
廈門大學



软件学院

《计算机网络》实验报告

题 目 CISCO IOS 路由器基本配置

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1 实验目的

通过学习 Cisco IOS 的预备知识，对 IOS 配置环境有一个初步的认识，了解交换机、路由器的基本结构，理解交换机、路由器在网络中所起的作用；掌握静态路由的配置、动态路由的配置、交换机端口的 VLAN（虚拟局域网）的配置，为走向工作岗位奠定基础。

2 实验环境


操作系统: Windows10 21H2

实验软件: Router eSIM v1.1 模拟器、CCNA Network Visualizer 6.0

3 实验结果

实验项-2: Router eSIM v1.1 模拟器中, 查看某台路由器的路由表


①将 ABCDE 五个路由器全部连通，并选择查看 A 路由器



Cisco Networking Academy Program

Router eSIM™

Student Version 1.1



Router eSIM™
Student Version 1.1

A The eSIMStudent Version will allow you to practice many of the labs in the Cisco Networking Academy Program on a single computer without having to be connected to a router.

B

C


D

E

While it does not support all of the commands, it does support a majority of those you will need to use in semesters one and two of the academy program.

Use the A, B, C, D, and E buttons to the left to access the routers.

Refer to the topology when needed, by clicking on the Show Topology button below.


☒ Hide Done

Checking Your Configuration

This activity is completed!

Please click on one of the buttons below to **check** that Router's Configuration:

A

B

C

D

E

Please click on one of the buttons below to **set** that Router's Configuration:

A

B

C


D

E


Loads all router variables for this eSIM™ scenario except the IP host table, which means, for example, that you will not be able to use the router name as part of ping or telnet commands.

Lab_A	Completed
Hostname	Done
Enable Secret	Done
Line Console Login	Done
Line Console Password	Done
Line vty Login	Done
Line vty Password	Done
E0 IP	Done
E0 Shutdown	Done
E1 IP	Done
E1 Shutdown	Done
S0 IP	Done
S0 Clock Rate	Done
S0 Shutdown	Done
Routing Protocol	Done
Network 1	Done
Network 2	Done
Network 3	Done
IP Host Lab_A	Done
IP Host Lab_B	Done
IP Host Lab_C	Done
IP Host Lab_D	Done
IP Host Lab_E	Done


Time elapsed
01:50



EXIT



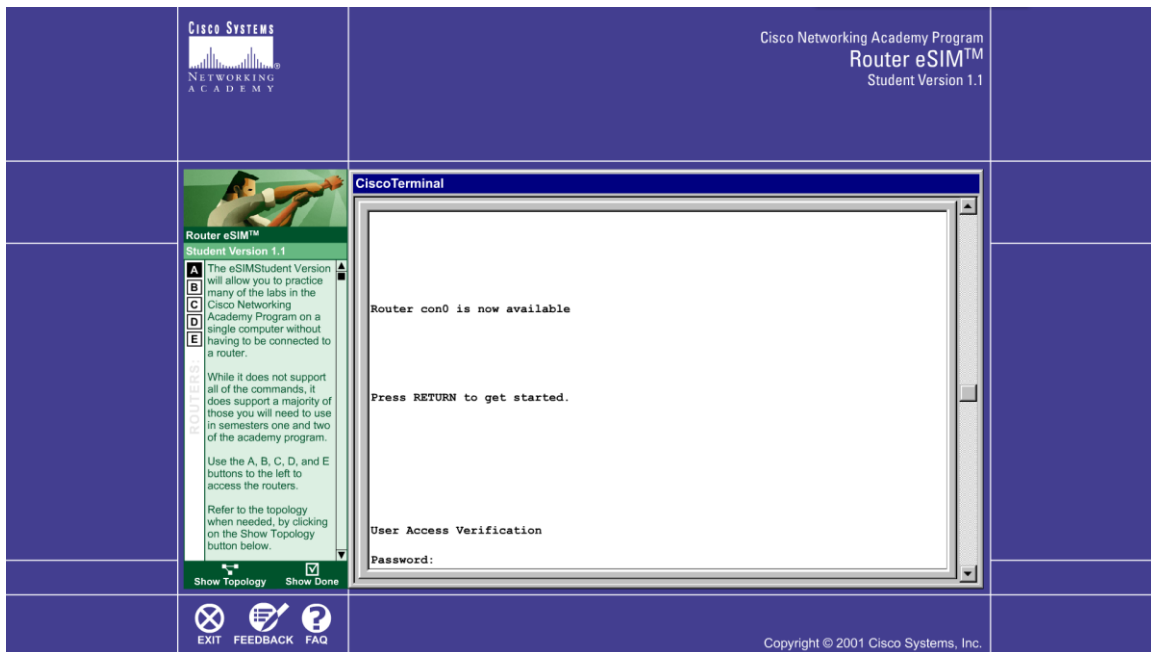
FEEDBACK



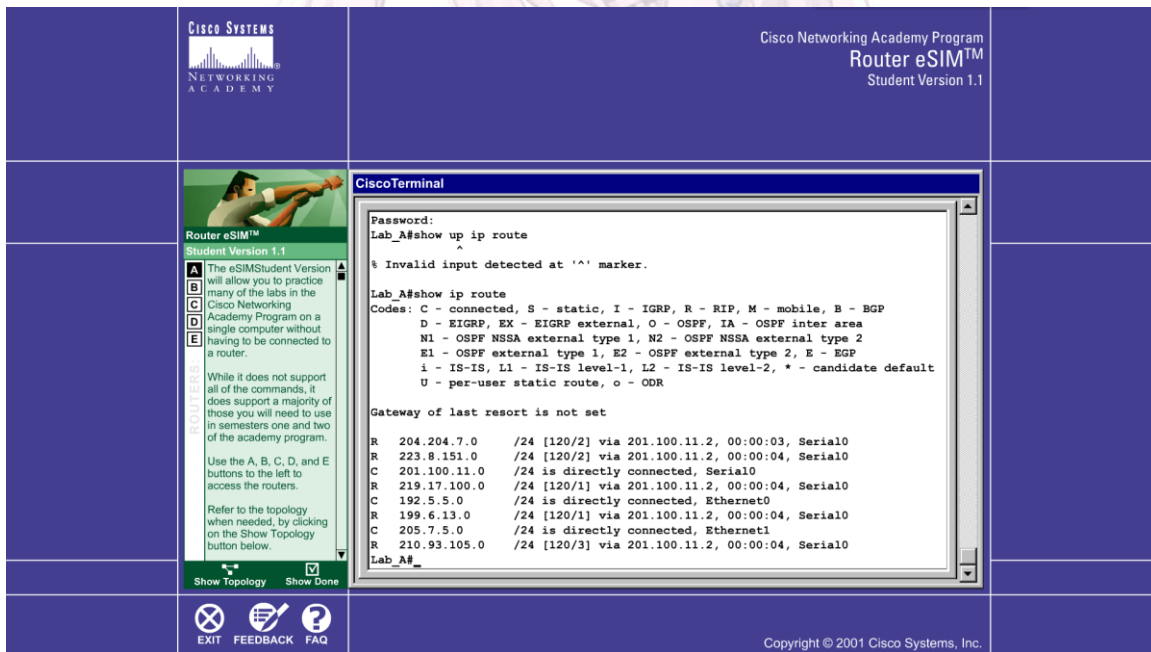
FAQ

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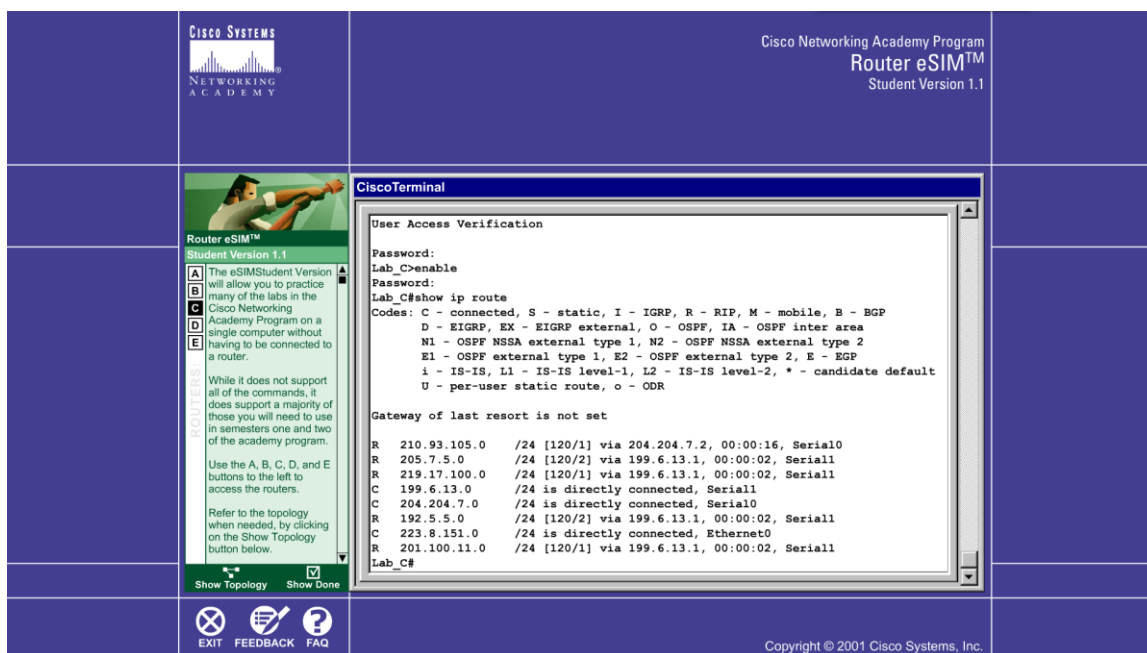
②回到主界面，选择查看 A 路由器



③输入两个密码：cisco，class，再 show ip route 即可查看



④查看路由器 B、C、D、E 的路由表同理，选择路由器 C，输入两个密码：cisco，class，再 show ip route 即可查看



⑤解答：Are passwords required to access the simulated routers of the Router eSIM™ Student Version?

答：当路由协议配置完成后，需要密码。

实验项-1：思考题：同一交换机下的两台主机，处于不同子网的主机能否直接进行通信？为什么？

答：不能。

在同一个交换机下，不同子网的主机无法直接进行通信，因为它们之间的网络地址不相同。交换机只是一个二层设备，它通过 MAC 地址来转发数据帧，而不关心 IP 地址或子网掩码。因此，如果两台主机位于不同的子网上，它们将无法直接相互通信。

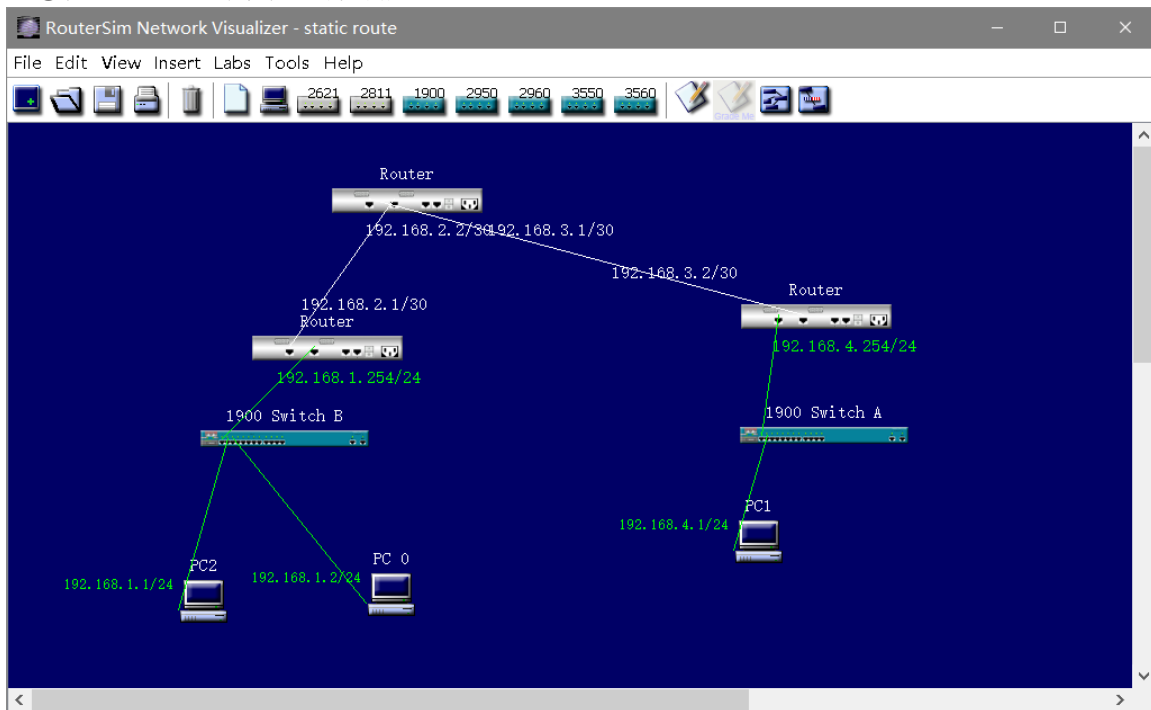
换句话说，如果在物理层进行通讯，用 MAC 地址互访能成功。但实际上应用程序不会只在第二层通讯，而是在 TCP/IP 层通讯。当电脑发现在不在同一网段时，就会将数据包用 MAC 地址发送到同一网段的网关进行路由了，而不是送到另一网段的其它机。这样，虽在同一交换机也不能直接通信了。

如果要想实现不同子网的主机之间的通信，需要在它们之间添加一个路由器来实现跨子网通信。路由器可以根据 IP 地址和子网掩码将数据包从一个子网转发到另一个子网，使得不同子网的主机可以互相通信。

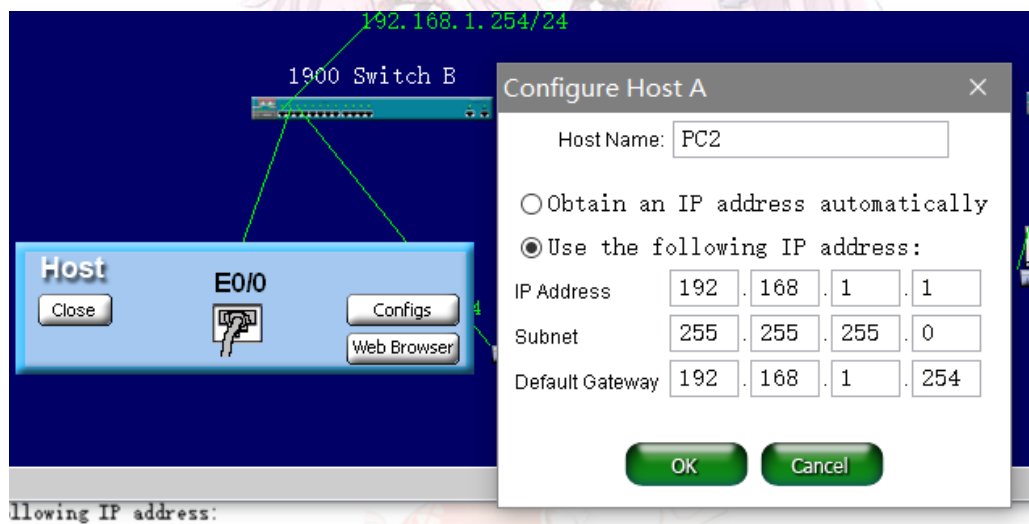
实验项 0：空白项

实验项 1：静态路由配置（CCNA Network Visualizer 6.0）

①配置过程：网络拓扑截图



配置 3 个主机的 IP、子网掩码和默认网关



Configure Host C

Host Name: PC1

☐ Obtain an IP address automatically

☒ Use the following IP address:

IP Address
192.168.4.1

Subnet
255.255.255.0

Default Gateway
192.168.4.254

OK Cancel

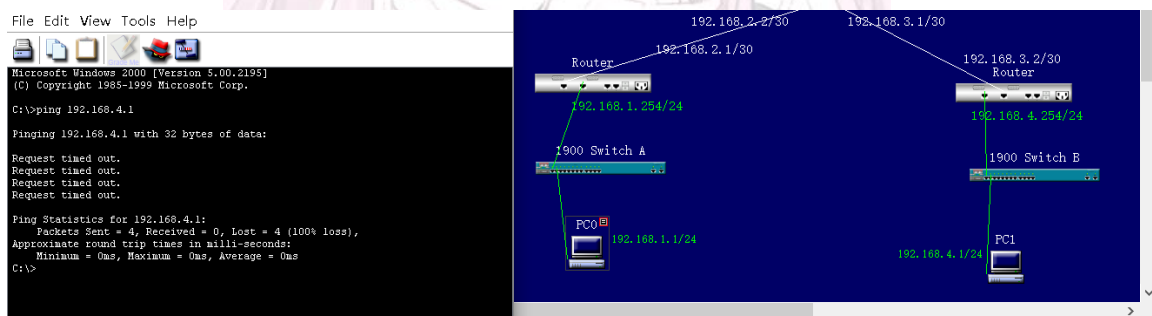
设置路由器 A

设置路由器连接的网 ip

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z
Router(config)#int f0/0
Router(config-if)#ip add 192.168.1.254 255.255.255.0
Router(config-if)#no shutdown
12:00:19 %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
12:00:19 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
```

```
Router(config-if)#int f0/1
Router(config-if)#ip add 192.168.2.1 255.255.255.252
Router(config-if)#no shutdown
12:00:58 %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up
12:00:58 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
```

添加路由表前，两台不同网络下的主机互相 Ping 不通



手动添加路由表内容

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z
Router(config)#ip route 192.168.4.0 255.255.255.252 192.168.2.2
Router(config)#ip route 192.168.3.0 255.255.255.252 192.168.2.2

Router#wr
Building configuration...
[OK]
Router#
```

设置路由器 B


```

Router(config)#int f0/0
Router(config-if)#ip add 192.168.2.2 255.255.255.252
Router(config-if)#no shutdown
Router(config-if)#int f0/1
Router(config-if)#ip add 192.168.3.1 255.255.255.252
Router(config-if)#no sh
12:24:49 %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up
12:24:49 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Router(config-if)#end
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z
Router(config)#ip route 192.168.1.0 255.255.255.0 192.168.2.1
Router(config)#ip route 192.168.4.0 255.255.255.0 192.168.3.2

```

设置路由器 C

```

Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z
Router(config)#int f0/0
Router(config-if)#ip add 192.168.3.2 255.255.255.252
Router(config-if)#no sh
12:34:14 %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
12:34:14 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#no shutdown
Router(config-if)#int f0/1
Router(config-if)#ip add 192.168.4.254 255.255.255.0
Router(config-if)#no shutdown
12:35:32 %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up
12:35:32 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Router(config-if)#end
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z
Router(config)#ip route 192.168.1.0 255.255.255.0 192.168.3.1
Router(config)#ip route 192.168.2.0 255.255.255.0 192.168.3.1
Router(config)#
Router#wr
Building configuration...
[OK]
Router#

```

打印路由表内容:

A 的路由表



Press RETURN to get started!

```

Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
        U - per-user static route, o - ODR, P - periodic downloaded static route
        T - traffic engineered route

Gateway of last resort is not set

    192.168.2.0/30 is subnetted, 1 subnets
C       192.168.2.0 is directly connected, FastEthernet0/1
    192.168.4.0/30 is subnetted, 1 subnets
S       192.168.4.0 [1/0] via 192.168.2.2
C       192.168.1.0/24 is directly connected, FastEthernet0/0
Router#

```

B 的路由表

```
Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR, P - periodic downloaded static route
       T - traffic engineered route

Gateway of last resort is not set

    192.168.3.0/30 is subnetted, 1 subnets
C       192.168.3.0 is directly connected, FastEthernet0/1
    192.168.2.0/30 is subnetted, 1 subnets
C       192.168.2.0 is directly connected, FastEthernet0/0
S       192.168.4.0 [1/0] via 192.168.3.2
S       192.168.1.0 [1/0] via 192.168.2.1
Router#
```

C 的路由表

```
Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR, P - periodic downloaded static route
       T - traffic engineered route

Gateway of last resort is not set

    192.168.3.0/30 is subnetted, 1 subnets
C       192.168.3.0 is directly connected, FastEthernet0/0
S       192.168.2.0 [1/0] via 192.168.3.1
C       192.168.4.0/24 is directly connected, FastEthernet0/1
S       192.168.1.0 [1/0] via 192.168.3.1
Router#
```

主机 A ping 主机 B

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富力

Console for PC2

RouterSim Network Visualizer - static route

File Edit View Tools Help

Microsoft Windows [Version 5.00.2195]
(C) Copyright 1985-1999 Microsoft Corp.

C:\>ping 192.168.4.1

Pinging 192.168.4.1 with 32 bytes of data:

Reply from 192.168.4.1: bytes=32 time=22ms TTL=254

Reply from 192.168.4.1: bytes=32 time=22ms TTL=254

Reply from 192.168.4.1: bytes=32 time=22ms TTL=254

Reply from 192.168.4.1: bytes=32 time=22ms TTL=254

Ping Statistics for 192.168.4.1:

Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),

Approximate round trip times in milliseconds:

Minimum = 22ms, Maximum = 23ms, Average = 22ms

C:\>

File Edit View Insert Labs Tools Help

Router

192.168.2.2/30-192.168.3.1/30

Router

192.168.2.1/30

192.168.1.254/24

1900 Switch B

1900 Switch A

PC1

192.168.1.1/24

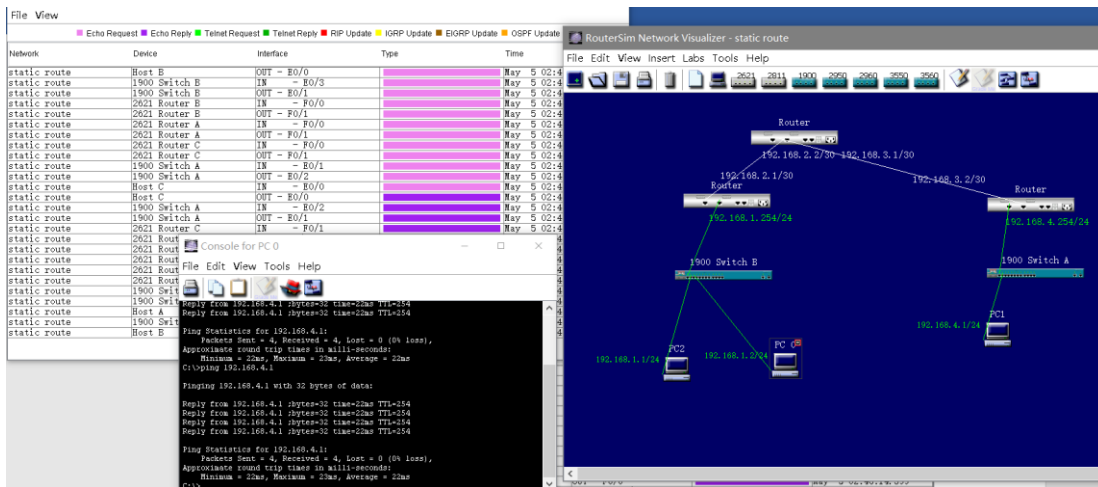
192.168.1.2/24

PC 0

192.168.4.254/24

主机 A ping 主机 B

②添加某一个主机，修改路由配置，使得该主机与其它主机能相互 ping 通
(添加了 PC0，配置好后)



③分析 ping 过程中，数据包在通信网络里的走向，解释为什么。

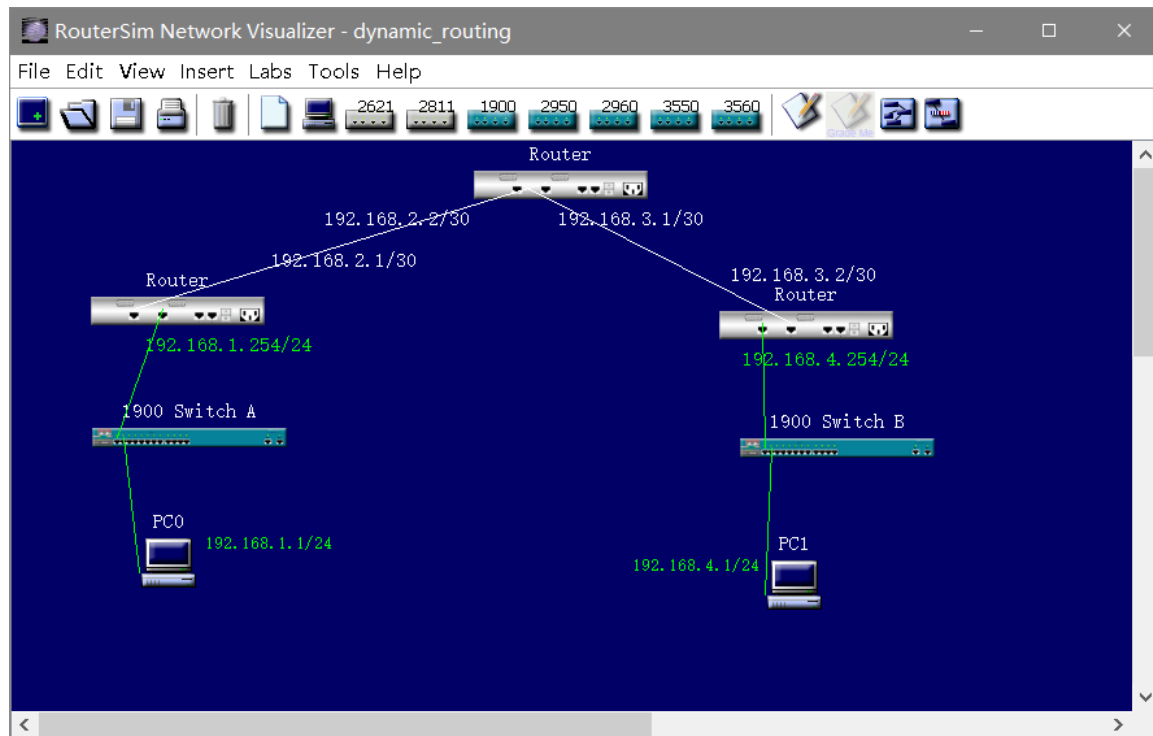
在 Monitor 中查看走向流程：

Net Packet Monitor				
File View				
Echo Request Echo Reply Telnet Request Telnet Reply RIP Update IGRP Update EIGRP Update OSPF Update				
Network	Device	Interface	Type	Time
static route	Host B	OUT - E0/0		May 5 02:46:14.387
static route	1900 Switch B	IN - E0/3		May 5 02:46:14.399
static route	1900 Switch B	OUT - E0/1		May 5 02:46:14.399
static route	2621 Router B	IN - F0/0		May 5 02:46:14.399
static route	2621 Router B	OUT - F0/1		May 5 02:46:14.399
static route	2621 Router A	IN - F0/0		May 5 02:46:14.399
static route	2621 Router A	OUT - F0/1		May 5 02:46:14.399
static route	2621 Router C	IN - F0/0		May 5 02:46:14.399
static route	2621 Router C	OUT - F0/1		May 5 02:46:14.399
static route	1900 Switch A	IN - E0/1		May 5 02:46:14.399
static route	1900 Switch A	OUT - E0/2		May 5 02:46:14.399
static route	Host C	IN - E0/0		May 5 02:46:14.399
static route	Host C	OUT - E0/0		May 5 02:46:14.399
static route	1900 Switch A	IN - E0/2		May 5 02:46:14.399
static route	1900 Switch A	OUT - E0/1		May 5 02:46:14.399
static route	2621 Router C	IN - F0/1		May 5 02:46:14.399
static route	2621 Router C	OUT - F0/0		May 5 02:46:14.399
static route	2621 Router A	IN - F0/1		May 5 02:46:14.399
static route	2621 Router A	OUT - F0/0		May 5 02:46:14.399
static route	2621 Router B	IN - F0/1		May 5 02:46:14.399
static route	2621 Router B	OUT - F0/0		May 5 02:46:14.399
static route	1900 Switch B	IN - E0/1		May 5 02:46:14.399
static route	1900 Switch B	OUT - E0/2	Echo Reply	May 5 02:46:14.399
static route	Host A	IN - E0/0		May 5 02:46:14.399
static route	1900 Switch B	OUT - E0/3		May 5 02:46:14.399
static route	Host B	IN - E0/0		May 5 02:46:14.399

例如 PC0 和 PC1 ping 时，数据包： (Request) PC0→交换机→Router→交换机→PC1→ (Reply) 交换机→Router→交换机→PC0。下一跳根据路由表中的静态路由信息选择。

实验项 2：动态路由配置 (CCNA Network Visualizer 6.0)

①配置过程：添加两台主机 PC，三个路由器 Router，连接上交换机



配置路由器 Router: (这里以路由器 B 为例)

打开终端界面

enable

configure terminal

(设置端口地址:)

interface f0/0 (其中一个端口)

ip address 192.168.2.2 255.255.255.0 (这个端口的 IP 地址和子网掩码)

no shutdown

interface f0/1 (另一个端口)

ip address 192.168.3.1 255.255.255.0

no shutdown

exit

(动态配置路由表:)

router rip

network 192.168.3.0 (每个端口 ip 地址最后一个字节取 0)

network 192.168.2.0

exit

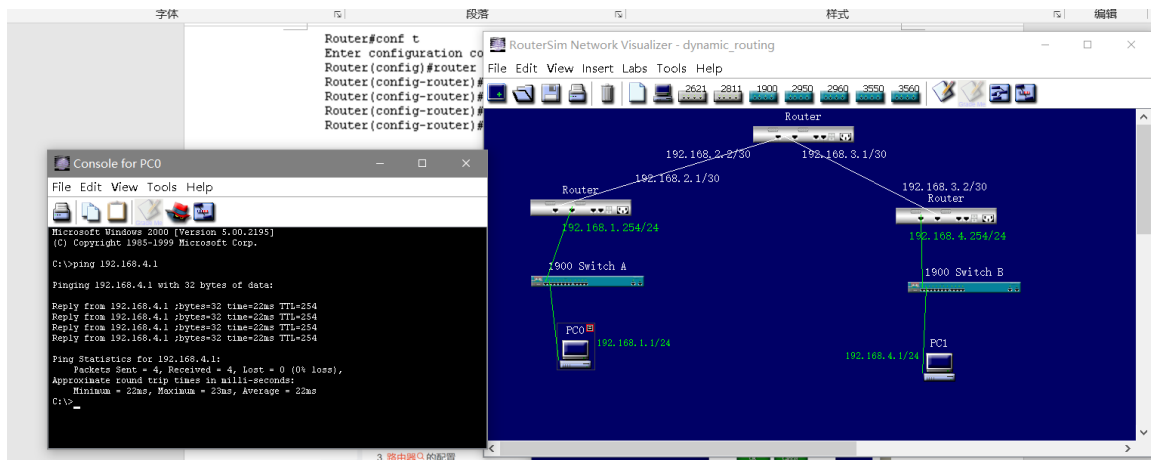
do write(保存)

```

Router#conf t
Enter configuration commands, one per line. End with CNTL/Z
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 192.168.1.1
Router(config-router)#network 192.168.3.1
Router(config-router)#

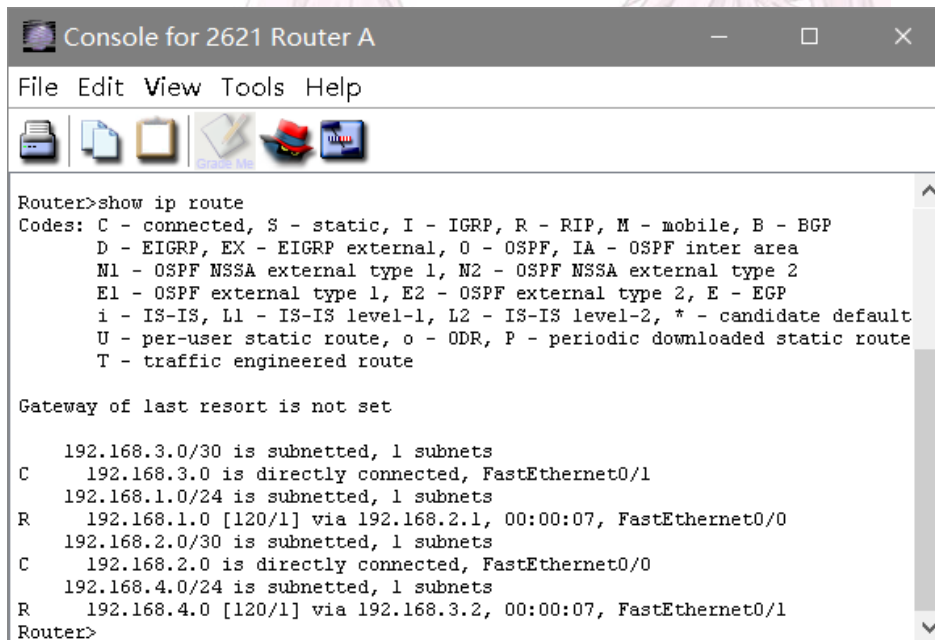
```

③两台主机可 ping 通



④打印 RouterABC 的路由表

RouterA:



RouterB:

```
Console for 2621 Router B
File Edit View Tools Help
Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR, P - periodic downloaded static route
       T - traffic engineered route

Gateway of last resort is not set

    192.168.3.0/30 is subnetted, 1 subnets
R       192.168.3.0 [120/1] via 192.168.2.2, 00:00:19, FastEthernet0/1
    192.168.2.0/30 is subnetted, 1 subnets
C       192.168.2.0 is directly connected, FastEthernet0/1
    192.168.4.0/24 is subnetted, 1 subnets
R       192.168.4.0 [120/2] via 192.168.2.2, 00:00:19, FastEthernet0/1
C       192.168.1.0/24 is directly connected, FastEthernet0/0
Router#
```

RouterC:

```
Console for 2621 Router C
File Edit View Tools Help
Router>en
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
       U - per-user static route, o - ODR, P - periodic downloaded static route
       T - traffic engineered route

Gateway of last resort is not set

    192.168.3.0/30 is subnetted, 1 subnets
C       192.168.3.0 is directly connected, FastEthernet0/0
    192.168.1.0/24 is subnetted, 1 subnets
R       192.168.1.0 [120/2] via 192.168.3.1, 00:00:22, FastEthernet0/0
    192.168.2.0/30 is subnetted, 1 subnets
R       192.168.2.0 [120/1] via 192.168.3.1, 00:00:22, FastEthernet0/0
C       192.168.4.0/24 is directly connected, FastEthernet0/1
Router#
```

(开头为 R: 代表通过 rip 协议学到的新网络)

[120/1]:120:距离, 1: 跳数

实验项 3: VLAN 配置 (CCNA Network Visualizer 6.0)

(1) 配置 SwitchA

设置 f0/1 交换机接口工作模式为 Trunk, f0/2 接口连上 vlan2, f0/3 接口连上 vlan3。

File Edit View Tools Help



Press RETURN to get started!

```
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)#vlan 3
switch(config-vlan)#exit
switch(config)#int f0/2
switch(config-if)#switch access vlan 2
switch(config-if)#exit
switch(config)#int f0/3
switch(config-if)#switch access vlan 3
switch(config-if)#exit
switch(config)#int f0/1
switch(config-if)#switchport mode trunk
switch(config-if)#end
switch#
```

(2) 配置 SwitchB

同样将设置 f0/1 交换机接口工作模式为 Trunk, f0/2 接口连上 vlan2, f0/3 接口连上 vlan3。

(show vlan 查看 vlan 设置状态)

Console for 2950 Switch B

File Edit View Tools Help



```
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)#vlan 3
switch(config-vlan)#exit
switch(config)#int f0/2
switch(config-if)#switch access vlan 2
switch(config-if)#exit
switch(config)#int f0/3
switch(config-if)#switch access vlan 3
switch(config-if)#exit
switch(config)#int f0/1
switch(config-if)#switchport mode trunk
switch(config-if)#end
switch#show vlan
```

VLAN Name	Status	Ports
1 default	active	Fa0/4, Fa0/5, Fa0/6, Fa0/7 Fa0/8, Fa0/9, Fa0/10, Fa0/11 Fa0/12
2 VLAN0002	active	Fa0/2
3 VLAN0003	active	Fa0/3
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

--More--
switch#

配置 4 个主机的 IP、子网掩码和默认网关

Configure Host A

Host Name:

☐ Obtain an IP address automatically

☒ Use the following IP address:

IP Address

Subnet

Default Gateway

Configure Host B

Host Name:

☐ Obtain an IP address automatically

☒ Use the following IP address:

IP Address

Subnet

Default Gateway

Configure Host C

Host Name:

☐ Obtain an IP address automatically

☒ Use the following IP address:

IP Address

Subnet

Default Gateway

Configure Host D

Host Name:

☐ Obtain an IP address automatically

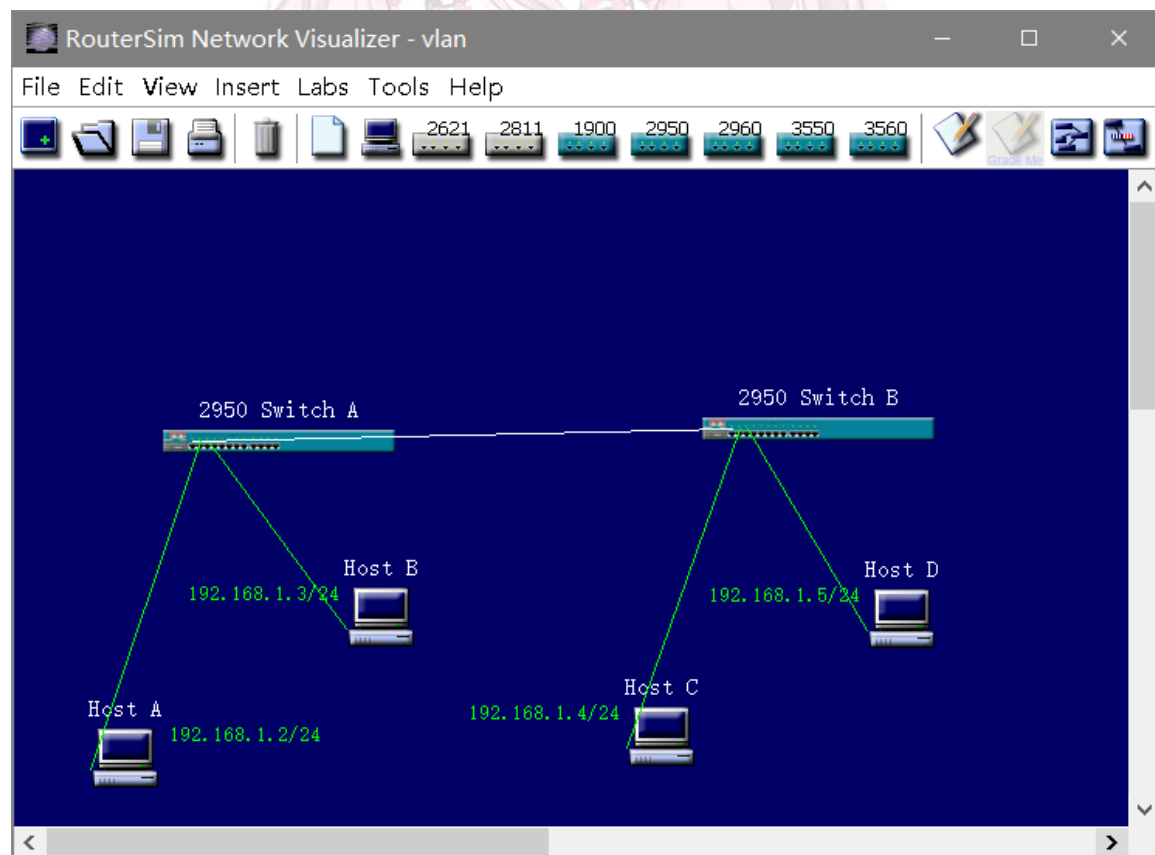
☒ Use the following IP address:

IP Address

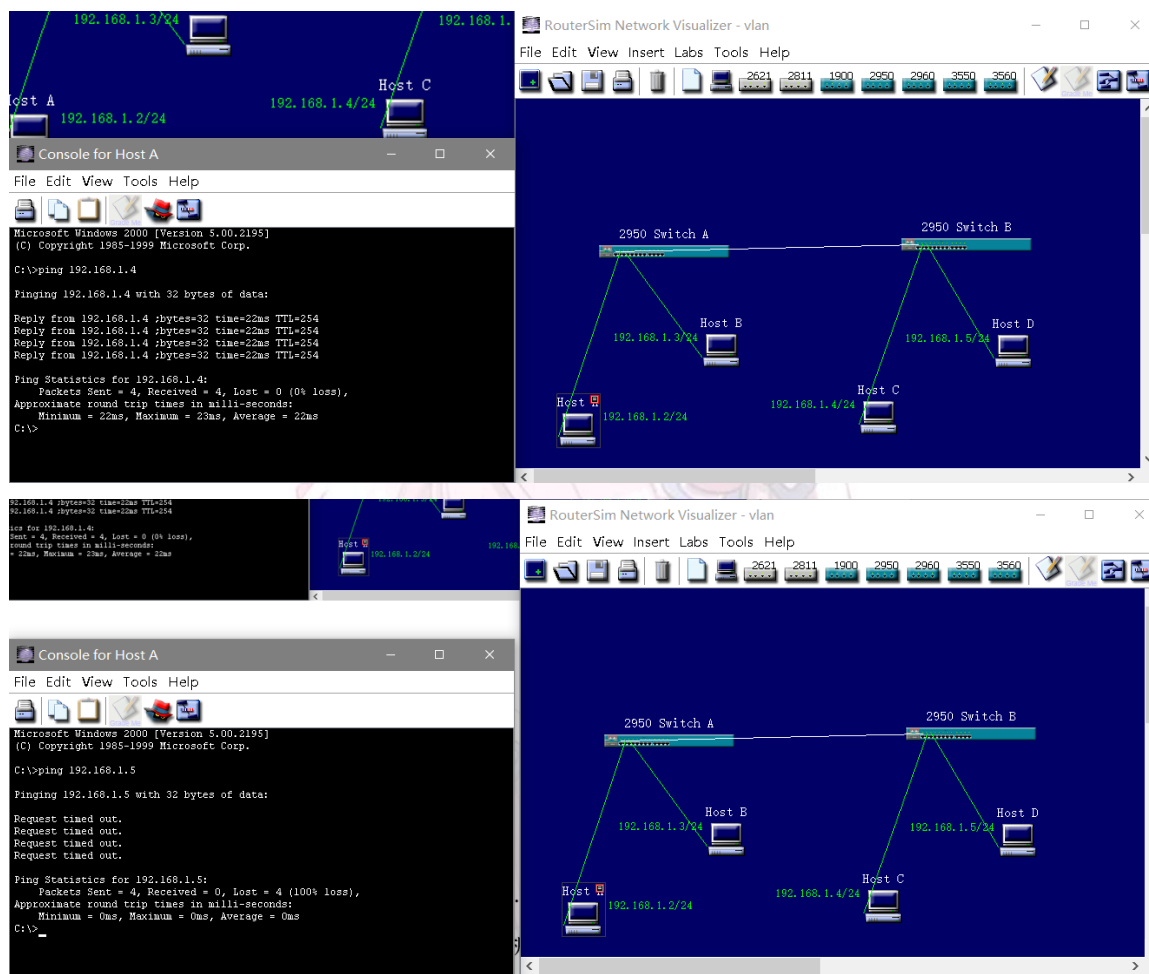
Subnet

Default Gateway

hostA 跟 hostC 在同个 vlan , hostB 跟 hostD 在同个 vlan



用 A 主机 ping C 主机跟 D 主机
C 主机在 vlan 2 所以 ping 得通
D 主机在 vlan 3 所以 ping 不通。



4 实验总结

通过这次实验，我利用 CCNANetwork Visualizer 6.0 学习了路由和交换机端口、路由表的配置，完成了静态路由、动态路由和交换机端口的 VLAN 的配置实验。还尝试 Packet Monitor 分析 ping 过程中数据包在网络中的走向。其中，我对 VLAN 的认识尤其得到了加深，如 VLAN 使得网络设备的移动、添加和修改的管理开销减少；可以控制广播活动，减小开销；提高网络的安全性等。

以下是参考的文章：

https://blog.csdn.net/qq_52641289/article/details/124489446

https://blog.csdn.net/m0_47110032/article/details/124674076

