
Switch(config-if)#exit
Switch(config)#interface fastethernet 0/24
Switch(config-if)#swtichport mode trunk
                  ^
% Invalid input detected at '^' marker.

Switch(config-if)#switchport mode trunk
```

```
Switch#show vlan

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                 Fa0/6, Fa0/7, Fa0/8, Fa0/9
                                                 Fa0/10, Fa0/11, Fa0/12, Fa0/13
                                                 Fa0/14, Fa0/16, Fa0/17, Fa0/18
                                                 Fa0/19, Fa0/20, Fa0/21, Fa0/22
                                                 Fa0/23, Gig0/1, Gig0/2
10   sales                             active    Fa0/5
20   technical                         active    Fa0/15
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
10   enet  100010     1500  -      -      -        -    -        0      0
20   enet  100020     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
```

PC1 ping PC2、PC3、PC4：



PC2 ping PC3、PC4：



由图中显示，PC1 与 PC3 互相连接，PC2 与 PC4 互相连接。

3. PC1 ping PC3，PC2 ping PC4,进行抓包查看报文，是否有 VLAN ID？如果没有，讨论能够捕获到的方法：

PC1 ping PC3：

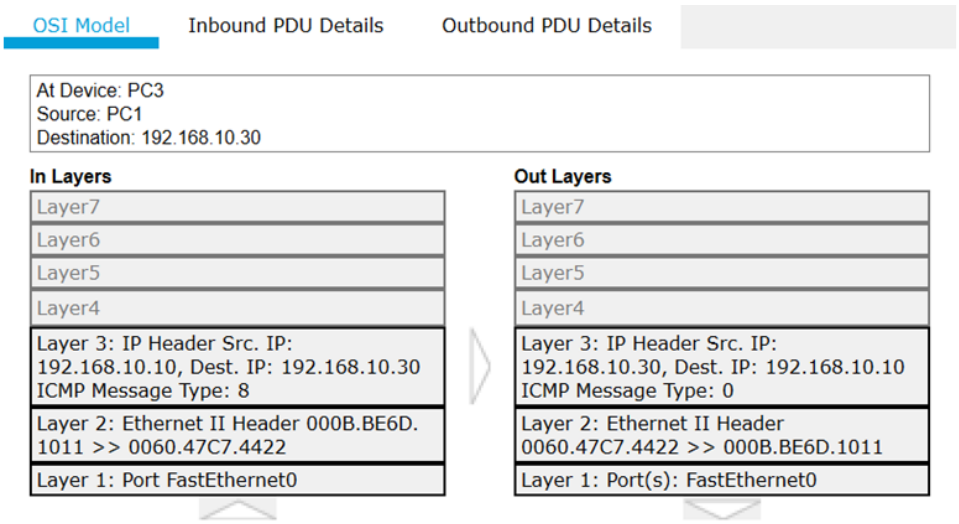
```
C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Reply from 192.168.10.30: bytes=32 time=6ms TTL=128
Reply from 192.168.10.30: bytes=32 time=6ms TTL=128
Reply from 192.168.10.30: bytes=32 time=6ms TTL=128
Reply from 192.168.10.30: bytes=32 time=6ms TTL=128

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 6ms, Average = 6ms
```

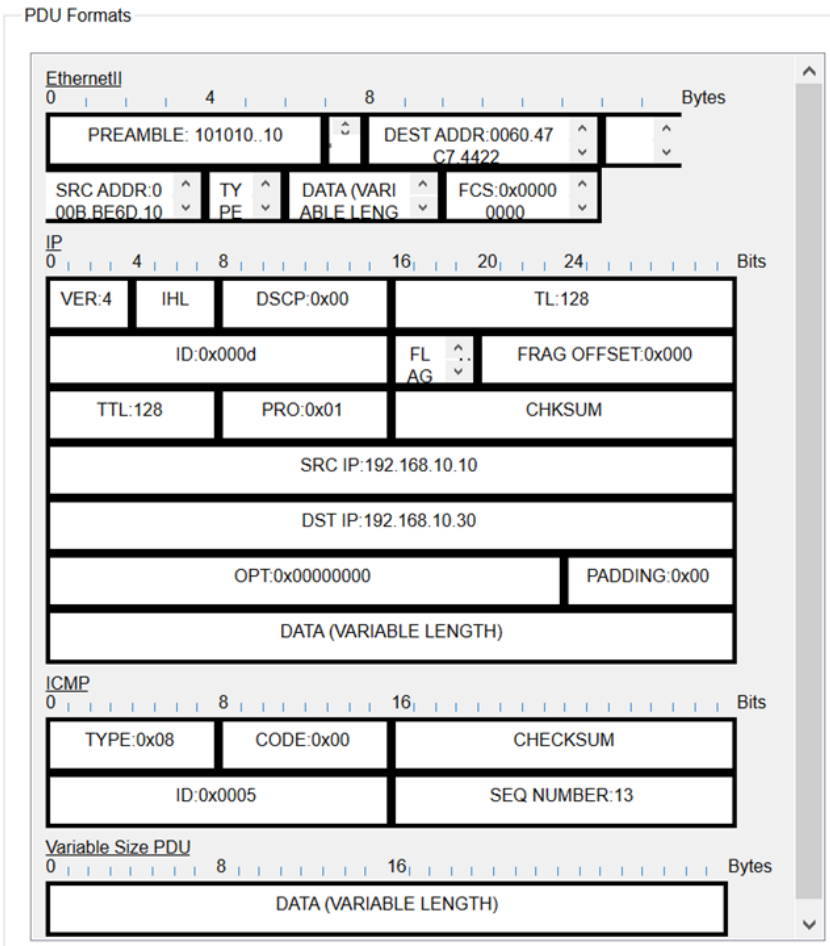
PC2 ping PC4：

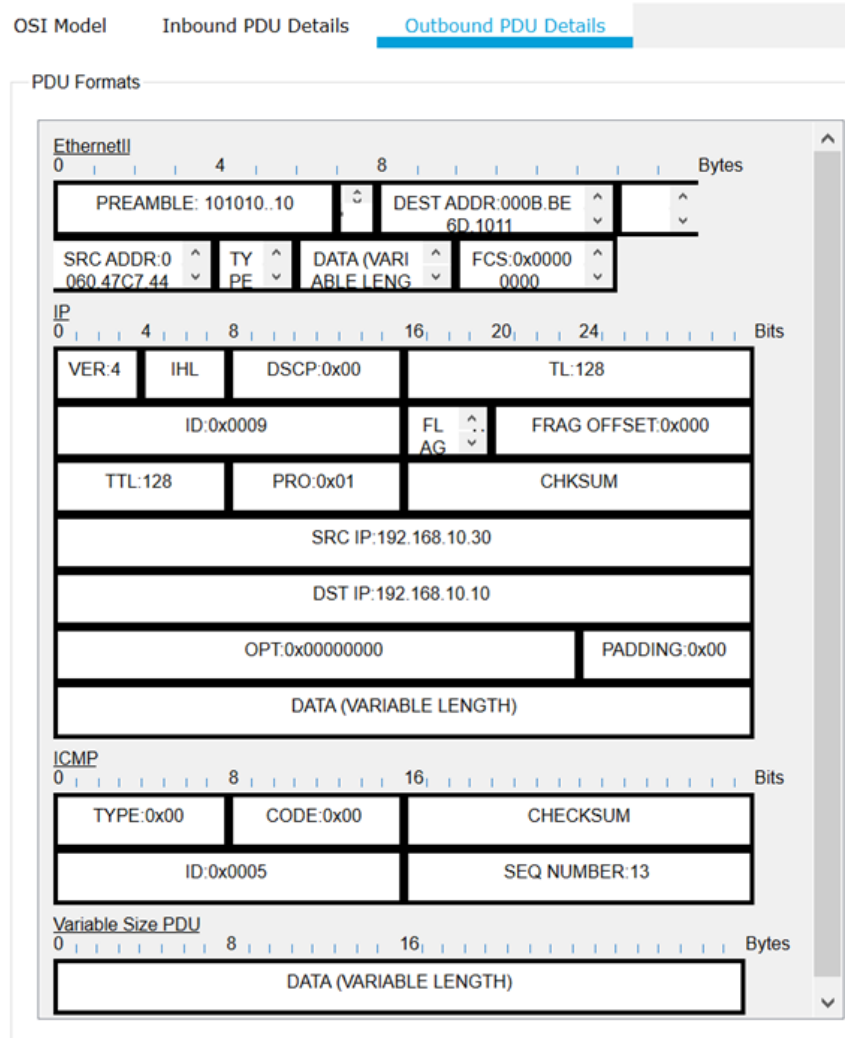
```
C:\>ping 192.168.10.40

Pinging 192.168.10.40 with 32 bytes of data:

Reply from 192.168.10.40: bytes=32 time=6ms TTL=128
Reply from 192.168.10.40: bytes=32 time=6ms TTL=128
Reply from 192.168.10.40: bytes=32 time=6ms TTL=128
Reply from 192.168.10.40: bytes=32 time=6ms TTL=128

Ping statistics for 192.168.10.40:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 6ms, Maximum = 6ms, Average = 6ms
```

抓包图：

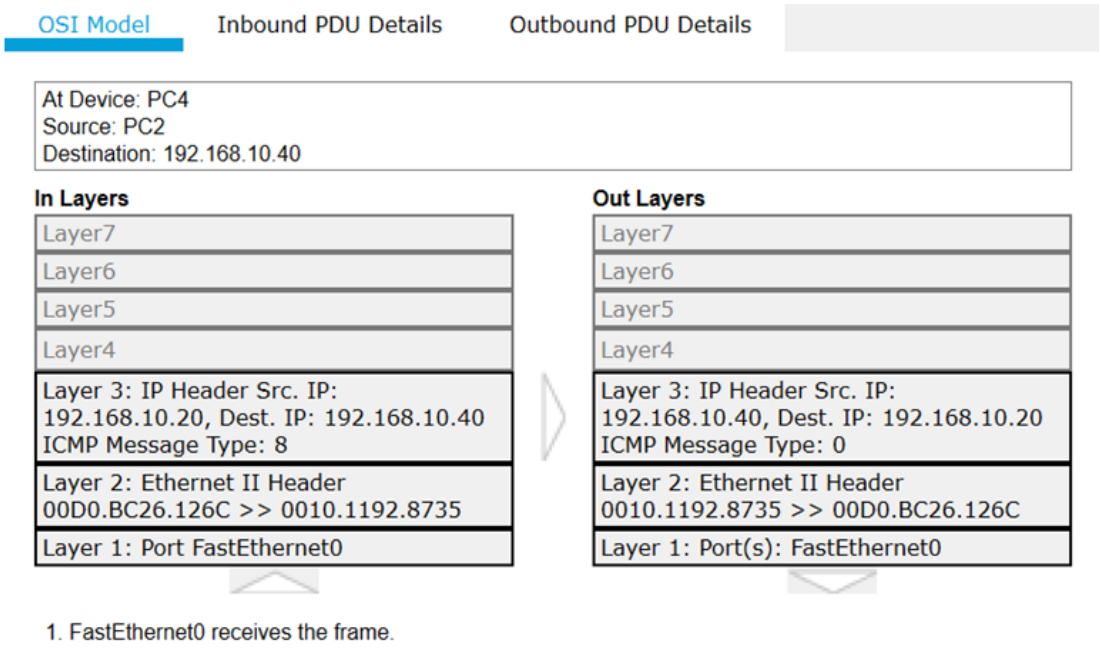
PC1 ping PC3：

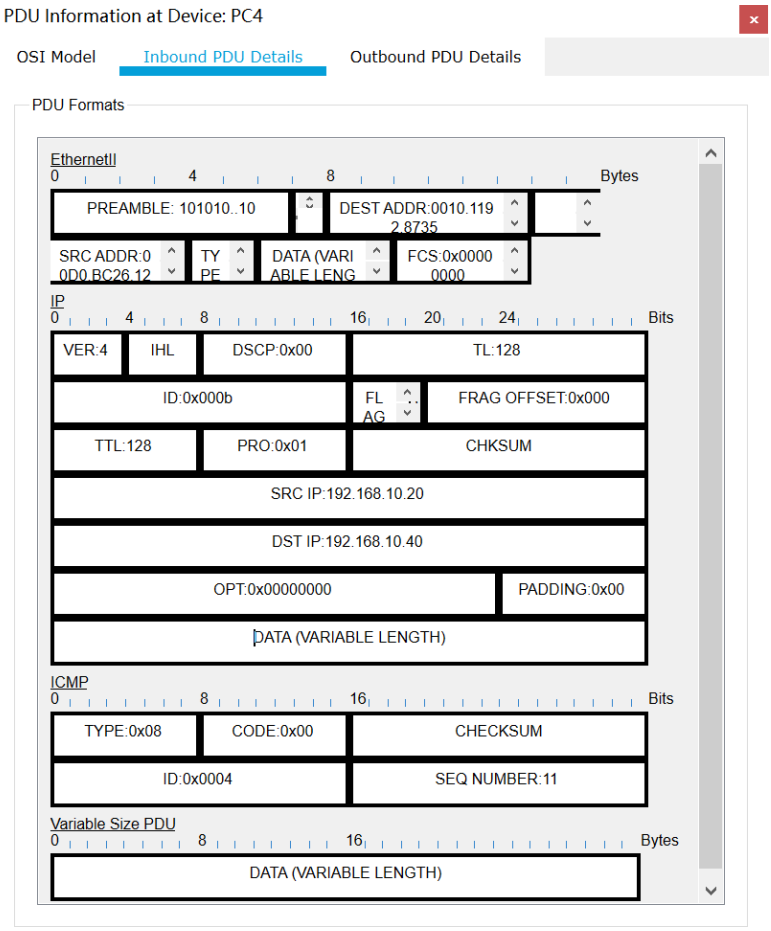


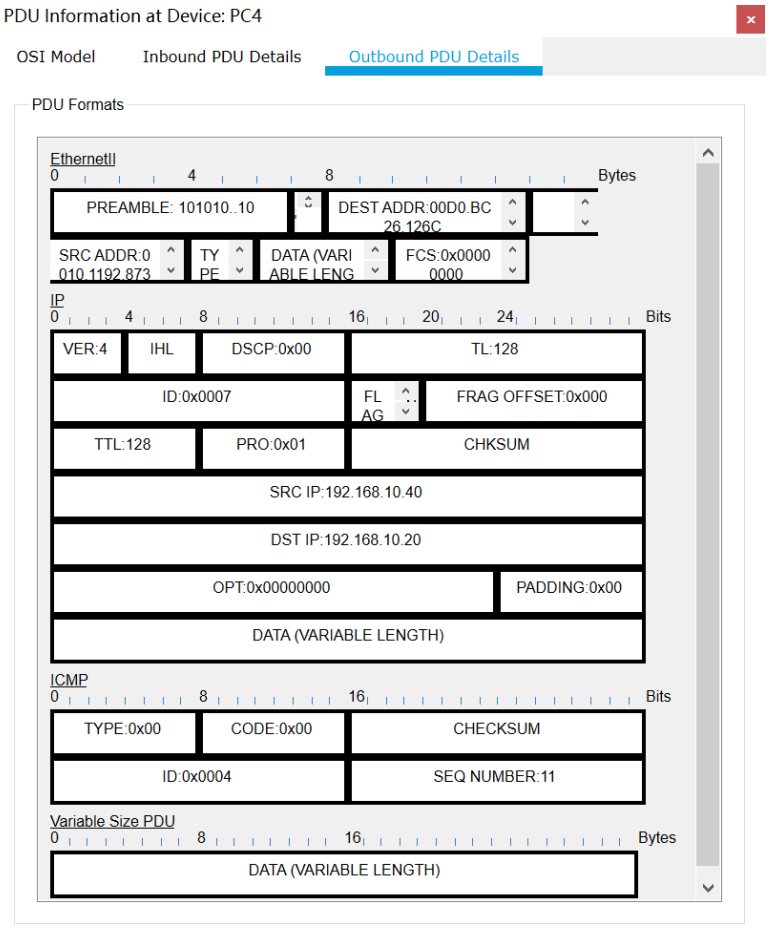



OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
EthernetII
0
4
8
Bytes
PREAMBLE: 101010..10
DEST ADDR:000B.BE6D.1011
SRC ADDR:0060.47C7.44
TYPE
DATA (VARIABLE LENG
FCS:0x00000000
IP
0
4
8
16
20
24
Bits
VER:4
IHL
DSCP:0x00
TL:128
ID:0x0009
FLAG
FRAG OFFSET:0x000
TTL:128
PRO:0x01
CHKSUM
SRC IP:192.168.10.30
DST IP:192.168.10.10
OPT:0x00000000
PADDING:0x00
DATA (VARIABLE LENGTH)
ICMP
0
8
16
Bits
TYPE:0x00
CODE:0x00
CHECKSUM
ID:0x0005
SEQ NUMBER:13
Variable Size PDU
0
8
16
Bytes
DATA (VARIABLE LENGTH)

PC2 ping PC4：


OSI Model
Inbound PDU Details
Outbound PDU Details
At Device: PC4
Source: PC2
Destination: 192.168.10.40
In Layers
Layer7
Layer6
Layer5
Layer4
Layer 3: IP Header Src. IP: 192.168.10.20, Dest. IP: 192.168.10.40 ICMP Message Type: 8
Layer 2: Ethernet II Header 00D0.BC26.126C >> 0010.1192.8735
Layer 1: Port FastEthernet0
Out Layers
Layer7
Layer6
Layer5
Layer4
Layer 3: IP Header Src. IP: 192.168.10.40, Dest. IP: 192.168.10.20 ICMP Message Type: 0
Layer 2: Ethernet II Header 0010.1192.8735 >> 00D0.BC26.126C
Layer 1: Port(s): FastEthernet0
1. FastEthernet0 receives the frame.


PDU Information at Device: PC4
OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
EthernetII
0 4 8 Bytes
PREAMBLE: 101010..10
DEST ADDR:0010.1192.8735
SRC ADDR:00D0.BC26.126C
TYPE
DATA (VARIABLE LENG
FCS:0x00000000
IP
0 4 8 16 20 24 Bits
VER:4
IHL
DSCP:0x00
TL:128
ID:0x000b
FLAG
FRAG OFFSET:0x000
TTL:128
PRO:0x01
CHKSUM
SRC IP:192.168.10.20
DST IP:192.168.10.40
OPT:0x00000000
PADDING:0x00
DATA (VARIABLE LENGTH)
ICMP
0 8 16 Bits
TYPE:0x08
CODE:0x00
CHECKSUM
ID:0x0004
SEQ NUMBER:11
Variable Size PDU
0 8 16 Bytes
DATA (VARIABLE LENGTH)


PDU Information at Device: PC4
OSI Model
Inbound PDU Details
Outbound PDU Details
PDU Formats
EthernetII
0 4 8 Bytes
PREAMBLE: 101010..10
DEST ADDR:00D0.BC26.126C
SRC ADDR:0010.1192.8735
TYPE
DATA (VARIABLE LENG
FCS:0x00000000
IP
0 4 8 16 20 24 Bits
VER:4
IHL
DSCP:0x00
TL:128
ID:0x0007
FLAG
FRAG OFFSET:0x000
TTL:128
PRO:0x01
CHKSUM
SRC IP:192.168.10.40
DST IP:192.168.10.20
OPT:0x00000000
PADDING:0x00
DATA (VARIABLE LENGTH)
ICMP
0 8 16 Bits
TYPE:0x00
CODE:0x00
CHECKSUM
ID:0x0004
SEQ NUMBER:11
Variable Size PDU
0 8 16 Bytes
DATA (VARIABLE LENGTH)

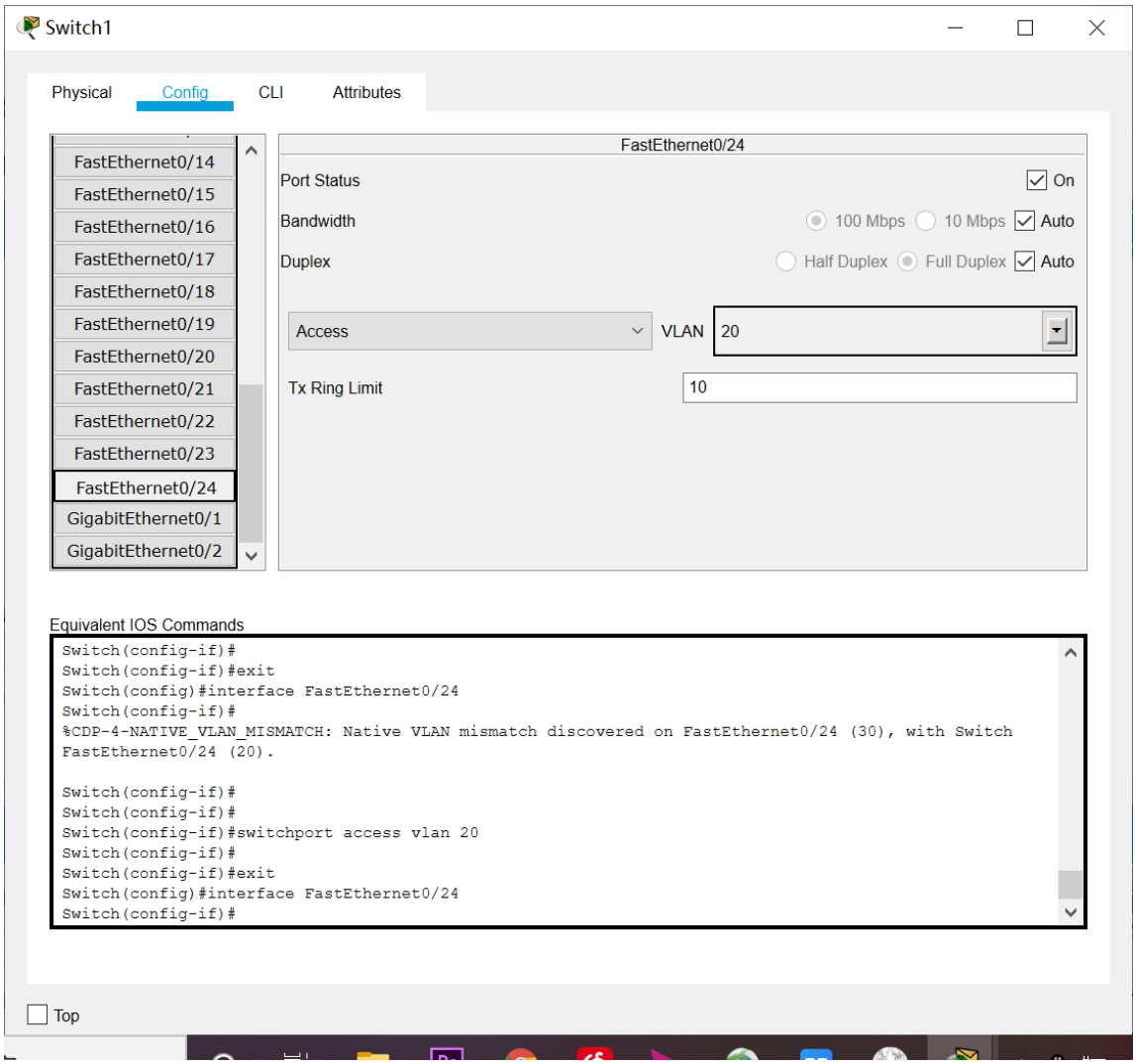
最后发现报文中并没有 VLAN ID，原因跟之前的实验一样，因为 PC 与交换机连接的是 access 端口，access 端口会在发包前将 TAG 删除。
解决方法：将端口改为其他不会删除 TAG 的端口（Hybrid）即可。

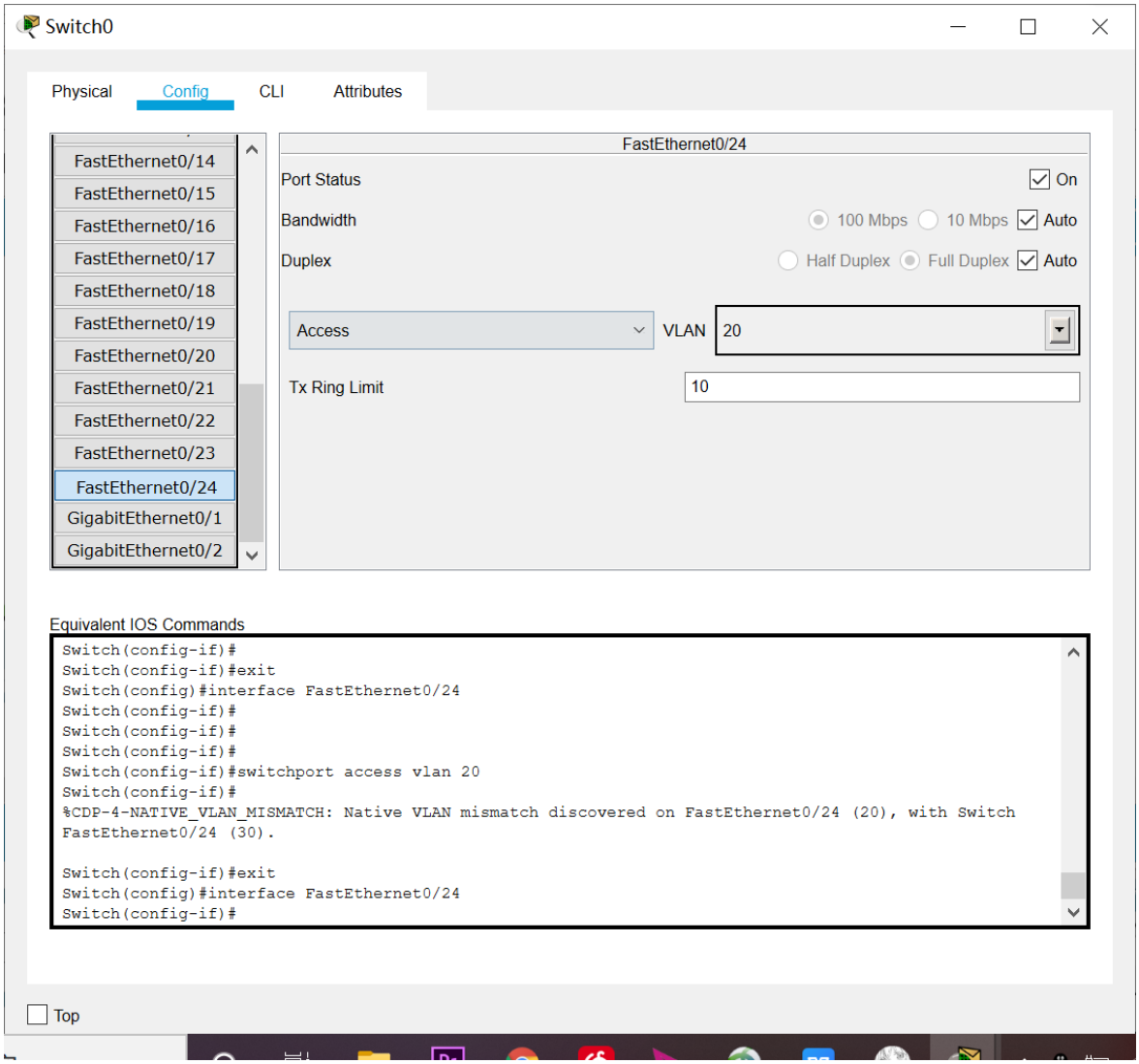
(3) 跨交换机实现 VLAN 通信时，思考不用 Trunk 模式且也能进行跨交换机 VLAN 通信的替代方法，并进行实验验证：

答：我们想到了两种方法：

1.在不用 Trunk 模式的情况下，我们可以考虑使用 Hybrid 模式来代替 Trunk 模式，这样也可以完成跨交换机 VLAN 通信。但是由于思科的仿真软件 packet tracer 中交换机没有 Hybrid 类型接口所以无法进行实验验证，只能从理论角度进行分析：Hybrid 与 Trunk 的功能相接近，同时 Hybrid 也可以用在 PC 与交换机的连接上，所以可以认为 Hybrid 可以替代 Trunk。

2.此外，我们还想到一个方法：将两个交换机相连的接口改为某局域网，比如实验 6-2 中将接口改为 vlan 20，此时 PC1 仍能够与 PC2 进行相连，而 PC0 仍无法与 PC1、PC2 相连。





PC2 ping PC3、PC1：

```
C:\>ping 192.168.10.30

Pinging 192.168.10.30 with 32 bytes of data:

Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time=1ms TTL=128
Reply from 192.168.10.30: bytes=32 time<1ms TTL=128
Reply from 192.168.10.30: bytes=32 time=1ms TTL=128

Ping statistics for 192.168.10.30:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>ping 192.168.10.10

Pinging 192.168.10.10 with 32 bytes of data:

Request timed out.
Request timed out.
Request timed out.
Request timed out.

Ping statistics for 192.168.10.10:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

计算机网络实验报告

姓名	学号	自评分
郑卓民	18342138	100
南樟	18342077	100

【交实验报告】

上传实验报告：aceralon@qq.com　　截止日期（不迟于）：1 周之内

上传包括两个文件：

（1）小组实验报告。上传文件名格式：小组号_跨交换机实现 VLAN.pdf （由组长负责上传）

例如: 文件名“10_跨交换机实现 VLAN.pdf”表示第 10 组的 Ftp 协议分析实验报告

（2）小组成员实验体会。每个同学单独交一份只填写了实验体会的实验报告。只需填写自己的学号和姓名。

文件名格式：小组号_学号_姓名_跨交换机实现 VLAN.pdf （由组员自行上传）

例如: 文件名“10_05373092_张三_跨交换机实现 VLAN.pdf”表示第 10 组的 Ftp 协议分析实验报告。

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