南 开 大 学

网络空间安全学院学院

网络技术与应用课程报告

第 1 次实验报告

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专业：密码科学与技术

2022 年 10 月 13 日

第 1 节 实验内容说明

1） 仿真环境下的共享式以太网组网

要求如下：（1）学习虚拟仿真软件的基本使用方法。（2）在仿真环境下进行单集线器共享式以太网组网，测试网络的连通性。（3）在仿真环境下进行多集线器共享式以太网组网，测试网络的连通性。（4）在仿真环境的“模拟”方式中观察数据包在共享式以太网中的传递过程，并进行分析。

2） 仿真环境下的交换式以太网组网和 VLAN 配置

要求如下：（1）在仿真环境下进行单交换机以太网组网，测试网络的连通性。（2）在仿真环境下利用终端方式对交换机进行配置。（3）在单台交换机中划分 VLAN，测试同一 VLAN 中主机的连通性和不同 VLAN 中主机的连通性，并对现象进行分析。（4）在仿真环境下组建多集线器、多交换机混合式网络。划分跨越交换机的 VLAN，测试同一 VLAN 中主机的连通性和不同 VLAN 中主机的连通性，并对现象进行分析。（5）在仿真环境的“模拟”方式中观察数据包在混合式以太网、虚拟局域网中的传递过程，并进行分析。（6）学习仿真环境提供的简化配置方式。

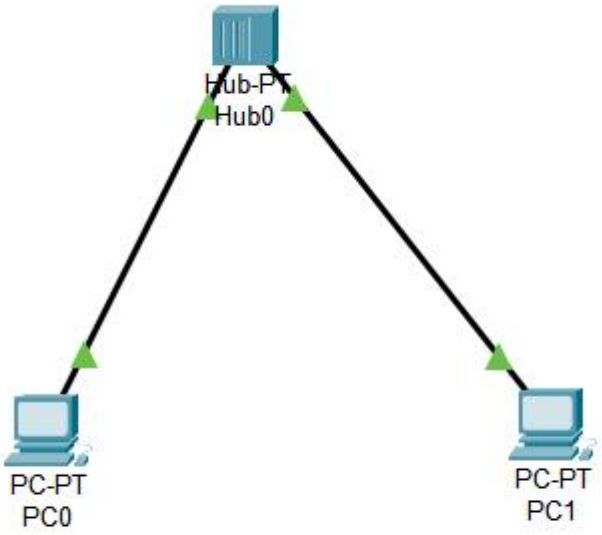
评分原则：

前期准备 25，实验过程 50，实验报告 25，总分 100。

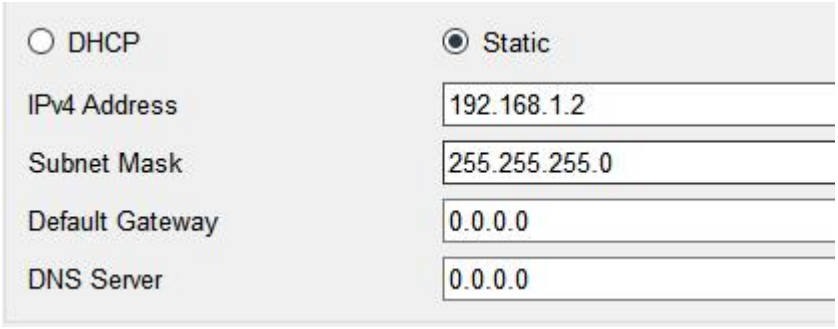
第 2 节 实验准备

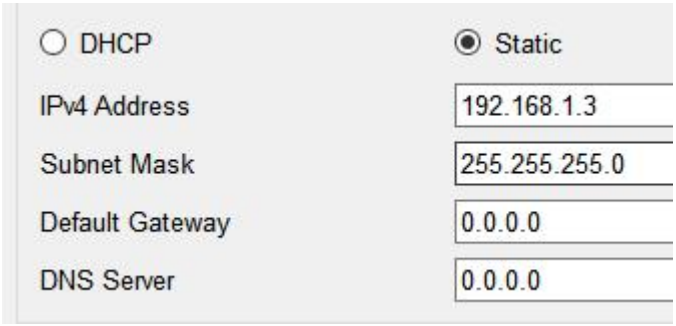
1.注册账号，安装软件。

2.添加集线器和 PC 端



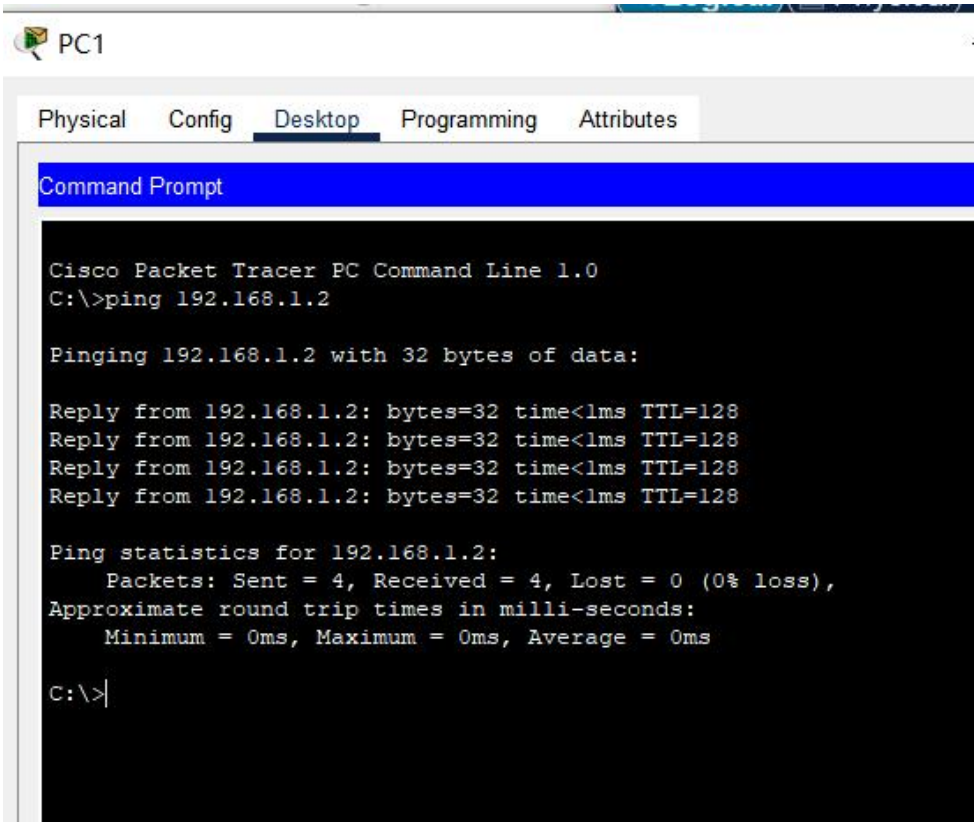
3.配置 PC 端 ip



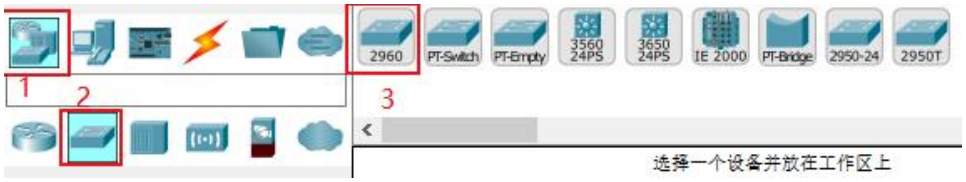


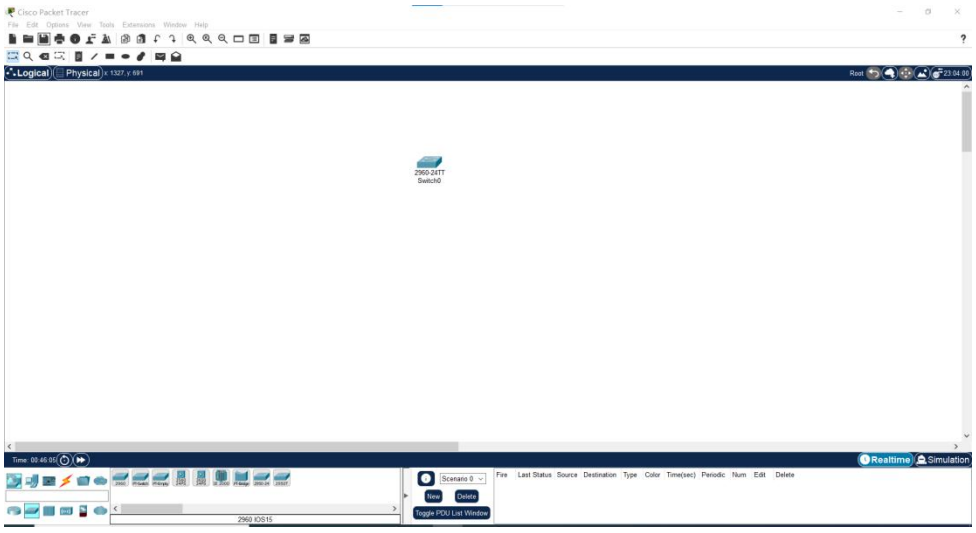
4.测试网络连通性

```
C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time=5ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 5ms, Average = 1ms

C:\>z
```

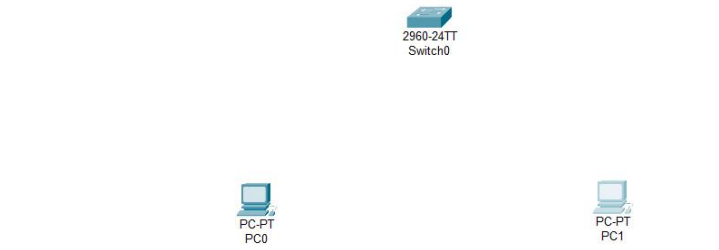


5.添加交换机

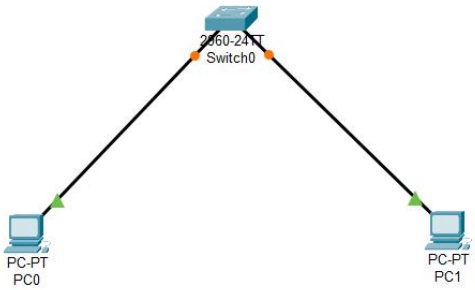




6.添加终端设备

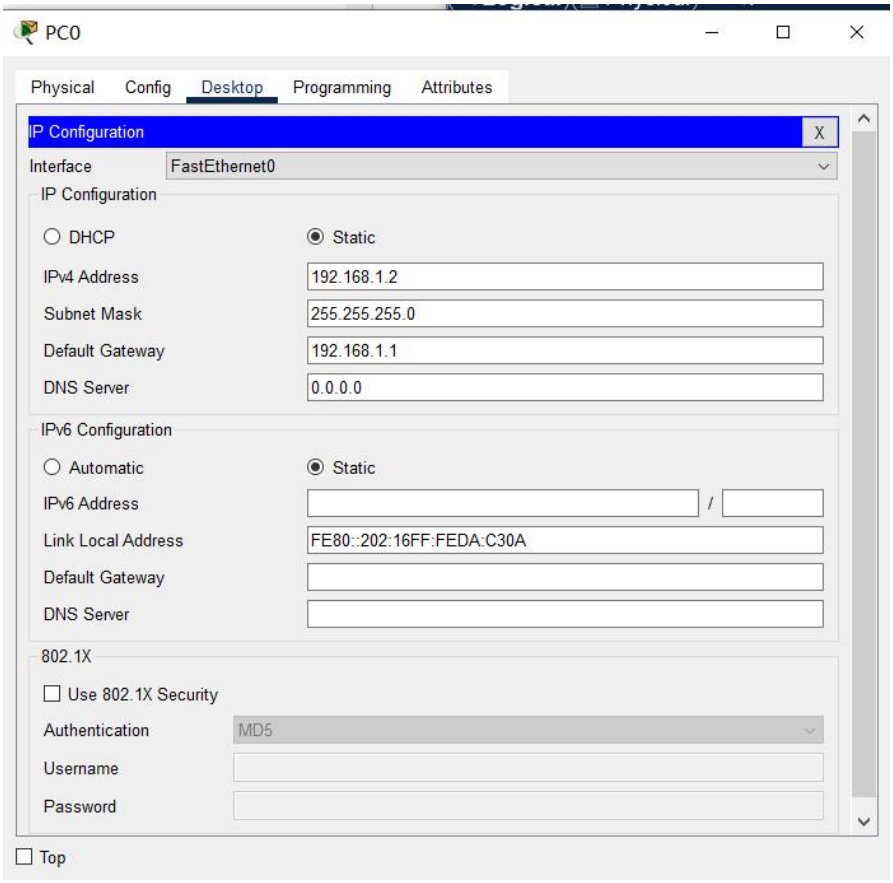


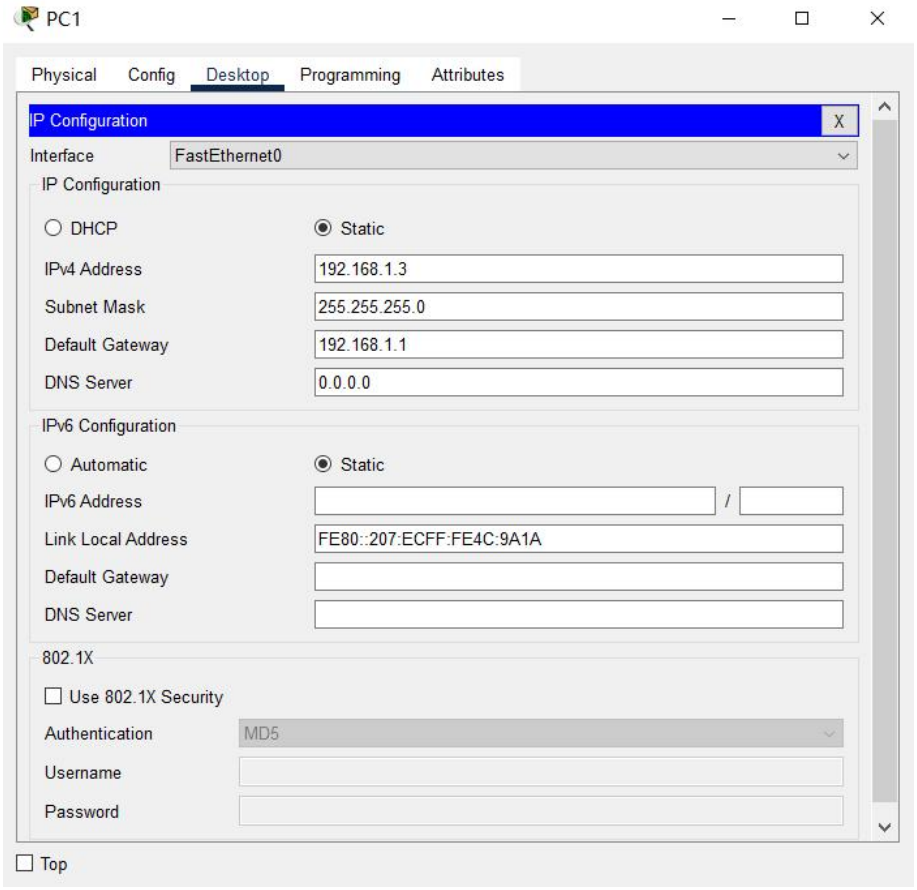
7.连接主机和 PC 端



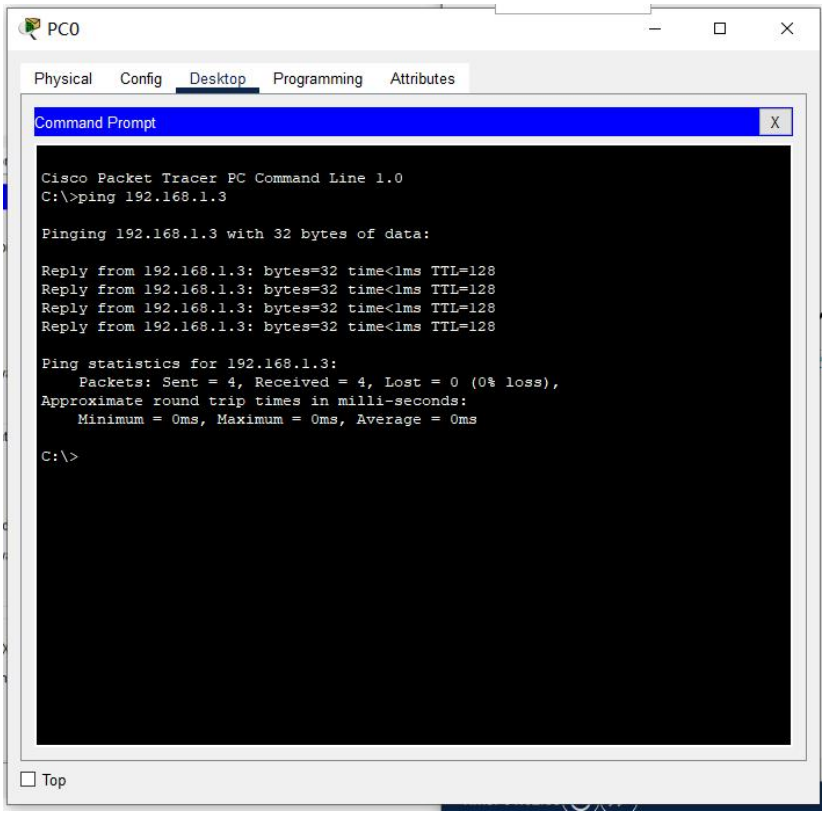
8.测试网络连通性

添加 PC0 和 PC1 的 ip 地址

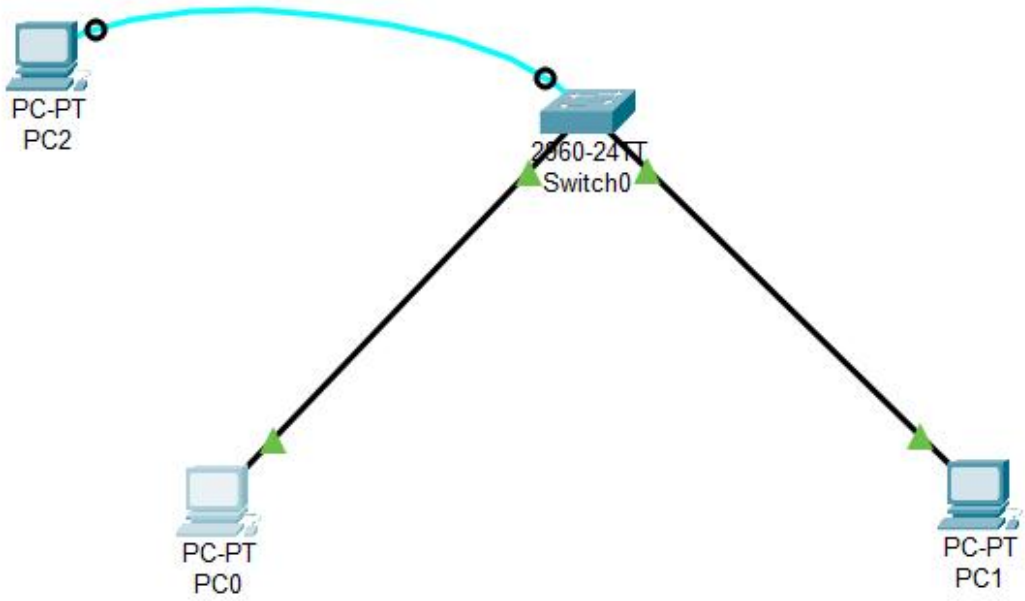



PC1
Physical
Config
Desktop
Programming
Attributes
IP Configuration
X
Interface
FastEthernet0
IP Configuration
DHCP
Static
IPv4 Address
192.168.1.3
Subnet Mask
255.255.255.0
Default Gateway
192.168.1.1
DNS Server
0.0.0.0
IPv6 Configuration
Automatic
Static
IPv6 Address
Link Local Address
FE80::207:ECFF:FE4C:9A1A
Default Gateway
DNS Server
802.1X
Use 802.1X Security
Authentication
MD5
Username
Password
Top

9.执行 ping 命令


PC0
Physical
Config
Desktop
Programming
Attributes
Command Prompt
X
Cisco Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.3
Pinging 192.168.1.3 with 32 bytes of data:
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Ping statistics for 192.168.1.3:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms
C:\>
Top

10.添加 pc 端，并用串行线连接



11.show mac-address-table

Ping 命令之后不是空表

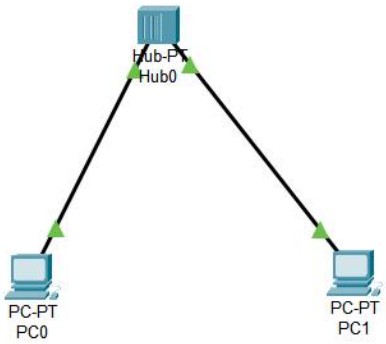
```
Switch>show mac-address-table
          Mac Address Table
-------------------------------------------

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

Switch>show mac-address-table
          Mac Address Table
-------------------------------------------

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

   1    0002.16da.c30a    DYNAMIC     Fa0/1
   1    0007.ec4c.9a1a    DYNAMIC     Fa0/2
```

第 3 节 实验过程

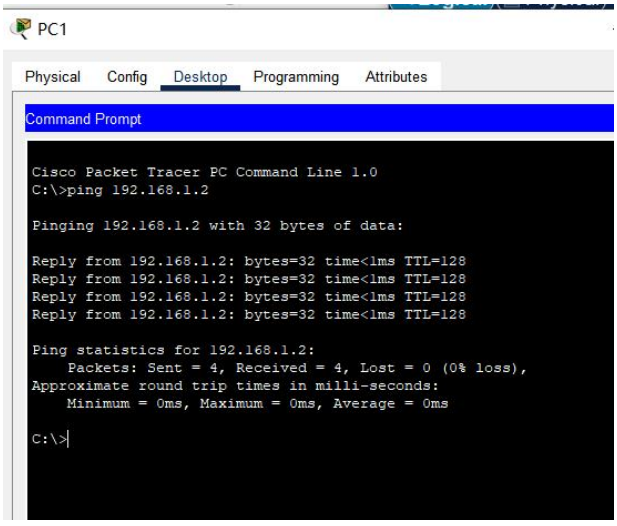
一、仿真环境下的共享式以太网组网

1.单集线器

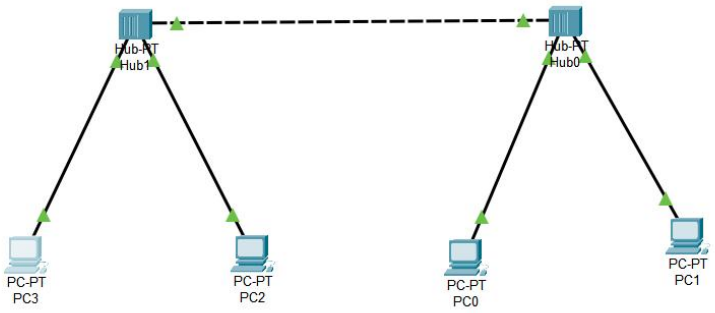
具体操作见前期准备部分。

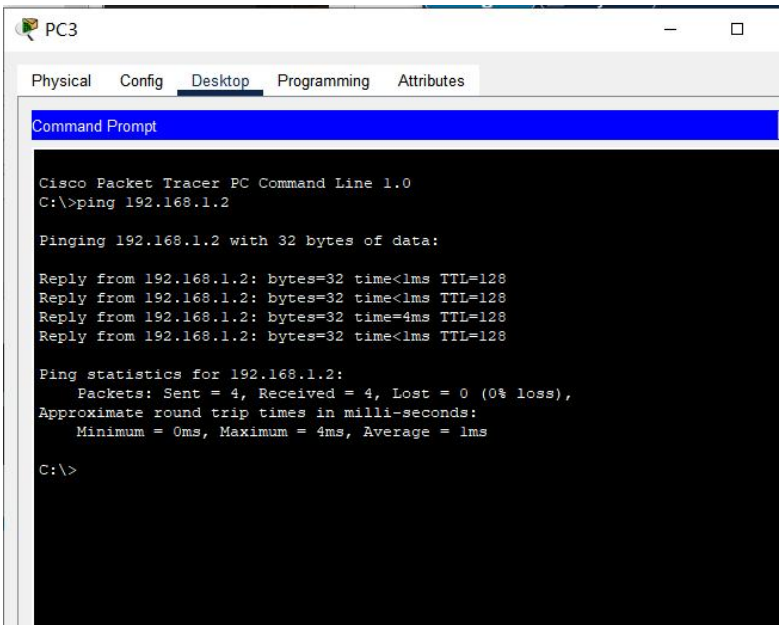



```
C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time=5ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 5ms, Average = 1ms

C:\>2
```

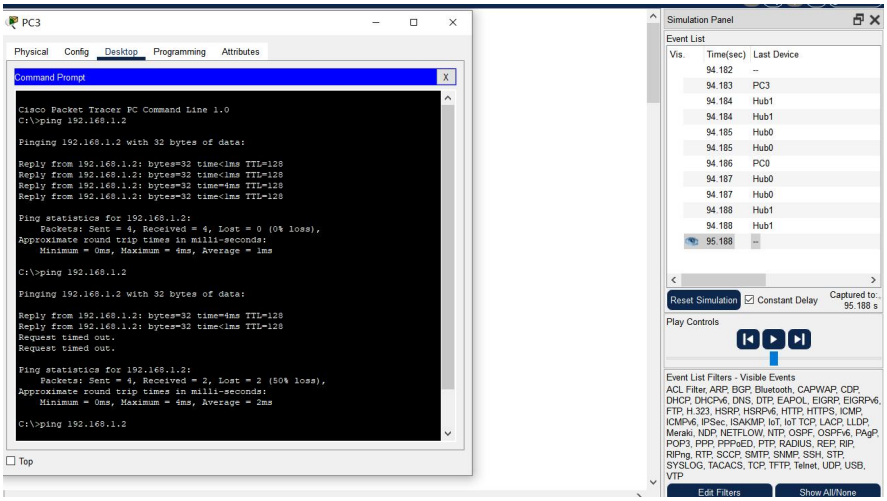


2. 多集线器共享式以太网组网





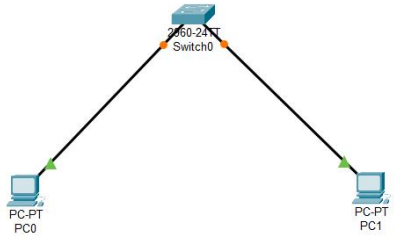
3. 数据包传递



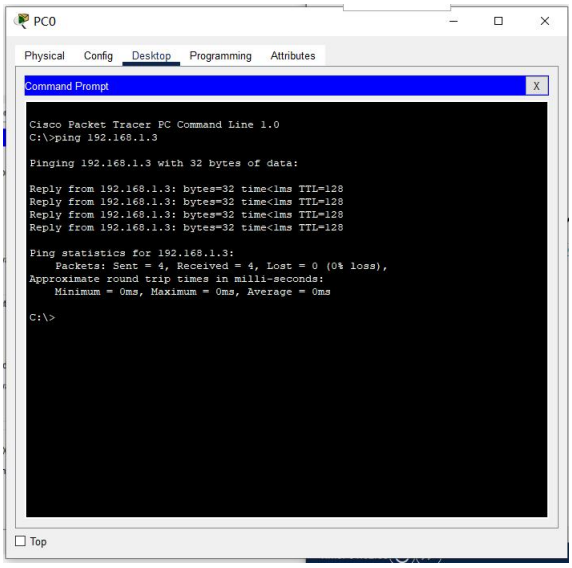
可以发现，数据包被广播给所有设备

二、 仿真环境下的交换式以太网组网和 VLAN 配置

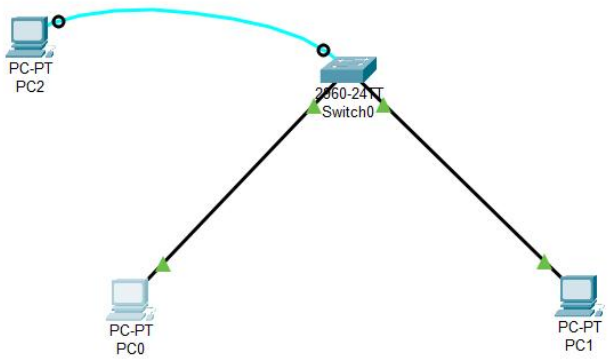
1. 单交换机



测试网络连通性



2.利用终端方式对交换机进行配置



2. show mac-address-table

Ping 命令之后不是空表

```
Switch>show mac-address-table
          Mac Address Table
-------------------------------------------

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

Switch>show mac-address-table
          Mac Address Table
-------------------------------------------

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

   1    0002.16da.c30a    DYNAMIC     Fa0/1
   1    0007.ec4c.9ala    DYNAMIC     Fa0/2
```

3. 利用终端方式对交换机进行配置

选择交换机——CLI——设置端口的传输速度

```
Switch>enable
Switch#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#interface fastEthernet 0/1
Switch(config-if)#speed ?
  10    Force 10 Mbps operation
  100   Force 100 Mbps operation
  auto  Enable AUTO speed configuration
Switch(config-if)#speed speed auto
                      ^
% Invalid input detected at '^' marker.

Switch(config-if)#speed auto
```

4. 单台交换机中划分 VLAN

```
Switch(config-if)#exit
Switch(config)#vlan 2
Switch(config-vlan)#eit
                    ^
% Invalid input detected at '^' marker.

Switch(config-vlan)#exit
Switch(config)#interface fa0/3
Switch(config-if)#switchport access vlan 2
Switch(config-if)#exit
Switch(config)#interface fa0/4
Switch(config-if)#switchport access vlan 2
Switch(config-if)#exit
Switch(config)#exit
```

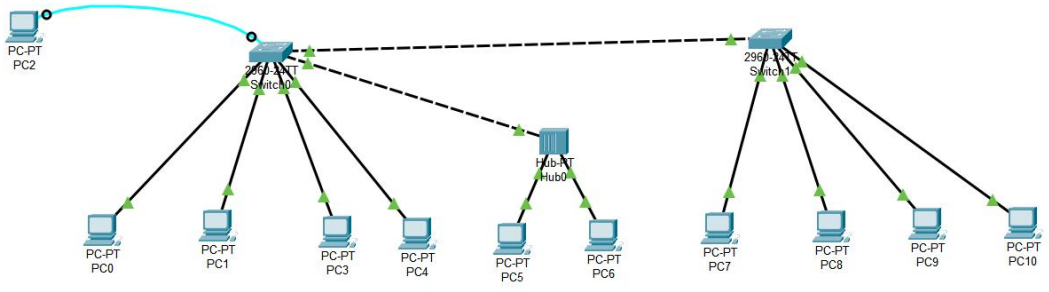
```
VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/1, Fa0/2, Fa0/5, Fa0/6
                                                 Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                 Fa0/11, 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    VLAN0002                          active    Fa0/3, Fa0/4
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
2    enet  100002     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
```

此时 PC0 可以 ping 通 PC1，但无法 ping 通 PC3，因为不在一个 VLAN 下

```
C:\>ping 192.168.1.3

Pinging 192.168.1.3 with 32 bytes of data:

Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128
Reply from 192.168.1.3: bytes=32 time<1ms TTL=128

Ping statistics for 192.168.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 192.168.1.4

Pinging 192.168.1.4 with 32 bytes of data:

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

Ping statistics for 192.168.1.4:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),

C:\>
```

5. 组建多集线器、多交换机混合式网络

拓扑图



Switch0

```
Switch#en
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 2
Switch(config-vlan)#exit
Switch(config)#interface fa0/3
Switch(config-if)#switchport access vlan 2
Switch(config-if)#exit
Switch(config)#vlan 3
Switch(config-vlan)#exit
Switch(config)#interface fa0/4
Switch(config-if)#switchport access vlan 3
Switch(config-if)#exit
Switch(config)#exit
Switch#
%SYS-5-CONFIG_I: Configured from console by console
```

```
Switch#show vlan

VLAN Name                             Status    Ports
---- -------------------------------- --------- -------------------------------
1    default                          active    Fa0/1, Fa0/2, Fa0/5, Fa0/6
                                                Fa0/7, Fa0/8, Fa0/9, Fa0/10
                                                Fa0/11, 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    VLAN0002                         active    Fa0/3
3    VLAN0003                         active    Fa0/4
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
2    enet  100002     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
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------

Remote SPAN VLANs
------------------------------------------------------------------------------

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
Switch#
```

Switch1

```
Switch>en
Switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Switch(config)#vlan 2
Switch(config-vlan)#exit
Switch(config)#interface fa0/2
Switch(config-if)#switchport access vlan 2
Switch(config-if)#exit
Switch(config)#interface fa0/3
Switch(config-if)#switchport access vlan 2
Switch(config-if)#exit
Switch(config)#vlan 3
Switch(config-vlan)#exit
Switch(config)#interface fa0/4
Switch(config-if)#switchport access vlan 3
Switch(config-if)#exit
Switch(config)#exit
Switch#
```

```
Switch#show vlan

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/1, Fa0/5, Fa0/6, Fa0/7
                                                 Fa0/8, Fa0/9, Fa0/10, Fa0/11
                                                 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    VLAN0002                          active    Fa0/2, Fa0/3
3    VLAN0003                          active    Fa0/4
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
2    enet  100002     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
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------

Remote SPAN VLANs
------------------------------------------------------------------------------

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
Switch#
```

网络连通性

此时，PC0、PC1、PC7 都在 VLAN1 中，可以互 ping，可以和 PC5、PC6 互 ping，其余 PC 端不在 VLAN1 或不连接在集线器中，无法互 ping；同时 PC3 无法和 PC5 互 ping。这是由于 hub0 也在 VLAN1 中，所以 PC5 和 PC6 都在 VLAN1 中，而 PC3 在 VLAN2 中。

可以得到结论：在同一 VLAN 域中的 PC 端可以连通。

6. 数据包在混合式以太网、虚拟局域网中的传递过程。

Vis.	Time(sec)	Last Device	At Device	Type
	0.000	--	PC1	ICMP
	0.001	PC1	Switch0	ICMP
	0.002	Switch0	PC0	ICMP
	0.003	PC0	Switch0	ICMP
	0.004	Switch0	PC1	ICMP
	0.231	--	Switch1	STP
	0.232	Switch1	PC7	STP
	0.232	Switch1	Switch0	STP
	0.233	Switch0	PC0	STP
	0.233	Switch0	PC1	STP
	0.233	Switch0	Hub0	STP
	0.234	Hub0	PC5	STP
	0.234	Hub0	PC6	STP
	0.235	--	Switch0	STP
	0.236	Switch0	PC3	STP
	0.239	--	Switch1	STP
	0.240	Switch1	PC8	STP
	0.240	Switch1	PC9	STP
	0.241	--	Switch0	STP

图为 PC1pingPC0 的过程

PC1 开始产生数据包 ICMP，并将 ICMP 数据包发送给交换机，交换机直接将 ICMP 数据

包发给主机 PC0，主机 PC0 收到后又将 ICMP 发送给交换机，并由交换机发送给 PC1。

然后 Switch1 产生一个 STP 包，这个包会被广播到和交换机相连的所有端口。完成这个包的传输后，PC1 继续发送 ICMP 包。

0.242	Switch0	PC4	STP
1.007	--	PC1	ICMP
1.008	PC1	Switch0	ICMP
1.009	Switch0	PC0	ICMP
1.010	PC0	Switch0	ICMP
1.011	Switch0	PC1	ICMP
1.251	--	Switch0	DTP
1.252	Switch0	PC1	DTP
1.998	--	Switch1	STP
1.999	Switch1	PC10	STP
2.011	--	PC1	ICMP
2.012	PC1	Switch0	ICMP
2.013	Switch0	PC0	ICMP
2.014	PC0	Switch0	ICMP

观察发现 ICMP 包只会经过发送设备、接收设备和交换机，而 STP 包被发送给所有终端。