厦門大學

信息学院软件工程系

《计算机网络》实验报告

题　　目 实验四　CISCO IOS 路由器基本配置

班　　级 软件工程 2020 级数媒班

姓　　名 陈鑫蕾

学　　号 22920202202877

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填写说明

1、本文件为 Word 模板文件，建议使用 Microsoft Word 2019 打开，在可填写的区域中如实填写；

2、填表时勿破坏排版，勿修改字体字号，打印成 PDF 文件提交；

3、文件总大小尽量控制在 1MB 以下，最大勿超过 5MB；

4、应将材料清单上传在代码托管平台上；

5、在实验课结束 14 天内，按原文件发送至课程 FTP 指定位置。

1 实验目的

通过完成实验，理解网络层和路由的基本原理。掌握路由器配置网络和组网 的方法；掌握 IP 协议、IP 地址配置和路由的概念；掌握 IP 协议和路由的基本原 理；了解在模拟器下根据教程配置网络的方法。

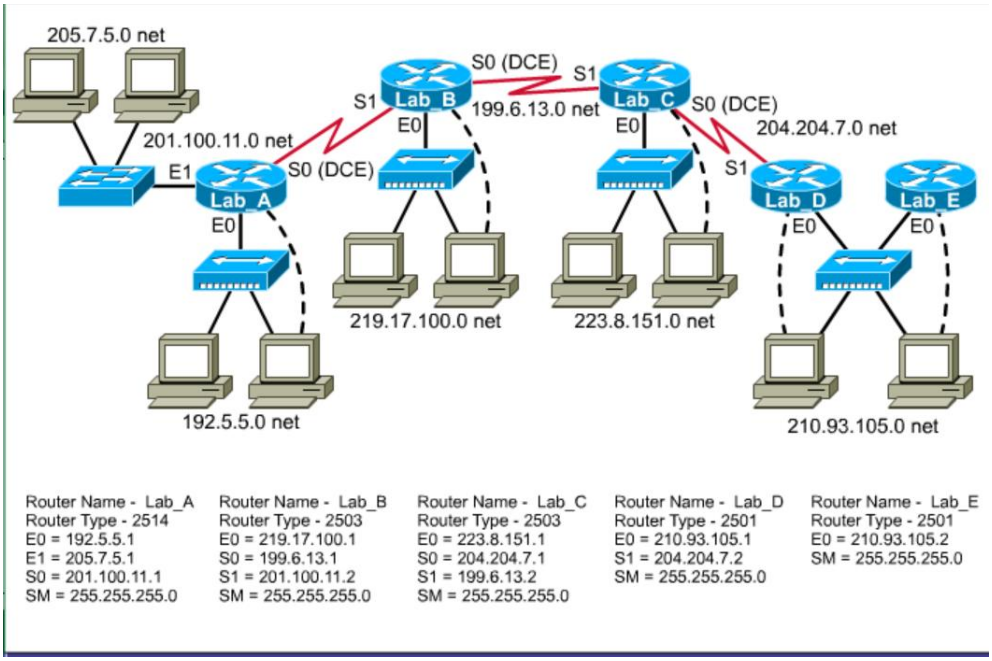
2 实验环境

Windows 10, Router eSIM v1.1

3 实验结果

（1）使用 Router eSIM v1.1 模拟器来模拟路由器的配置环境

1. 查看网络拓扑结构



2. 进入超级用户模式，再进入 config 模式

```
Router>enable
Router#config terminal
Enter configuration commands, one per line.  End with END.
```

3. 用 hostname 命令对所有路由器重命名

```
Router(config)#hostname Lab_A
Lab_A(config)#
```

4. 用 ip host 命令建立映射表

```
Lab_A(config)#ip host LAB_A 192.5.5.1 205.7.5.1 201.100.11.1
Lab_A(config)#ip host LAB_B 219.17.100.1 199.6.13.1 201.100.11.2
Lab_A(config)#ip host LAB_C 223.8.151.1 204.204.7.1 199.6.13.2
Lab_A(config)#ip host LAB_D 210.93.105.1 204.204.7.2
Lab_A(config)#ip host LAB_E 210.93.105.2
```

5. 使用 interface type number 命令进入接口配置模式，并使用 ip address 为路由器接口配置 IP 地址

```
Lab_A(config)#int eth 0
Lab_A(config-if)#ip address 192.5.5.1 255.255.255.0
Lab_A(config-if)#int eth 1
Lab_A(config-if)#ip address 205.7.5.1 255.255.255.0
Lab_A(config-if)#int serial 0
Lab_A(config-if)#ip address 201.100.11.1 255.255.255.0
```

6. 指定时钟频率

```
Lab_A(config-if)#clock rate 56000
```

7. 打开端口

```
Lab_A(config-if)#no shutdown
```

8. 使用 enable secret class 打开密码，并使用 login，password 等命令设置用户名和密码

```
Lab_A(config)#enable secret class
Lab_A(config)#line console 0
Lab_A(config-line)#login
Lab_A(config-line)#password cisco
Lab_A(config-line)#exit
Lab_A(config)#line vty 0 4
Lab_A(config-line)#login
Lab_A(config-line)#password cisco
```

9. 在全局配置模式下使用 network 命令配置动态路由

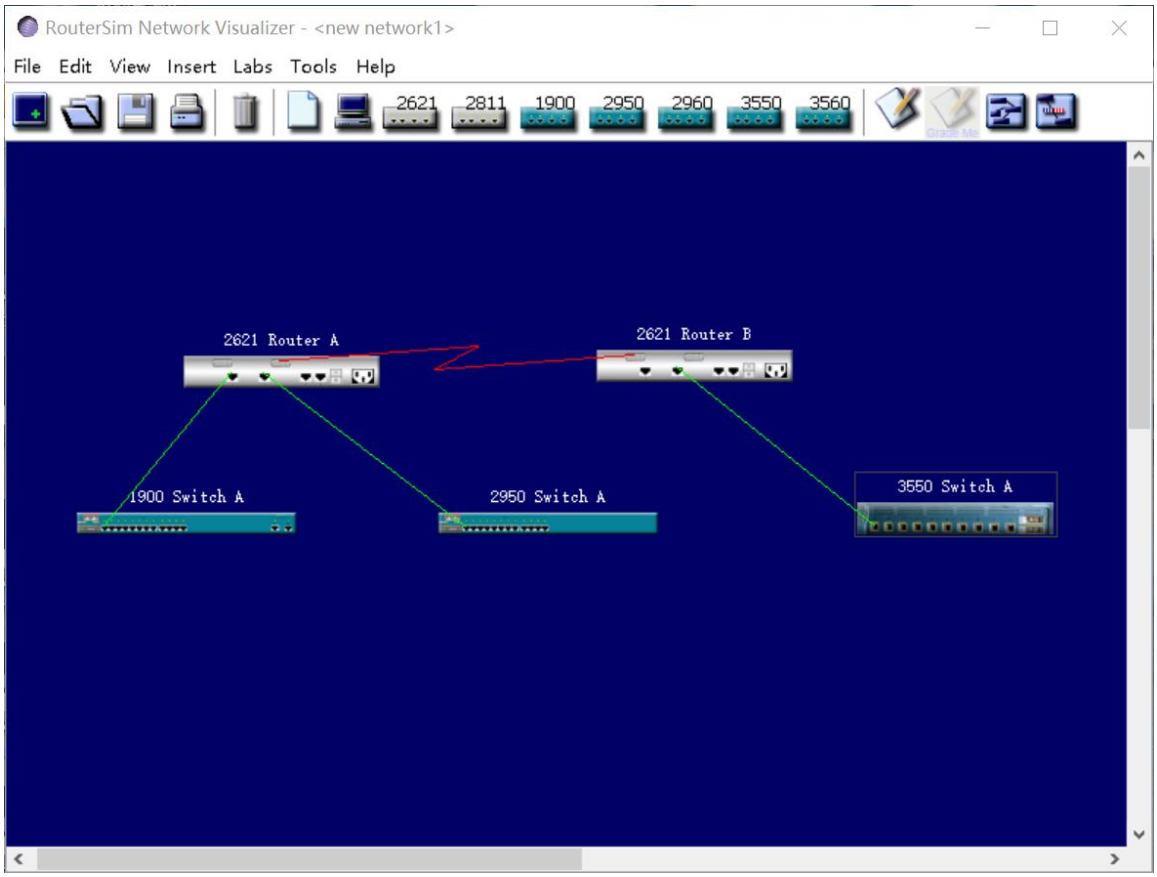
```
Lab_A(config-router)#network 192.5.5.1
Lab_A(config-router)#network 205.7.5.1
Lab_A(config-router)#net work 201.100.11.1
                           ^
% Invalid input detected at '^' marker.

Lab_A(config-router)#network 201.100.11.1
```

10. 此时 Lab_A 路由器已配置完毕，重复此步骤即可配置完所有路由器

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	39:49

（2）使用 CCNA Network Visualizer 6.0 配置静态路由

1. 网络拓扑如图：



2. 对路由器 A 的每个端口进行配置，分别设置其 ip 地址，掩码，同时激活端口，由于此处是 dce 接口，所以还需要配置时钟频率

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z
Router(config)#int f0/0
Router(config-if)#ip address 192.5.5.1 255.255.255.0
Router(config-if)#no shutdown
02:51:59 %LINK-3-UPDOWN:  Interface FastEthernet0/0, changed state to up
02:51:59 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to

Router(config-if)#int f0/1
Router(config-if)#ip address 205.7.5.1 255.255.255.0
Router(config-if)#no shutdown
02:52:42 %LINK-3-UPDOWN:  Interface FastEthernet0/1, changed state to up
02:52:42 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to

Router(config-if)#int s0/0
Router(config-if)#ip addr 201.100.11.1 255.255.255.0
Router(config-if)#clock rate 56000
Router(config-if)#no shutdown
02:53:15 %LINK-3-UPDOWN:  Interface Serial0/0, changed state to up
02:53:15 %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to up
```

3. 查看路由表，状态都为 c，配置完成

```
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
C     192.5.5.0/24 is directly connected, FastEthernet0/0
C     201.100.11.0/24 is directly connected, Serial0/0
C     205.7.5.0/24 is directly connected, FastEthernet0/1
Router#
```

4. 同样对路由器 B 进行相应的配置

```
Router>enable
Router#config
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line.  End with CNTL/Z
Router(config)#int f0/0
Router(config-if)#ip address 199.6.13.1 255.255.255.0
Router(config-if)#no shutdown
02:58:16 %LINK-3-UPDOWN:  Interface FastEthernet0/0, changed state to up
02:58:16 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, change

Router(config-if)#int s0/1
Router(config-if)#ip address 201.100.11.2 255.255.255.0
Router(config-if)#no shutdown
02:58:41 %LINK-3-UPDOWN:  Interface Serial0/1, changed state to up
02:58:41 %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1, changed stat
```

5. 查看路由表，配置完成

```
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
C     201.100.11.0/24 is directly connected, Serial0/1
C     199.6.13.0/24 is directly connected, FastEthernet0/0
Router#
```

6. 使用 ping 命令进行测试路由器 A 到路由器 B 的直连网络是否连通

```
Router#ping 199.6.13.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 199.6.13.1, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5), round-trip min/avg/max = 0/0/0 ms
Router#
```

此时并未连通

7. 开始配置静态路由

```
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z
Router(config)#ip route 199.6.13.0 255.255.255.0 201.100.11.2
Router(config)#exit
```

8. 查看路由表

```
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
S     199.6.13.0 [1/0] via 201.100.11.2
C     201.100.11.0/24 is directly connected, Serial0/0
C     205.7.5.0/24 is directly connected, FastEthernet0/1
C     192.5.5.0/24 is directly connected, FastEthernet0/0
Router#
```

9. 使用 ping 命令查看网络接通是否良好

```
Router#ping 199.6.13.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 199.6.13.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms
```

网络接通良好，静态路由配置完成

（3）使用 CCNA Network Visualizer 6.0 配置动态路由

1. 启动 rip 协议，选择网络

```
Router(config)#router rip
Router(config-router)#network 201.100.11.0
Router(config-router)#network 199.6.13.0
Router(config-router)#exit
```

2. 查看路由协议 ip 工作情况，管理距离为 120

```
Router#show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 10 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 1, receive any version
    Interface             Send  Recv  Triggered RIP  Key-chain
    Serial0/1             1     1 2
    FastEthernet0/0       1     1 2
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for networks:
    201.100.11.0
    199.6.13.0
  Routing information sources:
    Gateway         Distance      Last Update
  Distance: <default is 120>
```

3. 查看路由表，查看当前学习到的网络

```
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for networks:
    201.100.11.0
    199.6.13.0
  Routing information sources:
    Gateway         Distance      Last Update
  Distance: <default is 120>

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
C     201.100.11.0/24 is directly connected, Serial0/1
C     199.6.13.0/24 is directly connected, FastEthernet0/0
```

4. 对路由器 A 进行同样的配置

```
Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z
Router(config)#router rip
Router(config-router)#network 192.5.5.9
Router(config-router)#network 205.7.5.0
Router(config-router)#network 201.100.11.0
Router(config-router)#exit
```

5. 查看路由协议 ip 工作情况

```
Router#show ip protocols

Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 20 seconds
  Invalid after 180 seconds, hold down 180, flushed after 240
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Redistributing: rip
  Default version control: send version 1, receive any version
    Interface             Send  Recv  Triggered RIP  Key-chain
    Serial0/0             1     1 2
    FastEthernet0/1       1     1 2
    FastEthernet0/0       1     1 2
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for networks:
    192.5.5.0
    201.100.11.0
    205.7.5.0
  Routing information sources:
    Gateway         Distance      Last Update
    201.100.11.2          120       00:00:10
  Distance: <default is 120>
--More--
```

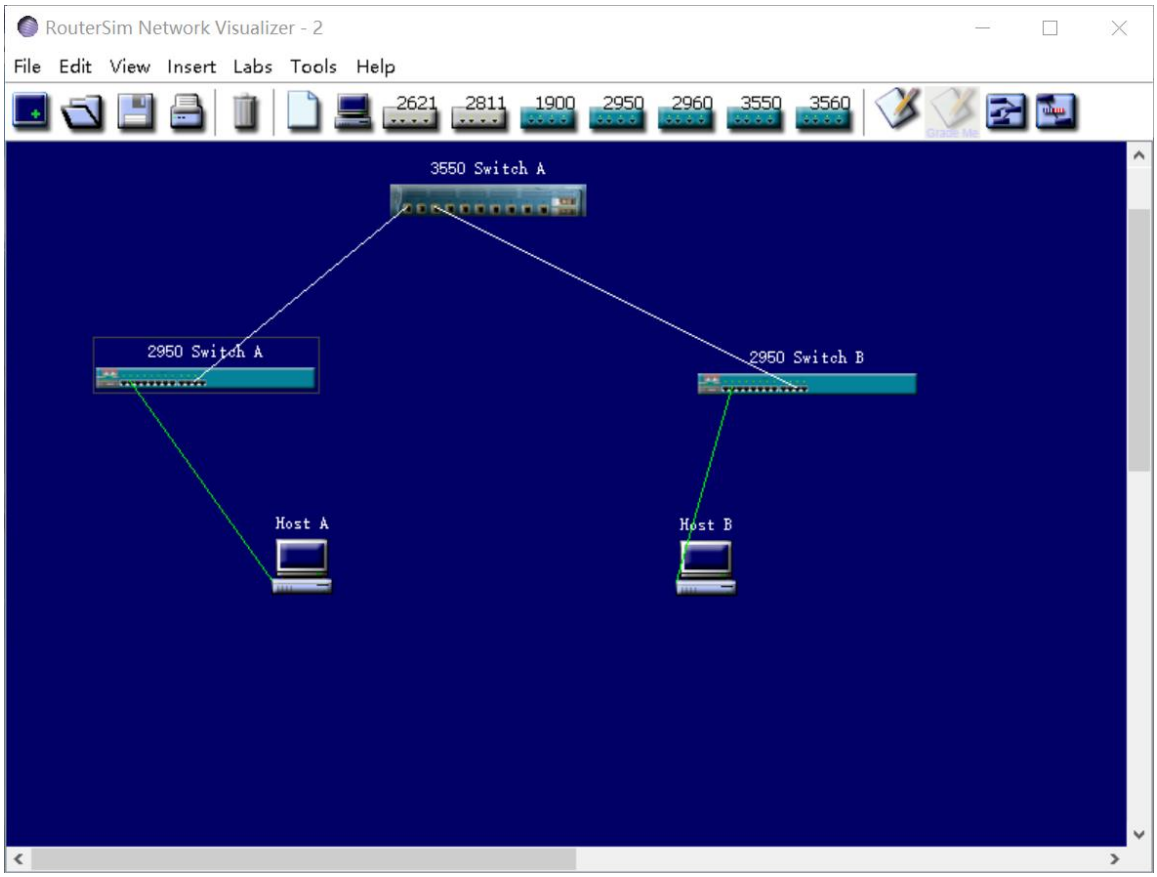
6. 查看路由表，发现两个由 rip 学习到的新的网络

```
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
R     192.5.5.0 [120/1] via 201.100.11.1, 00:00:18, Serial0/1
C     201.100.11.0/24 is directly connected, Serial0/1
C     199.6.13.0/24 is directly connected, FastEthernet0/0
R     205.7.5.0 [120/1] via 201.100.11.1, 00:00:18, Serial0/1
Router#
```

7. 动态路由配置结束

（4）使用 CCNA Network Visualizer 6.0 配置交换机端口的 VLAN（虚拟局域网）

1. 网络拓扑图



2. 设置 3550 交换机的 vtp 域，将其命名为 Cisco

```
switch>enable
switch#config t
Enter configuration commands, one per line.  End with CNTL/Z
switch(config)#hostname 3550A
3550A(config)#vtp domain Cisco
Changing VTP domain name from NULL to Cisco
```

3. 用 show 命令检查 vtp 配置情况

```
3550A#show vtp status
VTP Version                     : 2
Configuration Revision          : 1
Maximum VLANs supported locally : 64
Number of existing VLANs        : 5
VTP Operating Mode              : Server
VTP Domain Name                 : Cisco
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x70 0x01 0xF2 0x72 0x97 0xA1 0x35 0xEB
Configuration last modified by: 0.0.0.0 at 11-29-93 20:39:24
Local updater ID is 0.0.0.0 on interface Vl1 (lowest numbered VLAN interface
found)
3550A#
```

4. 接着对 2950A 进行同样的配置，此处需要将模式转换为客户模式

```
switch>en
switch#conf t
Enter configuration commands, one per line.  End with CNTL/Z
switch(config)#hostname 2950A
2950A(config)#vtp domain Cisco
Changing VTP domain name from NULL to Cisco
2950A(config)#vtp mode client
Setting device to VTP CLIENT mode.
```

```
2950A#show vtp status
VTP Version                     : 2
Configuration Revision          : 1
Maximum VLANs supported locally : 64
Number of existing VLANs        : 5
VTP Operating Mode              : Client
VTP Domain Name                 : Cisco
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x70 0x01 0xF2 0x72 0x97 0xA1 0x35 0xEB
Configuration last modified by: 2950 SwitchA at 11-29-93 20:39:24
Local updater ID is 2950 SwitchA on interface Vl1 (lowest numbered VLAN interface
found)
2950A#
```

5. 接着对 2950B 进行同样的配置，此处也需要将模式转换为客户模式

```
switch>enable
switch#config t
Enter configuration commands, one per line.  End with CNTL/Z
switch(config)#hostname 2950B
2950B(config)#vtp dimain Cisco
                 ^
% Invalid input detected at '^' marker.
2950B(config)#vtp domain Cisco
Changing VTP domain name from NULL to Cisco
2950B(config)#vtp mode client
Setting device to VTP CLIENT mode.
```

```
2950B#show vtp status
VTP Version                     : 2
Configuration Revision          : 1
Maximum VLANs supported locally : 64
Number of existing VLANs        : 5
VTP Operating Mode              : Client
VTP Domain Name                 : Cisco
VTP Pruning Mode                : Disabled
VTP V2 Mode                     : Disabled
VTP Traps Generation            : Disabled
MD5 digest                      : 0x70 0x01 0xF2 0x72 0x97 0xA1 0x35 0xEB
Configuration last modified by: 2950 SwitchB at 11-29-93 20:39:24
Local updater ID is 2950 SwitchB on interface Vl1 (lowest numbered VLAN interface
found)
2950B#
```

6. 接着进行端口汇聚配置，在交换机 3550A 中将端口 f0/1 和 f0/2 配置成 trunk 端口，同时进行封装。

```
3550A>enable
3550A#config t
Enter configuration commands, one per line.  End with CNTL/Z
3550A(config)#int fa0/1
3550A(config-if)#switchport trunk encapsulation dotlq
                                                   ^
% Invalid input detected at '^' marker.
3550A(config-if)#switchport trunk encapsulation dotlq
03:38:25: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state
to down
03:38:25: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state t
3550A(config-if)#switchport mode trunk
3550A(config-if)#int fa0/3
3550A(config-if)#switchport trunk encapsulation dotlq
03:39:16: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state
to down
03:39:16: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state t
3550A(config-if)#switchport mode trunk
3550A(config-if)#
```

7. 接着配置交换机 2950A 以及 2950B 的端口

```
2950A>enable
2950A#config t
Enter configuration commands, one per line.  End with CNTL/Z
2950A(config)#interface fa0/11
2950A(config-if)#switchport mode trunk
2950A(config-if)#
```

```
2950B>enable
2950B#config t
Enter configuration commands, one per line.  End with CNTL/Z
2950B(config)#interface fa0/11
2950B(config-if)#switchport mode trunk
2950B(config-if)#
```

8. 创建两个局域网

```
3550A#show vlan

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/2, Fa0/4, Fa0/5, Fa0/6
                                                 Fa0/7, Fa0/8, Fa0/9, Fa0/10
10   VLAN0010                          active
20   VLAN0020                          active
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
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

--More--
```

配置完成

9. 将 2950A 和 2950B 的端口加入虚拟局域网

```
2950A(config)#interface fa0/2
2950A(config-if)#switchport access vlan 10
2950A(config-if)#
```

```
2950B(config)#interface fa0/2
2950B(config-if)#switchport access vlan 20
```

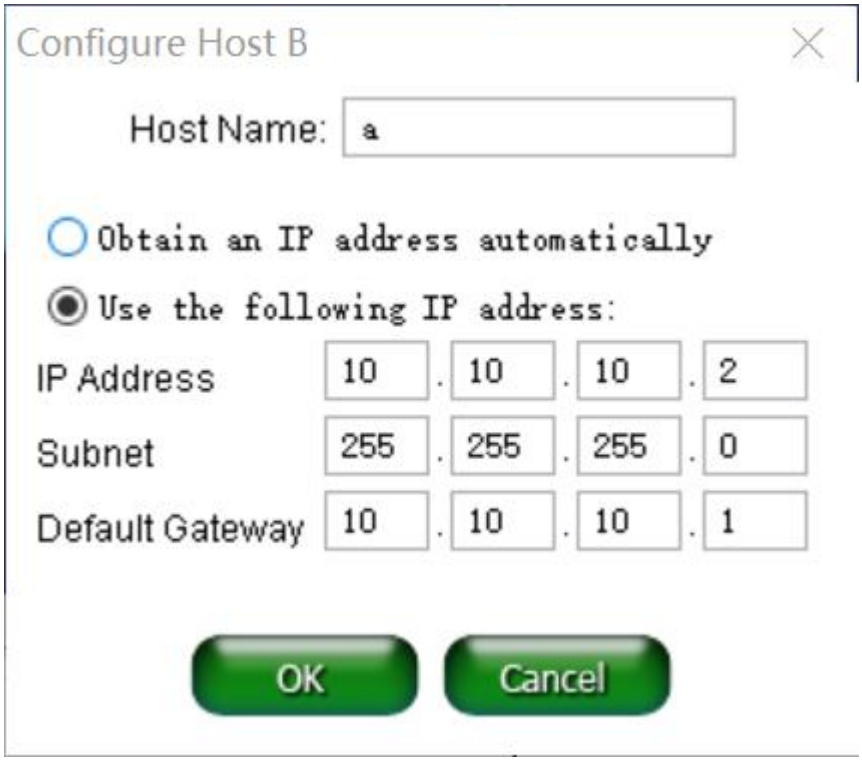
10. 接着配置第三层交换机

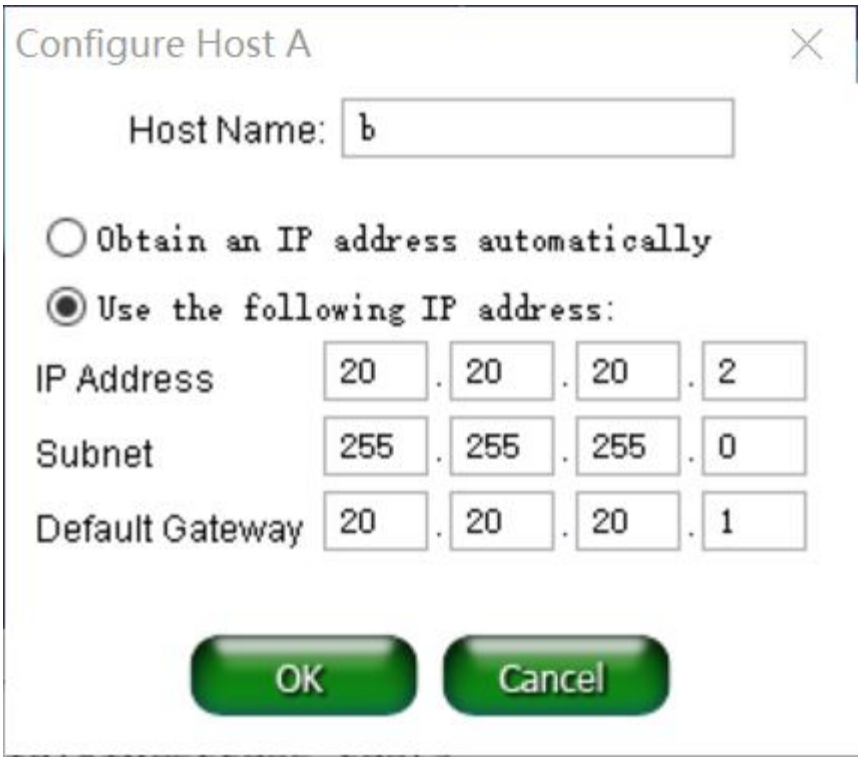
```
3550A>enable
3550A#conf t
Enter configuration commands, one per line.  End with CNTL/Z
3550A(config)#int vlan 10
3550A(config-if)#ip address 10.10.10.1 255.255.255.0
3550A(config-if)#no shutdown
3550A(config-if)#int vlan20
3550A(config-if)#ip address 20.20.20.1 255.255.255.0
3550A(config-if)#no shutdown
3550A(config-if)#exit
```

11. 分别启用三台 swicth 的路由，并配置路由器地址

```
3550A(config)#ip routing
3550A(config)#int vlanl
% Incomplete command.
3550A(config)#int vlan 1
3550A(config-if)#ip address 192.169.10.1 255.255.255.0


2950A>enable
2950A#conf t
Enter configuration commands, one per line.  End with CNTL/Z
2950A(config)#int vlan 1
2950A(config-if)#ip address 192.168.10.2 255.255.255.0
2950A(config-if)#no shutdown
2950B(config)#int vlan 1
2950B(config-if)#ip address 192.168.10.3 255.255.255.0
2950B(config-if)#no shutdown
```

12. 配置主机 A,B 并进行分别测试



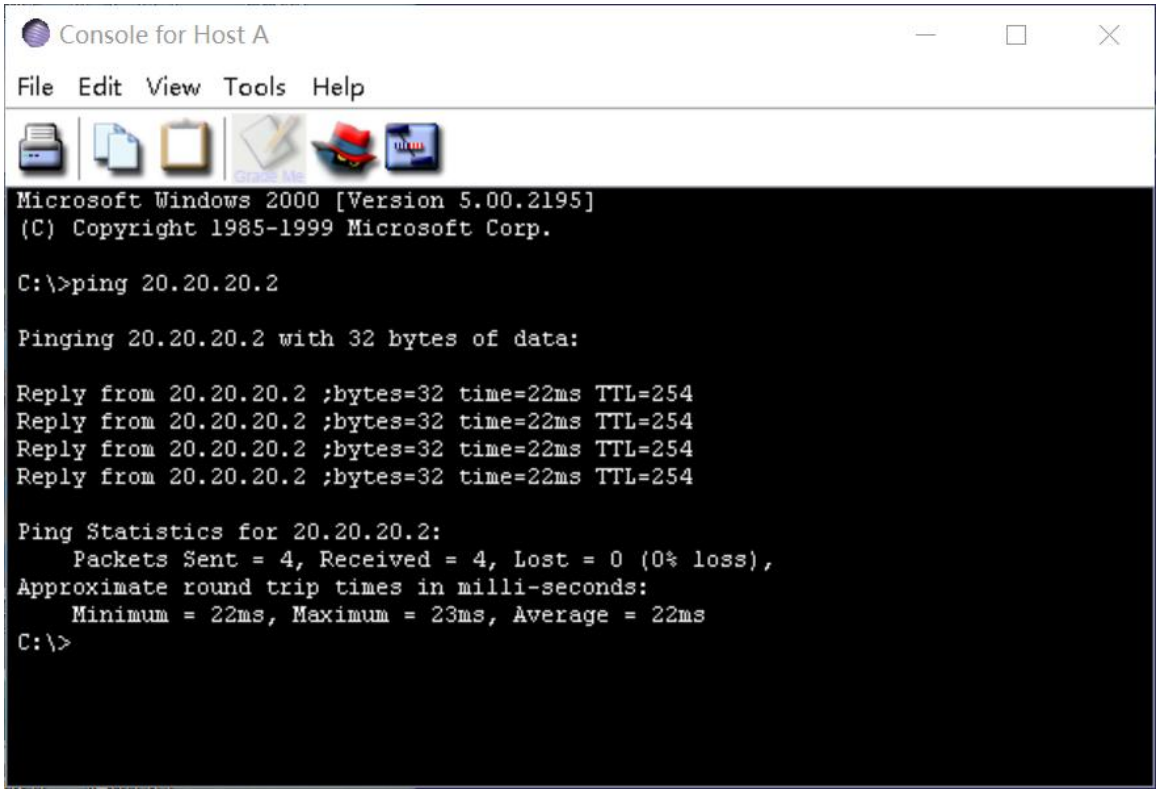


13. 使用 ping 命令查看网络接通是否良好

```
3550A#ping 192.168.10.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms
3550A#ping 192.168.10.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.3, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms
```

网络接通良好，配置完成

14. 使用 ping 命令在两台主机之间进行测试



4 实验代码

本次实验的代码已上传于以下代码仓库：https://gitee.com/Cutie_Chen/computer-network/tree/master/4

5 实验总结

本次实验主要联系了路由器静态路由、动态路由及相关配置。进一步加深了我对路由器工作原理的理解。