中国科学技术大学计算机学院

网络系统实验报告

实验一
交换机、虚拟局域网组网
(VLAN)技术与配置

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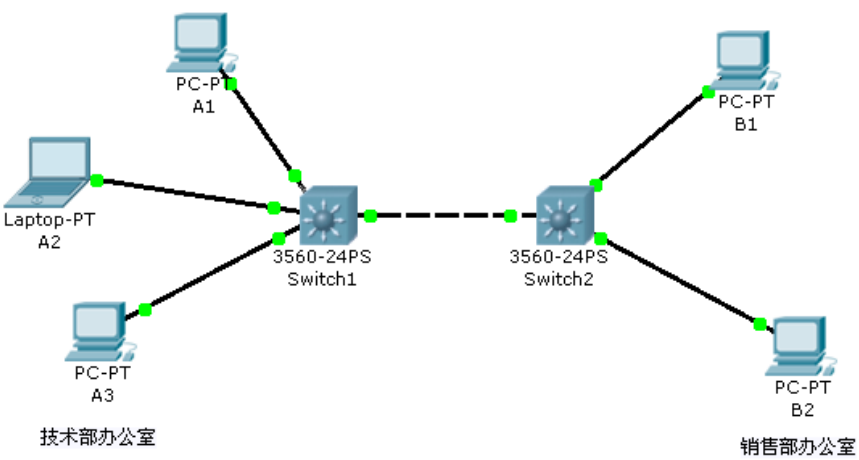
2021 年 3 月 18 日

一、 实验目的

- 了解 VLAN 交换机的特性与应用场合
- 掌握 VLAN 交换机组网的基本配置方法

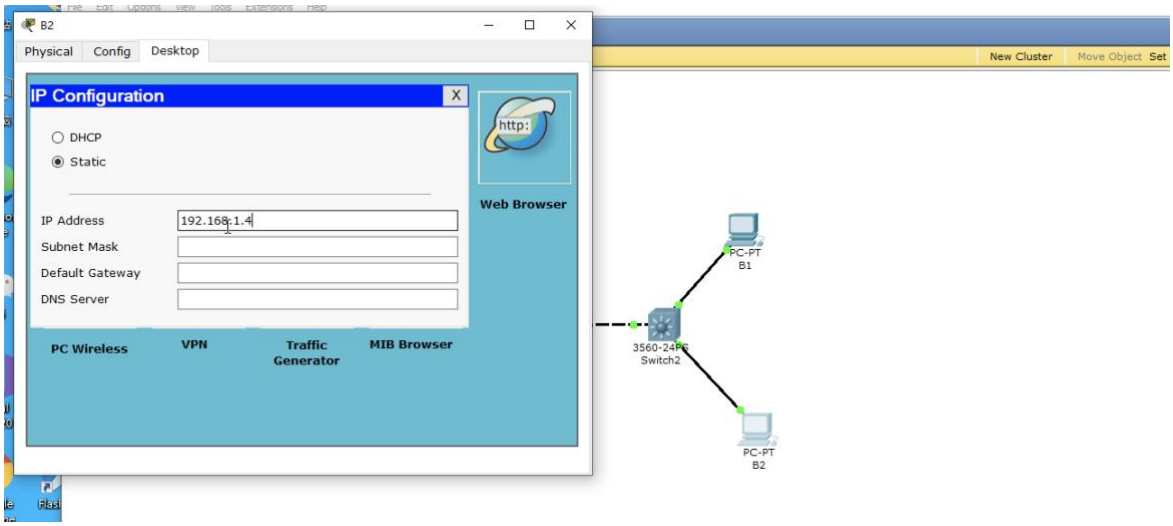
二、 实验环境

- 模拟软件 Cisco Packet Tracer 5.2
- 实验器材：3560 交换机 2 台，PC 机 5 台，连接线若干。
- 网络拓扑图如下：图中，A1、A2、A3 连接在 Switch1 上，B1、B2 连接在 Switch2 上。假定应用场景是 A1、A3 属于技术部，B1、B2、A2 属于销售部，要求同一部门的主机在同一个局域网上。



三、 实验过程

1. 依次放置终端和交换机后，配置 IP 地址和子网掩码。



2. 配置完主机 IP 地址，回答【问题 1】：每台主机相互 ping，查看哪些主机可以连通，哪些不可以？为什么？

使用任意一台主机对其他主机 ping，可以收到其他主机的数据，因此这五台主机都是连通的，这是因为这五台主机都在一个网络中。

```
PC>ping -n 1 255.255.255.255

Pinging 255.255.255.255 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=29ms TTL=128
Reply from 192.168.1.2: bytes=32 time=33ms TTL=128
Reply from 192.168.1.4: bytes=32 time=37ms TTL=128
Reply from 192.168.1.5: bytes=32 time=77ms TTL=128

PC>
```

3. 在交换机上配置 VLAN，配置信息和流程如下：

VLAN num	VLAN name	Switch port
2	tech	Switch1, port 2, 3
3	sales	Switch1, port1; Switch2, port2, 3

```
Switch(vlan)#vlan 2 name tech
VLAN 2 modified:
    Name: tech
Switch(vlan)#vlan 3 name sales
VLAN 3 modified:
    Name: sales
Switch(vlan)#exit
APPLY completed.
Exiting....
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface FastEthernet  0/1
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 2
Switch(config-if)#interface FastEthernet 0/2
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 3
Switch(config-if)#interface FastEthernet 0/3
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 2
Switch(config-if)#interface FastEthernet 0/11
Switch(config-if)#switchport mode trunk

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/11, changed state
to down
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/11, changed state
to up
Switch(config-if)#
```

- 在 Switch1 上用 show vlan 查看 vlan 信息如下：

```
Switch#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/4, Fa0/5, Fa0/6, Fa0/7
                                                Fa0/8, Fa0/9, Fa0/10, Fa0/12
                                                Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                                Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                                Gig0/1, Gig0/2
2    tech                             active    Fa0/1, Fa0/3
3    sales                            active    Fa0/2
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
2    enet  100002     1500  -      -      -        -    -        0      0
3    enet  100003     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
 --More--
```

- 在 Switch1 上用 show interfaces FastEthernet 0/1、0/2、0/11 switchport 查看端口信息如下：

```
Switch#show interfaces FastEthernet 0/1 switchport
Name: Fa0/1
Switchport: Enabled
Administrative Mode: static access
Operational Mode: static access
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: native
Negotiation of Trunking: Off
Access Mode VLAN: 2 (tech)
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
 --More--
```

```
Switch#show interfaces FastEthernet 0/2 switchport
Name: Fa0/2
Switchport: Enabled
Administrative Mode: static access
Operational Mode: static access
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: native
Negotiation of Trunking: Off
Access Mode VLAN: 3 (sales)
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
 --More--
```

```
Switch#show interfaces FastEthernet 0/11 switchport
Name: Fa0/11
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
 --More--
```

- 在 Switch2 上用 show vlan 查看 vlan 信息如下：

```
%SYS-5-CONFIG_I: Configured from console by console
Switch#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/3, Fa0/4, Fa0/5, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/12, Fa0/13, Fa0/14, Fa0/15
                                                Fa0/16, Fa0/17, Fa0/18, Fa0/19
                                                Fa0/20, Fa0/21, Fa0/22, Fa0/23
                                                Fa0/24, Gig0/1, Gig0/2
3    sales                            active    Fa0/1, Fa0/2
1002 fddi-default                     act/unsup
1003 token-ring-default               act/unsup
1004 fddinet-default                  act/unsup
1005 trnet-default                    act/unsup

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
3    enet  100003     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
 --More--
```

- 在 Switch2 上用 show interfaces FastEthernet 0/1、0/11 switchport 查看端口信息如下：

```
Switch#show interfaces FastEthernet 0/1 switchport
Name: Fa0/1
Switchport: Enabled
Administrative Mode: static access
Operational Mode: static access
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: native
Negotiation of Trunking: Off
Access Mode VLAN: 3 (sales)
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
 --More--
```

```
Switch#show interfaces FastEthernet 0/11 switchport
Name: Fa0/11
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
 --More--
```

- 在配置 VLAN 之后，回答【问题 2】：每台主机相互 ping，查看哪些主机可以连通，哪些可以？为什么？

答：主机 A1 只能接收到 A3 的数据，与其他主机不连通。A2，B1，B2 互相连通。原因是划分了 Vlan 后，A1 和 A3 同处于一个 vlan 网络中，而 A2，B1，B2 同处于另一个 vlan 网络中。

```
PC>ping -n 1 255.255.255.255

Pinging 255.255.255.255 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time=21ms TTL=128


PC>
```

4. DTP 的配置，其配置信息和流程如下：

- 将 Switch1 的 FastEthernet 0/11 接口的 Trunk 配置为：

```
Switch>enable
Switch#config
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface FastEthernet 0/11
Switch(config-if)#shutdown

%LINK-5-CHANGED: Interface FastEthernet0/11, changed state to administratively d
own
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/11, changed state
to down
Switch(config-if)#switchport mode dynamic desirable
Switch(config-if)#no shutdown

%LINK-5-CHANGED: Interface FastEthernet0/11, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/11, changed state
to up
Switch(config-if)#
```

- 将 Switch2 的 FastEthernet 0/11 接口的 Trunk 配置为 auto 模式：

```
Switch#config
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface FastEthernet 0/11
Switch(config-if)#shutdown

%LINK-5-CHANGED: Interface FastEthernet0/11, changed state to administratively d
own
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/11, changed state
to down
Switch(config-if)#switchport mode dynamic auto
Switch(config-if)#no shutdown

%LINK-5-CHANGED: Interface FastEthernet0/11, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/11, changed state
to up
Switch(config-if)#
```

- 在 Switch1 上用 show interfaces FastEthernet 0/11 switchport 查看端口信息如下：

```
%SYS-5-CONFIG_I: Configured from console by console
Switch#show interfaces FastEthernet 0/11 switchport
Name: Fa0/11
Switchport: Enabled
Administrative Mode: dynamic desirable
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
 --More--
```

- 在 Switch2 上用 show interfaces FastEthernet 0/11 switchport 查看端口信息如下：

```
%SYS-5-CONFIG_I: Configured from console by console
Switch#show interfaces FastEthernet 0/11 switchport
Name: Fa0/11
Switchport: Enabled
Administrative Mode: dynamic auto
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
 --More--
```

5. 按照课件中拓扑及端口配置，修改 Switch1 和 Switch2 的 FastEthernet 0/11 端口，考察 DTP 协议的运行规则，并通过实验回答以下问题：

- 将 Switch1 和 Switch2 都设置为 negotiate 模式，考察以下组合，哪些可以形成 Trunk？

	Switch2 trunk	**Switch2 dynamic desirable**	**Switch2 dynamic auto**
Switch1 trunk	可以	可以	可以
Switch1 dynamic desirable	可以	可以	可以
Switch1 dynamic auto	可以	可以	不可以

- 将 Switch1 设置为 nonegotiate 模式，Switch2 仍为 negotiate 模式，再考察以下组合，哪些可以形成 Trunk？

	Switch2 trunk	**Switch2 dynamic desirable**	**Switch2 dynamic auto**
Switch1 trunk	可以	可以	可以
Switch1 dynamic desirable	不可以	不可以	不可以
Switch1 dynamic auto	不可以	不可以	不可以

- 在配置时与两者都是 negotiate 模式时有什么区别？

答：两边都是 negotiate 模式下,只有两边都为 dynamicauto 时才不能形成 trunk,因为都在等待对方交换机主动和自己协商造成无限等待。一边是 negotiate 另一边是 nonegotiate 时，nonegotiate 的一方的接口模式只能为 trunk（或 access）,nonegotiate 的作用是启用 trunking 禁用 DTP,故可以和 trunk/dynamicdesiable/dynamic auto 形成 trunk.

- 考虑将 Switch1 设置为 nonegotiate 模式时，Switch1 还能否设置为 dynamic desirable dynamic auto 模式？

答：不能，输入指令后 switch 模式不变。