

廈門大學



信息学院软件工程系

《计算机网络》实验报告

题 目 实验五 路由器基本配置

班 级 软件工程 2023 级 1 班

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填写说明

- 1、本文件为 Word 模板文件，建议使用 Microsoft Word 2024 打开，在可填写的区域中如实填写；
- 2、填表时勿改变字体字号，保持排版工整，打印为 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、在实验课结束 14 天内，按实验报告提交到我校课程网站的指定位置，源代码等主要材料上传在公开的代码托管平台上。
- 5、鼓励同学之间探讨，鼓励合理使用人工智能平台，提升效率，但不应滥用相关资源，如抄袭代码和代写作业。

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

操作系统：Windows11；Router eSIM v1.1；CCNA Network Visualizer 6.0；思科模拟器 Packet Tracer 7.0

3 实验结果

按照附件一描述

一、使用 Router eSIM v1.1 模拟器来模拟路由器的配置环境；进入超级用户模式并进入全局配置模式，以修改路由器配置



路由器一些常规配置：

1. 改名：

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

2. 设置当日消息标题：将#...#之间的文本在各终端试图访问路由器时，在登录口令提示前显示出来。

```
lab_A(config)#banner motd #
Enter TEXT message. End with the character '#'.
Accounting Department
You have entered a secured system
Authorized access only' #
lab_A(config)#
```

3. 接口描述

```
lab_A(config)#interface ethernet 0
lab_A(config-if)#description Engineering LAN,Bldg,18
```

4. 设置控口口令

```
lab_A(config-if)#line console 0
lab_A(config-line)#login
lab_A(config-line)#password 123456
lab_A(config-line)#exit
lab_A(config)#
```

5. 设置虚拟终端口令

```
lab_A(config)#line vty 0 4
lab_A(config-line)#login
lab_A(config-line)#password 123456
lab_A(config-line)#exit
```

6. 建立名字解析的映射表

```
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
```

7. 给路由器接口配置 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
lab_A(config-if)#
```

8. 查看串行端口类型并配置充当 DCE 端的串行端口

```

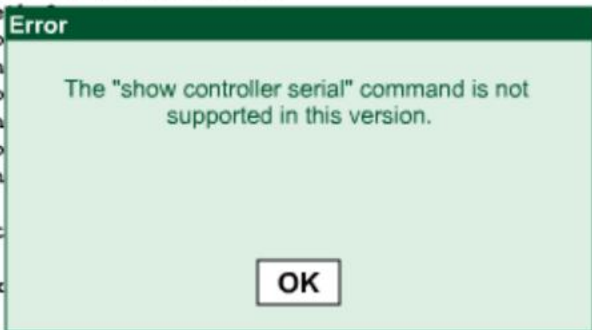
lab_A(config)#ip host lab_E 210.93.105.2
lab_A(config)#int e
lab_A(config-if)#ip
lab_A(config-if)#in
lab_A(config-if)#ip
lab_A(config-if)#in
lab_A(config-if)#ip
lab_A(config-if)#sh

% Invalid input detected at '^' marker.

lab_A(config-if)#ex
lab_A(config)#show
^
% Invalid input detected at '^' marker.

lab_A(config)#exit
00:51:41: %SYS-5-CONFIG I: Configured from console by console
lab_A#show controller serial 0

```



9. 显示串口的配置情况和一些工作数据

```

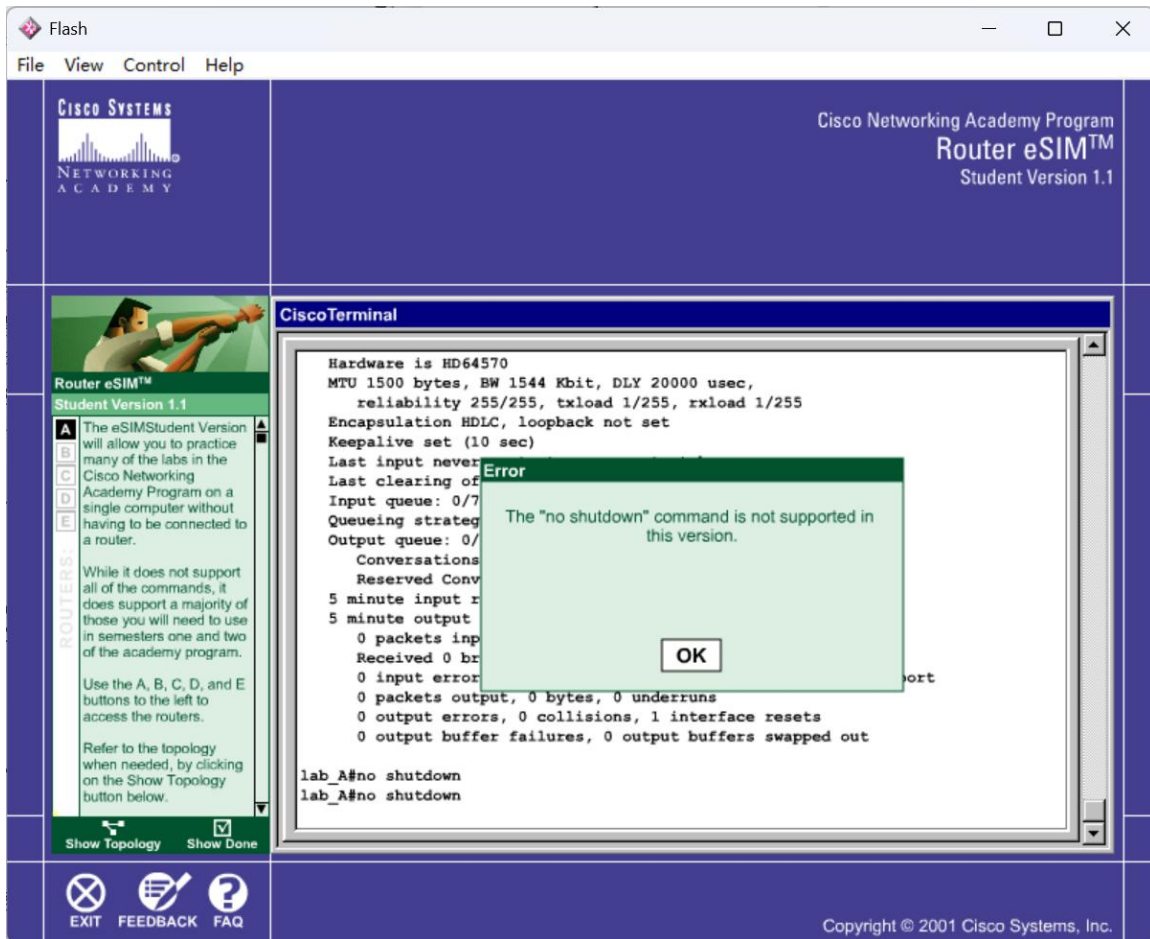
lab_A#config t
Enter configuration commands, one per line. End with END.
lab_A(config)#interface serial 0
lab_A(config-if)#clock rate 56000
^
% Invalid input detected at '^' marker.

lab_A#show interface serial 0
Serial0 is administratively down, line protocol is down
  Internet address is 201.100.11.1/24
  Hardware is HD64570
  MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation HDLC, loopback not set
  Keepalive set (10 sec)
  Last input never, output never, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0 (size/max/drops); Total output drops: 0
  Queueing strategy: weighted fair
  Output queue: 0/1000/64/0 (size/max total/threshold/drops)
    Conversations  0/0/256 (active/max active/max total)
    Reserved Conversations 0/0 (allocated/max allocated)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer
    Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
    0 packets output, 0 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 output buffer failures, 0 output buffers swapped out

```

第一行显示了网络的工作状况：管理员手动关闭该端口

10. 手工开启和关闭端口（模拟器做不到）



11.通过 Show done 检查各个路由器的配置状态

Checking Your Configuration

This activity is not 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

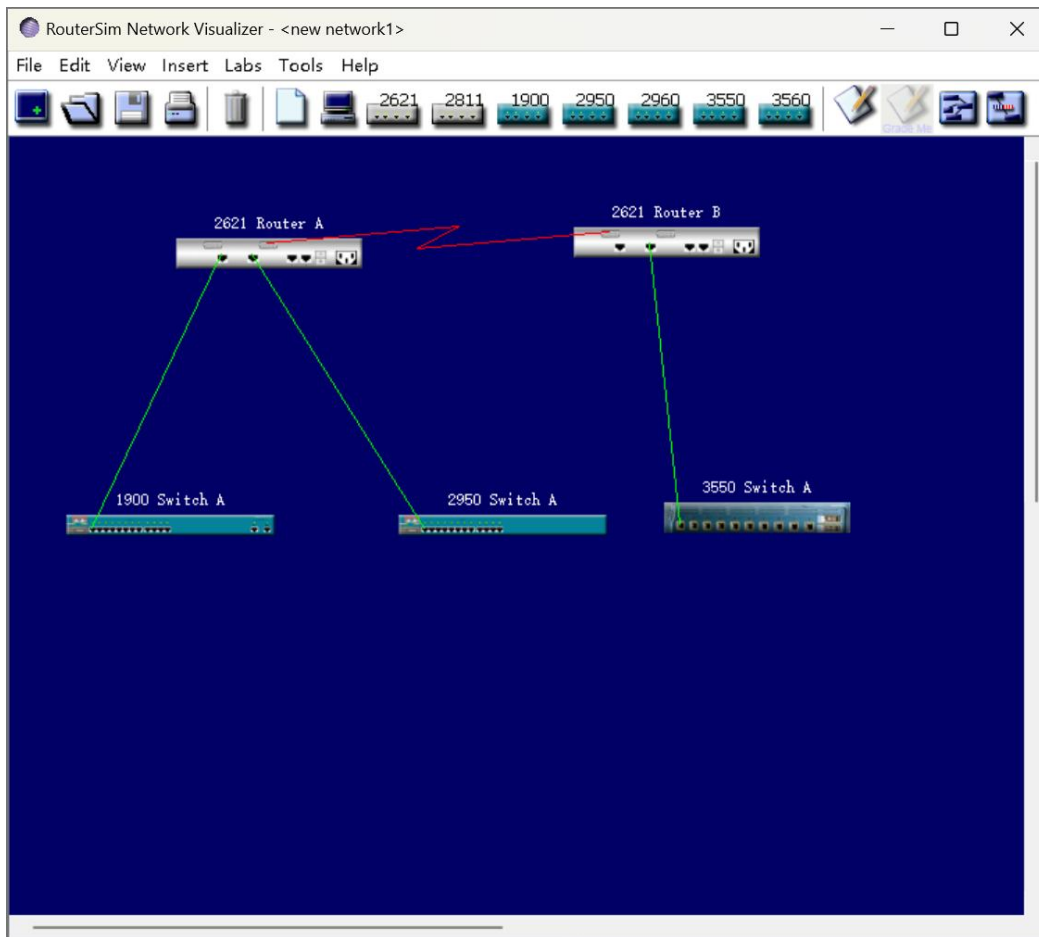
Loads all router variables for this eSIM™ scenario **except** the IP host table, which means, for example, that you will not be able to use the router name as part of ping or telnet commands.

Lab_A	Not Completed
Hostname	Done
Enable Secret	Not Done
Line Console Login	Done
Line Console Password	Not Done
Line vty Login	Done
Line vty Password	Not Done
E0 IP	Done
E0 Shutdown	Not Done
E1 IP	Done
E1 Shutdown	Not Done
S0 IP	Done
S0 Clock Rate	Done
S0 Shutdown	Not Done
Routing Protocol	Not Done
Network 1	Not Done
Network 2	Not Done
Network 3	Not 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	58:24

二、使用 CCNA Network Visualizer 6.0 配置静态路由、动态路由和交换机端口的 VLAN（虚拟局域网）。

1.静态路由配置

1) 连接路由器和交换机



2) 设置命令，配置静态路由

配置 routerA


```

Console for 2621 Router A
File Edit View Tools Help

Router>en
Router#config
Configuring from terminal, memory, or network [terminal]? 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
01:18:52 %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
01:18:52 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#int f0/1
Router(config-if)#ip address 205.7.5.1 255.255.255.0
Router(config-if)#no shutdown
01:19:17 %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up
01:19:17 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

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
^
% Invalid input detected at '^' marker.
Router(config-if)#no shutdown
01:19:57 %LINK-3-UPDOWN: Interface Serial0/0, changed state to up
01:19:57 %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to up

Router(config-if)#exit
Router(config)#exit
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, Serial0/0
C    192.5.5.0/24 is directly connected, FastEthernet0/0
C    205.7.5.0/24 is directly connected, FastEthernet0/1
Router#

```

配置 routerB

```

Console for 2621 Router B
File Edit View Tools Help

Router Con0 is now available

Press RETURN to get started!

Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z
Router(config)#int f0/0
Router(config-if)#ip addr 199.6.13.1 255.255.255.0
Router(config-if)#no shutdown
01:26:58 %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
01:26:58 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

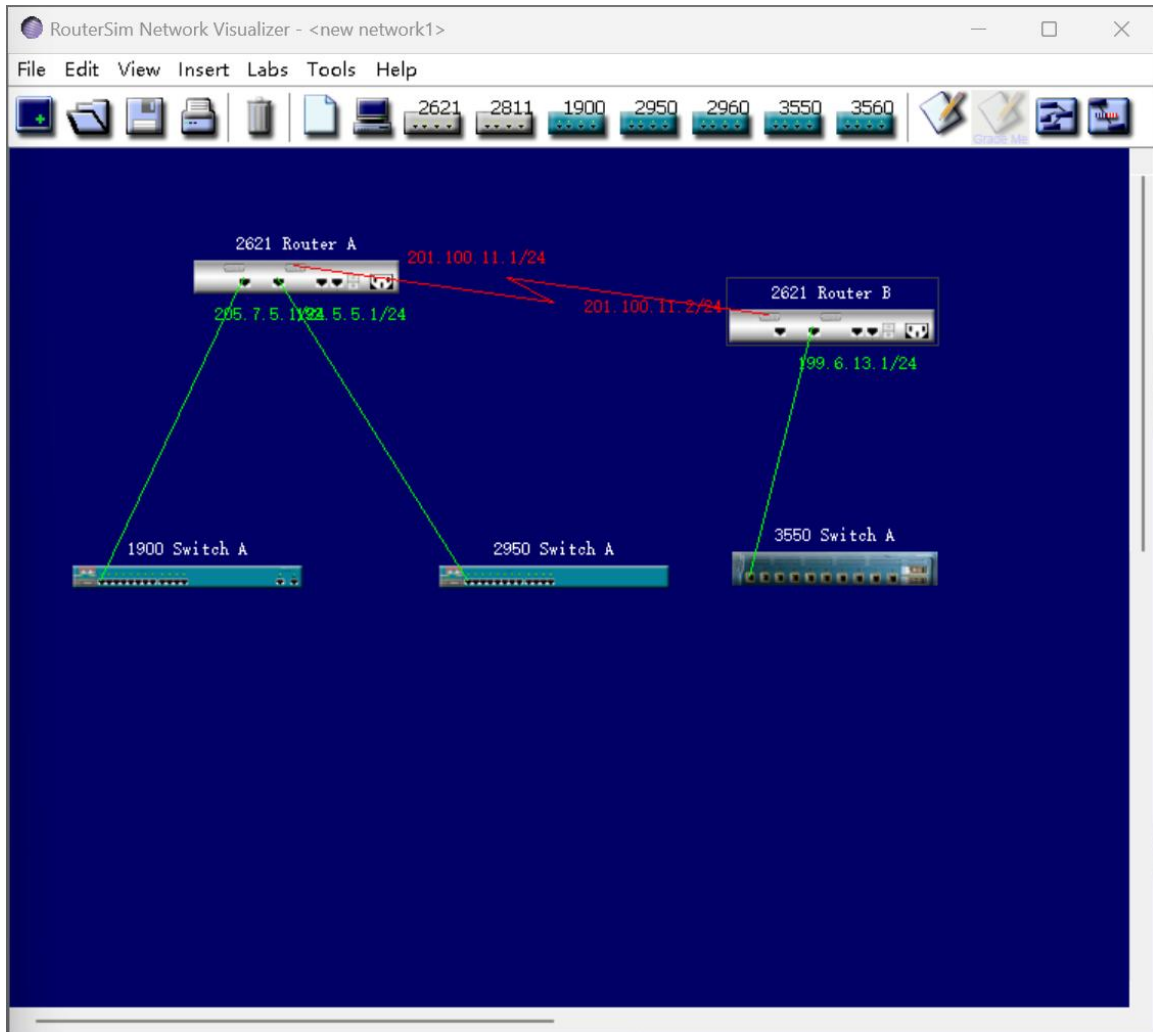
Router(config-if)#int s0/1
Router(config-if)#ip addr 201.100.11.2 255.255.255.0
Router(config-if)#no shutdown
01:27:21 %LINK-3-UPDOWN: Interface Serial0/1, changed state to up
01:27:21 %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1, changed state to up

Router(config-if)#exit
Router(config)#exit
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    199.6.13.0/24 is directly connected, FastEthernet0/0
C    201.100.11.0/24 is directly connected, Serial0/1
Router#

```

配置结果 ip 显示



先使用 `ip route 199.6.13.0 255.255.255.0 201.100.11.2` 命令建立静态路由，之后使用 `ping` 命令

```
Console for 2621 Router A
File Edit View Tools Help

Router Con0 is now available

Press RETURN to get started!

Router>en
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
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    192.5.5.0/24 is directly connected, FastEthernet0/0
C    205.7.5.0/24 is directly connected, FastEthernet0/1
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
Router#
```

2.动态路由配置

开始的连接路由器与交换机操作和静态路由配置相同，下面直接设置命令配置动态路由

1) 设置命令，配置动态路由

设置 routerB 后查看路由表

```
Console for 2621 Router B
File Edit View Tools Help

Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z
Router(config)#router rip
Router(config-router)#network 201.100.11.0
Router(config-router)#network 199.6.13.0
Router(config-router)#exit
Router(config)#exit
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
  Serial0/1            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>

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

设置 routerA 后查看路由表

```

Console for 2621 Router A
File Edit View Tools Help

Router>en
Router#config t
Enter configuration commands, one per line. End with CNTL/Z
Router(config)#router rip
Router(config-router)#network 192.5.5.0
Router(config-router)#205.7.5.0
^
% Invalid input detected at '^' marker.
Router(config-router)#network 205.7.5.0
Router(config-router)#network 201.100.11.0
Router(config-router)#exit
Router(config)#exit
Router#show ip protocols

Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 1 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        00:00:29
  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

```

```

Console for 2621 Router A
File Edit View Tools Help

Router(config-router)#exit
Router(config)#exit
Router#show ip protocols

Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 1 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        00:00:29
  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
S    199.6.13.0 [1/0] via 201.100.11.2
C    201.100.11.0/24 is directly connected, Serial0/0
C    192.5.5.0/24 is directly connected, FastEthernet0/0
C    205.7.5.0/24 is directly connected, FastEthernet0/1
Router#

```

在 routeB 中再次调用 show ip route 命令，查看 routeB 新添加的网络，R 代表通过 rip 协议学到的新网络，动态路由配置成功

```

Console for 2621 Router B
File Edit View Tools Help

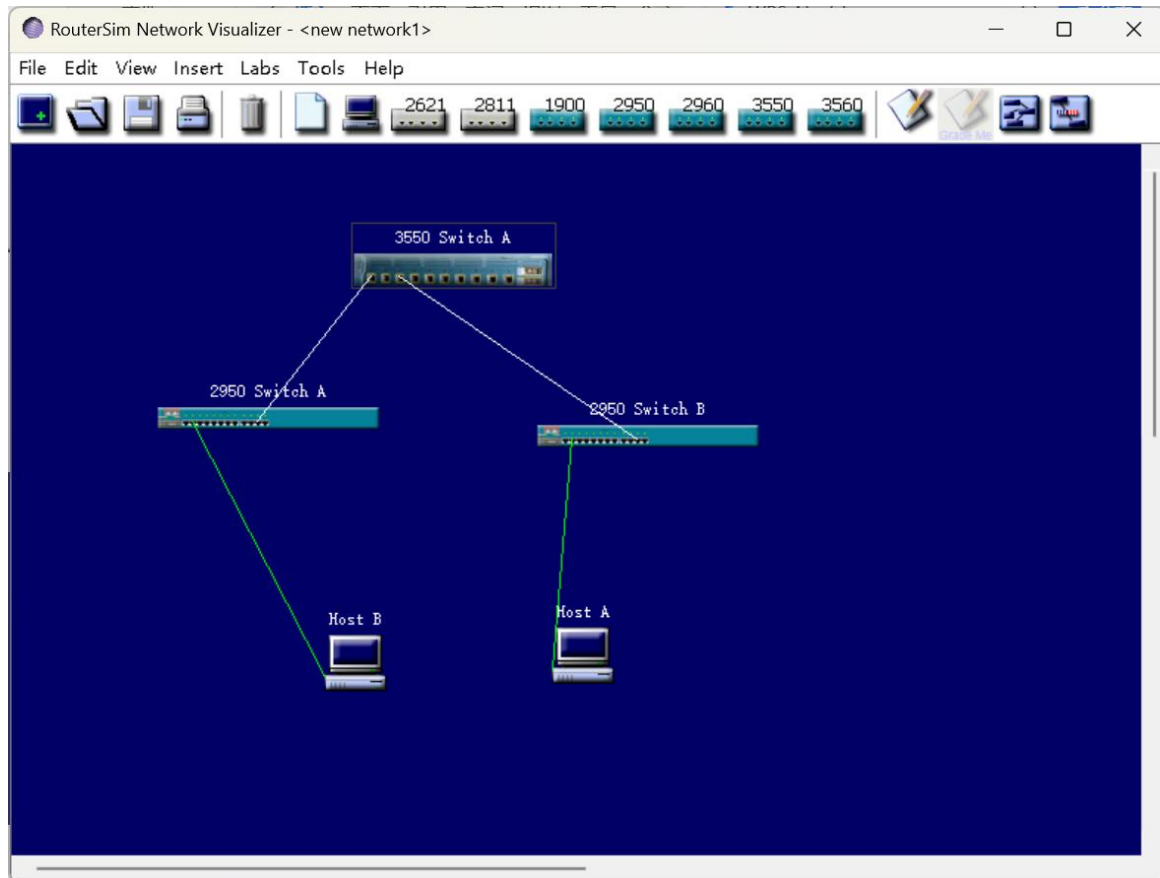
I - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, * - candidate default
U - per-user static route, o - ODR, P - periodic downloaded static route
T - traffic engineered route

Gateway of last resort is not set
C    199.6.13.0/24 is directly connected, FastEthernet0/0
C    201.100.11.0/24 is directly connected, Serial0/1
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    199.6.13.0/24 is directly connected, FastEthernet0/0
R    192.5.5.0 [120/1] via 201.100.11.1, 00:00:04, Serial0/1
C    201.100.11.0/24 is directly connected, Serial0/1
R    205.7.5.0 [120/1] via 201.100.11.1, 00:00:04, Serial0/1
Router#
  
```

3.VLAN 配置

1) 连接路由器、交换机和主机



2) 设置命令，配置 VLAN

配置 3550A 的 vtp

```
Console for 3550 Switch A
File Edit View Tools Help

switch Con0 is now available

Press RETURN to get started!

switch>en
switch>conf 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
3550A(config)#exit
3550A#sh 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 V11 (lowest numbered VLAN interface found)
3550A#_
```

配置 2950 switchA 的 vtp

```
Console for 2950 Switch A
File Edit View Tools Help

switch Con0 is now available

Press RETURN to get started!

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(config)#exit
2950A#sh 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 V11 (lowest numbered VLAN interface found)
2950A#_
```

配置 2950 switchB 的 vtp

```
Console for 2950 Switch B
File Edit View Tools Help

switch Con0 is now available

Press RETURN to get started!

switch>en
switch#conf t
Enter configuration commands, one per line. End with CNTL/Z
switch(config)#hostname 2950B
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(config)#exit
2950B#sh 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 V11 (lowest numbered VLAN interface found)
2950B#_
```

配置 3550A 的 trunk 端口


```
Console for 3550 Switch A
File Edit View Tools Help

3550A Con0 is now available

Press RETURN to get started!

3550A>en
3550A#conf
Enter configuration commands, one per line. End with CNTL/Z
3550A(config)#int fa0/1
3550A(config-if)#switchport trunk encapsulation ?
    dot1q   Interface uses only 802.1q trunking encapsulation when trunking
    isl      Interface uses only ISL trunking encapsulation when trunking
    negotiate Device will negotiate trunking encapsulation with peer on
             interface
3550A(config-if)#switchport trunk encapsulation dot1q
3550A(config-if)#switchport mode trunk
3550A(config-if)#interface fa0/3
3550A(config-if)#switchport trunk encapsulation dot1q
02:49:47: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state
to down
02:49:47: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
3550A(config-if)#switchport mode trunk
3550A(config-if)#
```

配置 2950A 的 trunk 端口

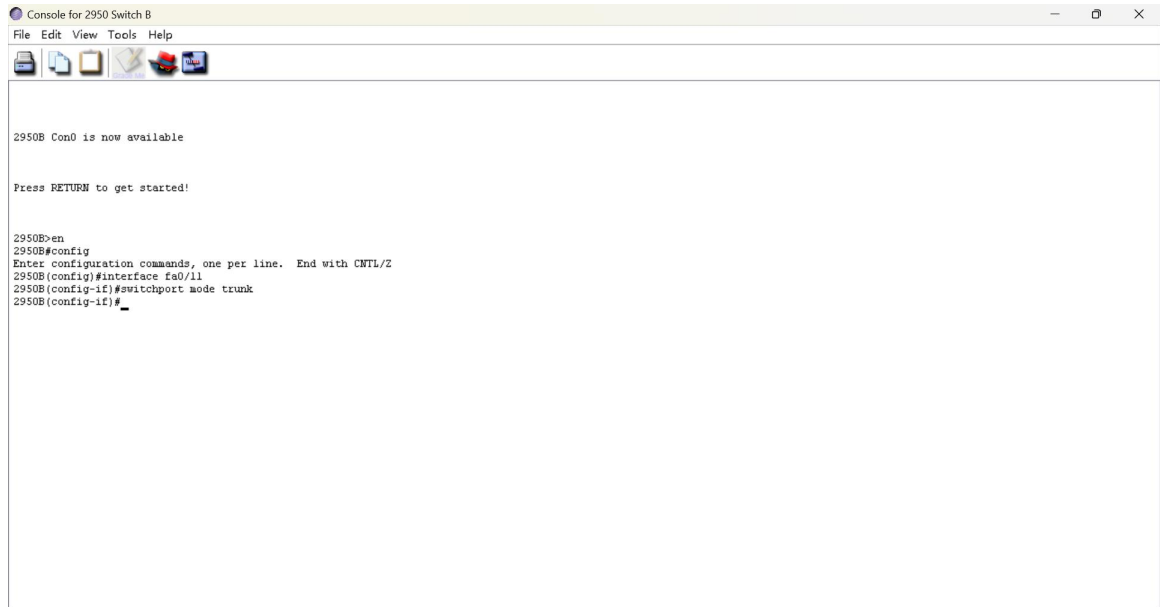
```
Console for 2950 Switch A
File Edit View Tools Help

2950A Con0 is now available

Press RETURN to get started!

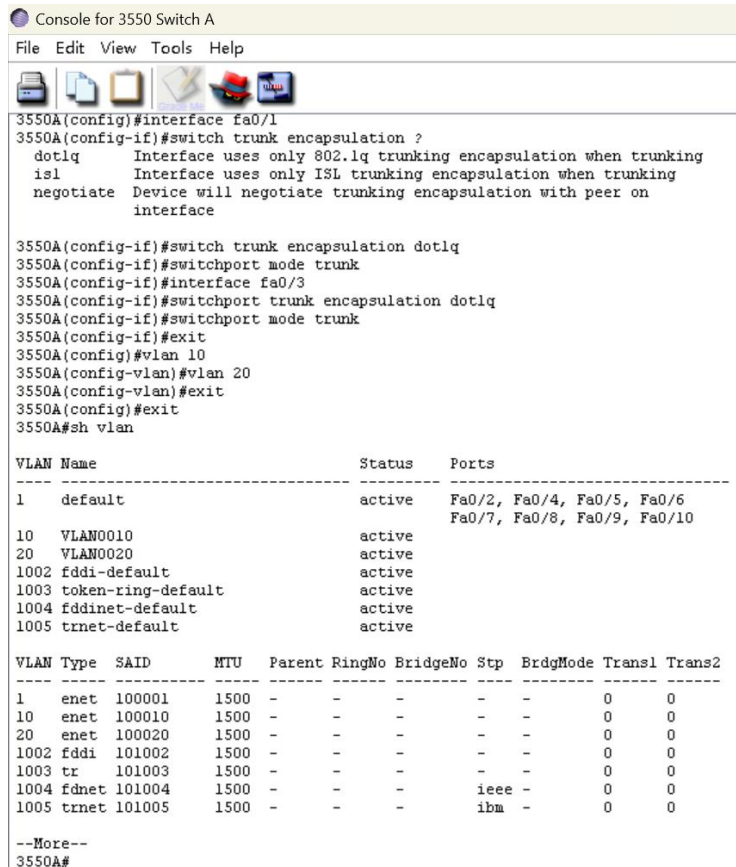
2950A>en
2950A#config
Enter configuration commands, one per line. End with CNTL/Z
2950A(config)#interface fa0/11
2950A(config-if)#switchport mode trunk
2950A(config-if)#_
```

配置 2950B 的 trunk 端口



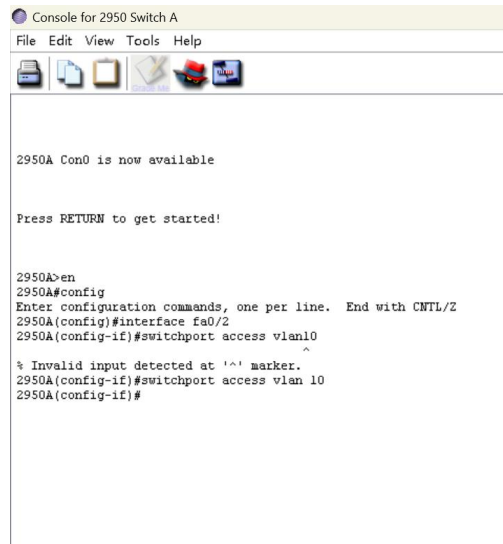
下面进行 VLAN 的创建

打开 3550 switchA



将交换机 2950A 的端口和 2950B 的端口 fa0/2 加入 vlan10 和 vlan20

打开 2950A



```
Console for 2950 Switch A
File Edit View Tools Help

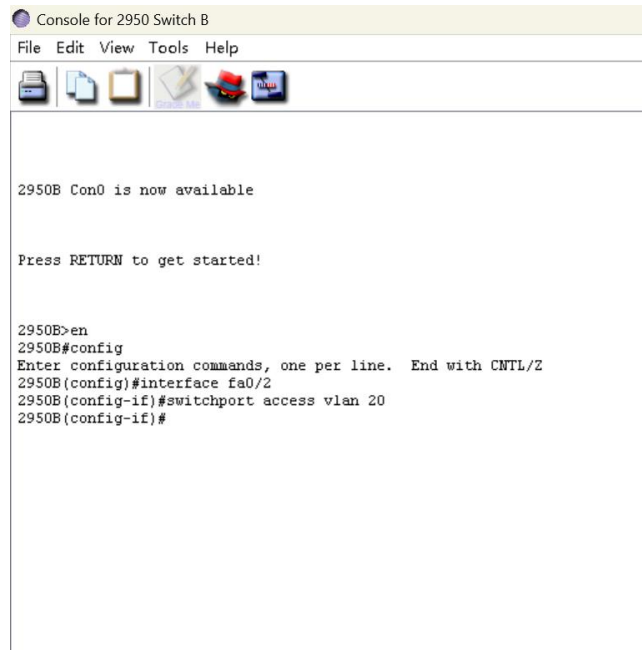
2950A Con0 is now available

Press RETURN to get started!

2950A>en
2950A#config
Enter configuration commands, one per line. End with CNTL/Z
2950A(config)#interface fa0/2
2950A(config-if)#switchport access vlan10

% Invalid input detected at '^' marker.
2950A(config-if)#switchport access vlan 10
2950A(config-if)#
```

打开 2950B



```
Console for 2950 Switch B
File Edit View Tools Help

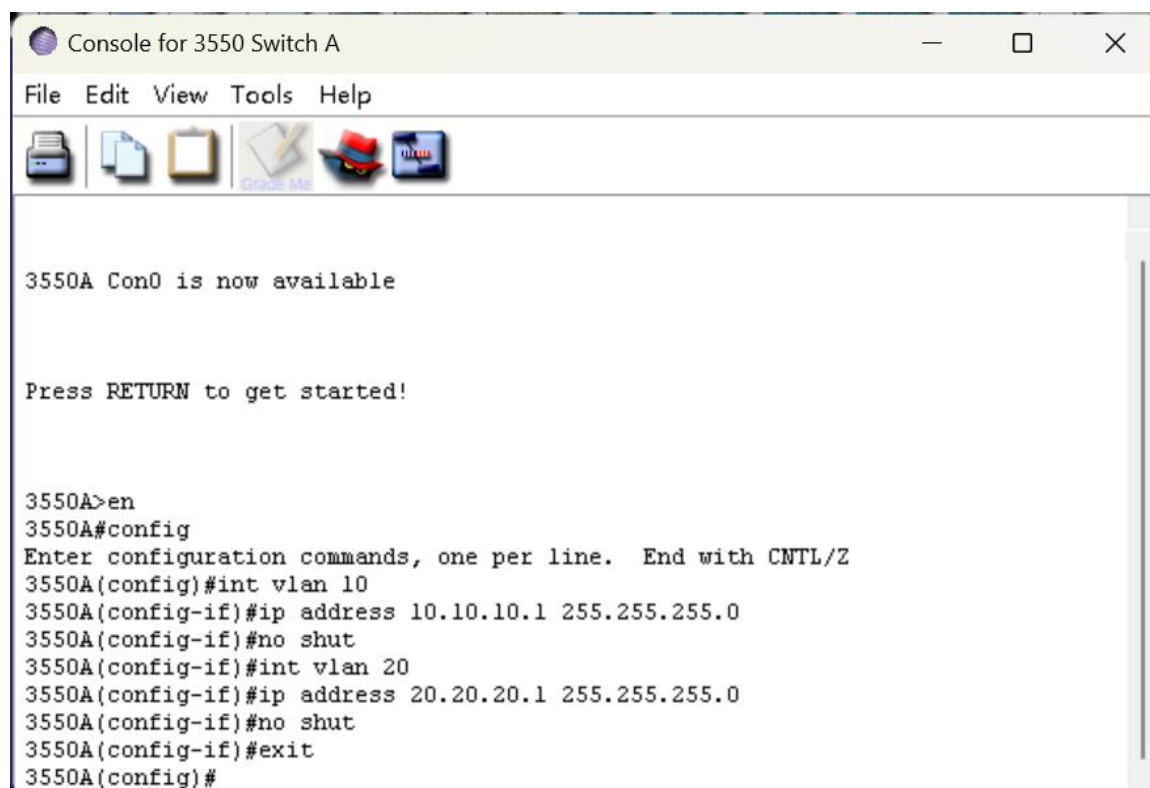
2950B Con0 is now available

Press RETURN to get started!

2950B>en
2950B#config
Enter configuration commands, one per line. End with CNTL/Z
2950B(config)#interface fa0/2
2950B(config-if)#switchport access vlan 20
2950B(config-if)#
```

设置 ip

打开 3550A



The screenshot shows a console window titled "Console for 3550 Switch A". The window has a menu bar with "File", "Edit", "View", "Tools", and "Help". Below the menu bar is a toolbar with icons for a printer, a document, a folder, a notepad, a red hat, and a blue box. The main area of the window displays the following text:

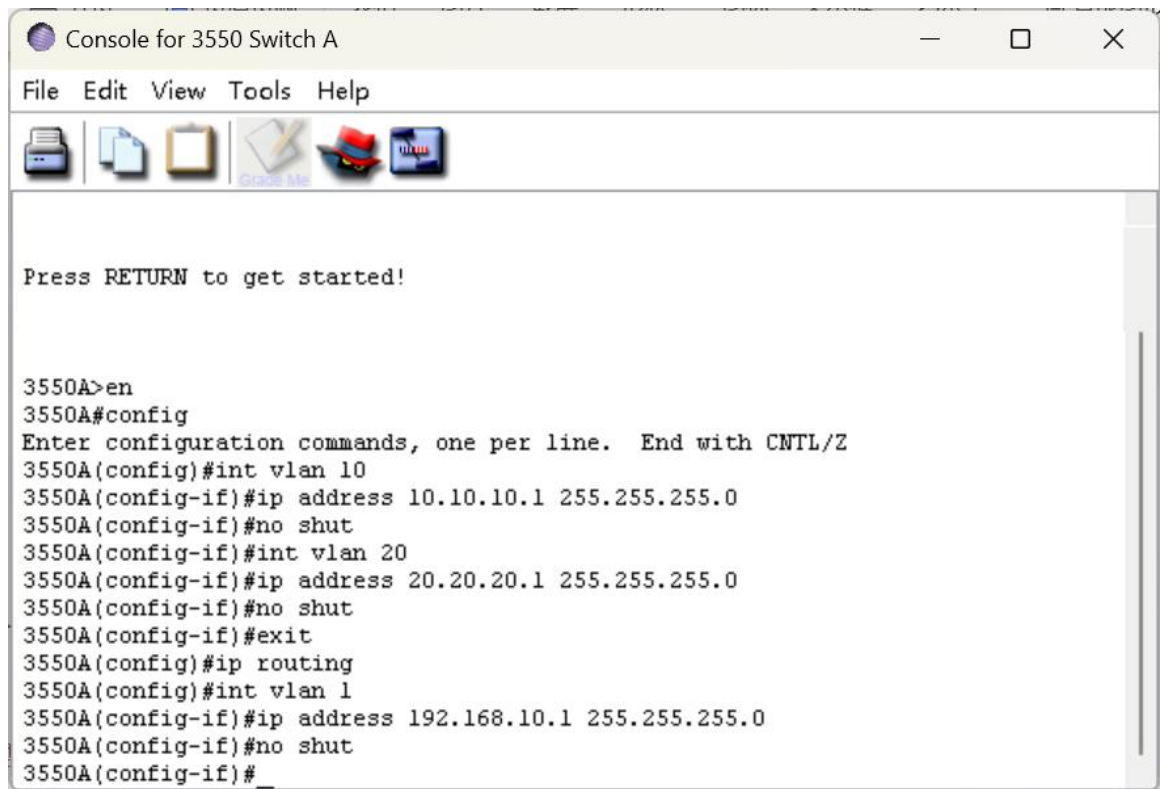
```
3550A Con0 is now available

Press RETURN to get started!

3550A>en
3550A#config
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 shut
3550A(config-if)#int vlan 20
3550A(config-if)#ip address 20.20.20.1 255.255.255.0
3550A(config-if)#no shut
3550A(config-if)#exit
3550A(config)#_
```

配置各交换机的管理地址

打开 3550A

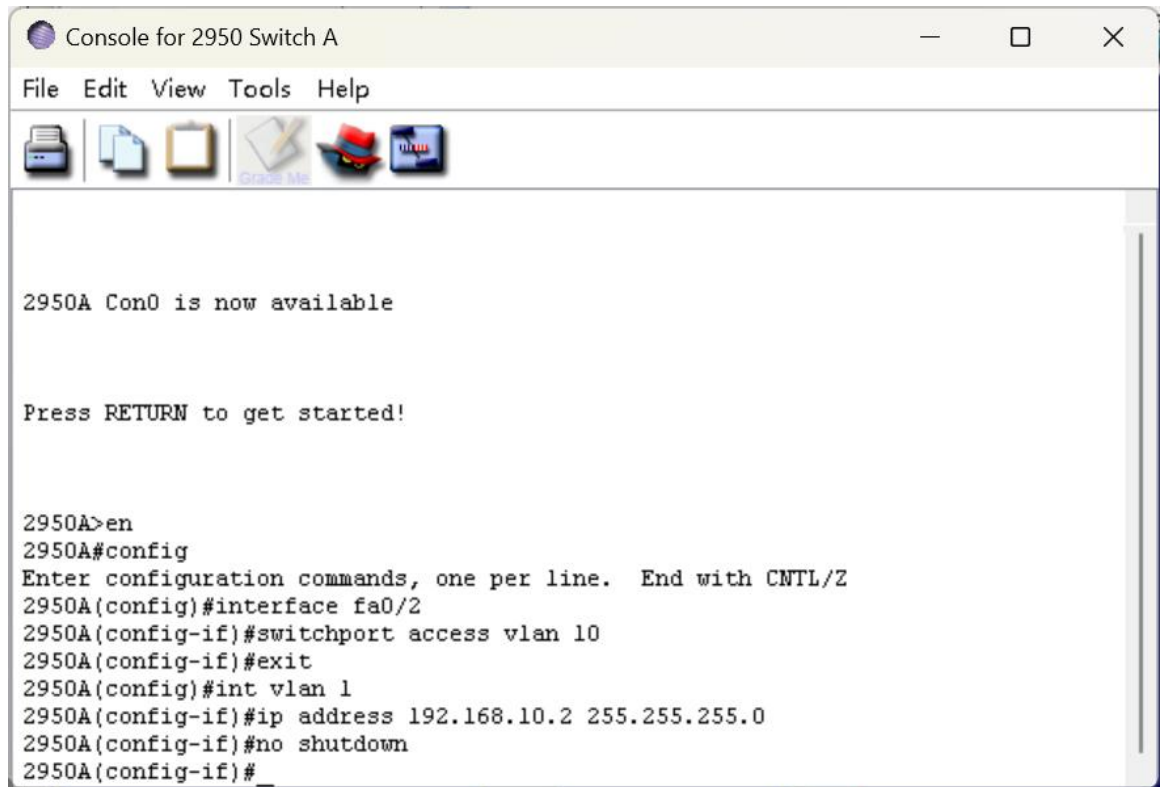


The screenshot shows a terminal window titled "Console for 3550 Switch A". The window has a menu bar with "File", "Edit", "View", "Tools", and "Help". Below the menu bar is a toolbar with icons for a printer, a document, a folder, a notepad, a red hat, and a blue box. The main text area contains the following commands and prompts:

```
Press RETURN to get started!

3550A>en
3550A#config
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 shut
3550A(config-if)#int vlan 20
3550A(config-if)#ip address 20.20.20.1 255.255.255.0
3550A(config-if)#no shut
3550A(config-if)#exit
3550A(config)#ip routing
3550A(config)#int vlan 1
3550A(config-if)#ip address 192.168.10.1 255.255.255.0
3550A(config-if)#no shut
3550A(config-if)#_
```

打开 2950A

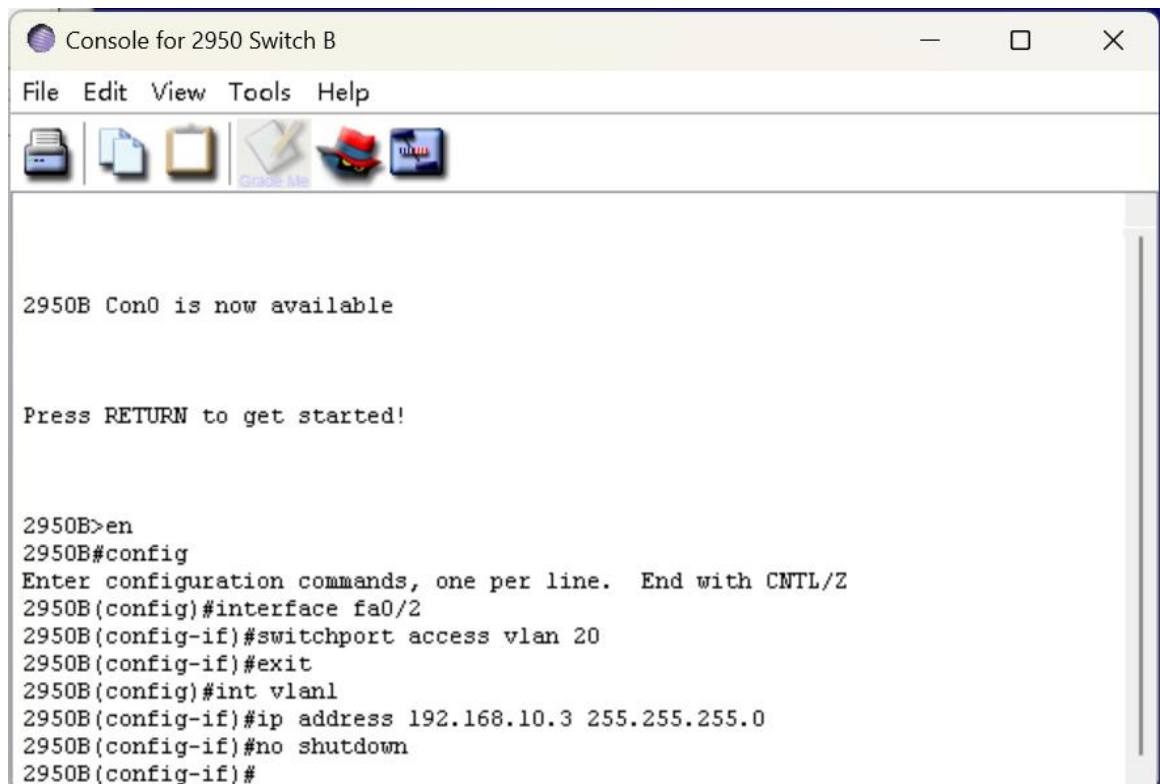


```
2950A Con0 is now available

Press RETURN to get started!

2950A>en
2950A#config
Enter configuration commands, one per line. End with CNTL/Z
2950A(config)#interface fa0/2
2950A(config-if)#switchport access vlan 10
2950A(config-if)#exit
2950A(config)#int vlan 1
2950A(config-if)#ip address 192.168.10.2 255.255.255.0
2950A(config-if)#no shutdown
2950A(config-if)#_
```

打开 2950B



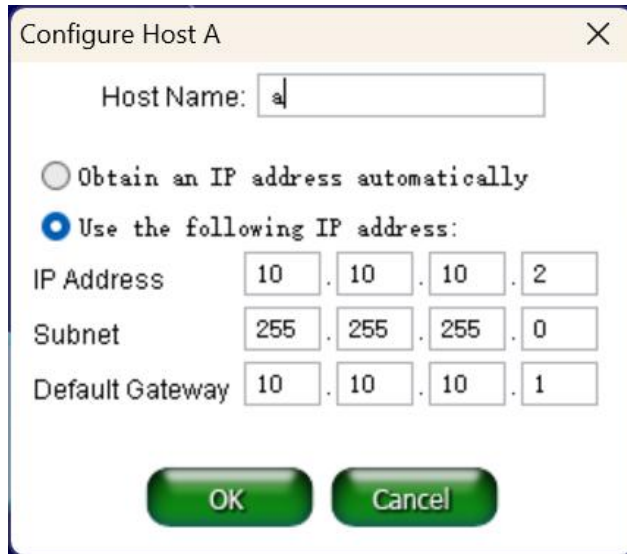
```
2950B Con0 is now available

Press RETURN to get started!

2950B>en
2950B#config
Enter configuration commands, one per line. End with CNTL/Z
2950B(config)#interface fa0/2
2950B(config-if)#switchport access vlan 20
2950B(config-if)#exit
2950B(config)#int vlan1
2950B(config-if)#ip address 192.168.10.3 255.255.255.0
2950B(config-if)#no shutdown
2950B(config-if)#_
```

设置主机

设置主机 A



The 'Configure Host A' dialog box is shown. It has a title bar with a close button. The 'Host Name' field contains 'a'. There are two radio buttons: 'Obtain an IP address automatically' (unselected) and 'Use the following IP address:' (selected). Below the radio buttons are three rows of input fields: 'IP Address' with values 10, 10, 10, 2; 'Subnet' with values 255, 255, 255, 0; and 'Default Gateway' with values 10, 10, 10, 1. At the bottom are 'OK' and 'Cancel' buttons.

Field	Value 1	Value 2	Value 3	Value 4
IP Address	10	10	10	2
Subnet	255	255	255	0
Default Gateway	10	10	10	1

设置主机 B



The 'Configure Host B' dialog box is shown. It has a title bar with a close button. The 'Host Name' field contains 'b'. There are two radio buttons: 'Obtain an IP address automatically' (unselected) and 'Use the following IP address:' (selected). Below the radio buttons are three rows of input fields: 'IP Address' with values 20, 20, 20, 2; 'Subnet' with values 255, 255, 255, 0; and 'Default Gateway' with values 20, 20, 20, 1. At the bottom are 'OK' and 'Cancel' buttons.

Field	Value 1	Value 2	Value 3	Value 4
IP Address	20	20	20	2
Subnet	255	255	255	0
Default Gateway	20	20	20	1

下面进行测试

在 3550 上分别 ping 两台交换机

```
Console for 3550 Switch A
File Edit View Tools Help

3550A Con0 is now available

Press RETURN to get started!

3550A>en
3550A#config
Enter configuration commands, one per line. End with CMTL/Z
3550A(config)#int vlan 10
3550A(config-if)#ip address 10.10.10.1 255.255.255.0
3550A(config-if)#no shut
3550A(config-if)#int vlan 20
3550A(config-if)#ip address 20.20.20.1 255.255.255.0
3550A(config-if)#no shut
3550A(config-if)#exit
3550A(config)#ip routing
3550A(config)#int vlan 1
3550A(config-if)#ip address 192.168.10.1 255.255.255.0
3550A(config-if)#no shut
3550A(config-if)#exit
3550A(config)#exit
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
3550A#
```

在主机上 ping

从 ApingB

```
Console for Host A
File Edit View Tools Help

Microsoft Windows 2000 [Version 5.00.2195]
(C) Copyright 1985-1999 Microsoft Corp.

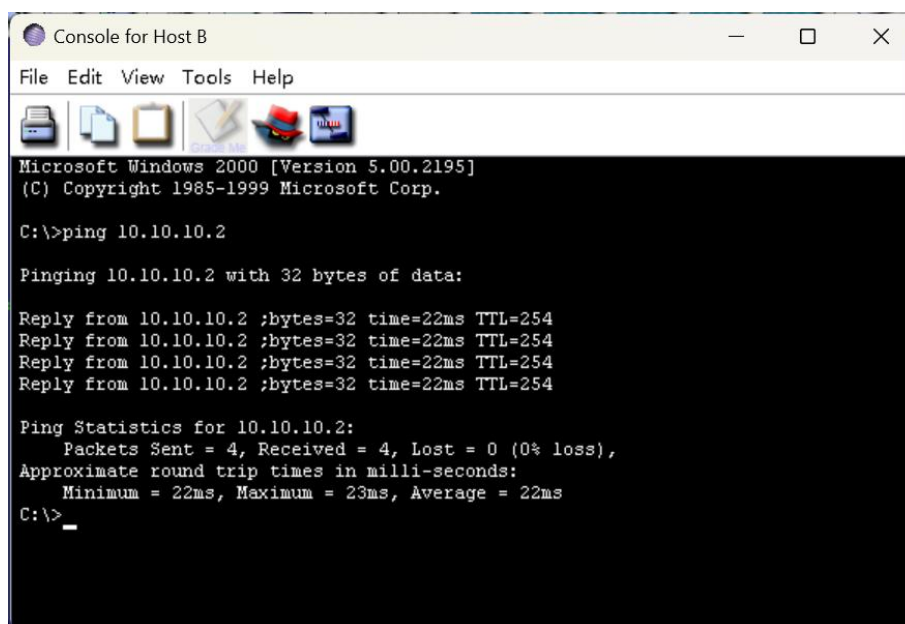
C:\>ping 20.20.20.2

Pinging 20.20.20.2 with 32 bytes of data:

Reply from 20.20.20.2 :bytes=32 time=22ms TTL=254
Reply from 20.20.20.2 :bytes=32 time=22ms TTL=254
Reply from 20.20.20.2 :bytes=32 time=22ms TTL=254
Reply from 20.20.20.2 :bytes=32 time=22ms TTL=254

Ping Statistics for 20.20.20.2:
    Packets Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 22ms, Maximum = 23ms, Average = 22ms
C:\>
```

从 Bping 到 A



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

C:\>ping 10.10.10.2

Pinging 10.10.10.2 with 32 bytes of data:

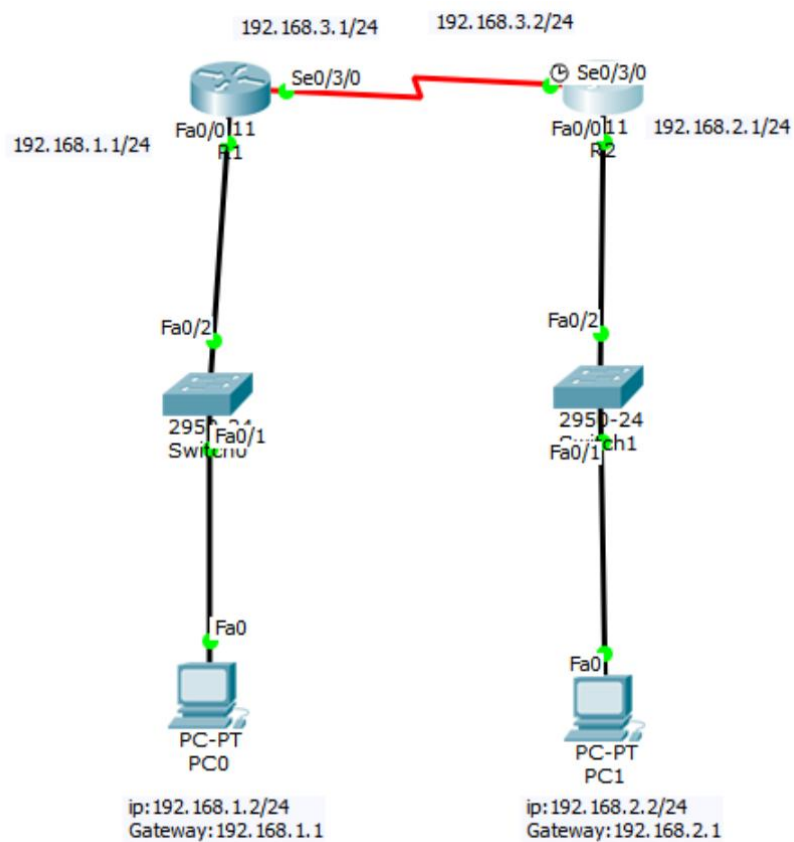
Reply from 10.10.10.2 :bytes=32 time=22ms TTL=254
Reply from 10.10.10.2 :bytes=32 time=22ms TTL=254
Reply from 10.10.10.2 :bytes=32 time=22ms TTL=254
Reply from 10.10.10.2 :bytes=32 time=22ms TTL=254

Ping Statistics for 10.10.10.2:
    Packets Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 22ms, Maximum = 23ms, Average = 22ms
C:\>
```

三、按照附件二视频介绍思科模拟器 Packet Tracer 7.0 使用，配置静态路由，配置各种网络设备组网的综合实验。

1.配置静态路由

搭建如下的实验拓扑图：



1) 设置两台电脑的 IP 和网关

PC0

Physical Config Desktop Custom Interface

IP Configuration

IP Configuration

☐ DHCP ☒ Static

IP Address: 192.168.1.2

Subnet Mask: 255.255.255.0

Default Gateway: 192.168.1.1

DNS Server:

IPv6 Configuration

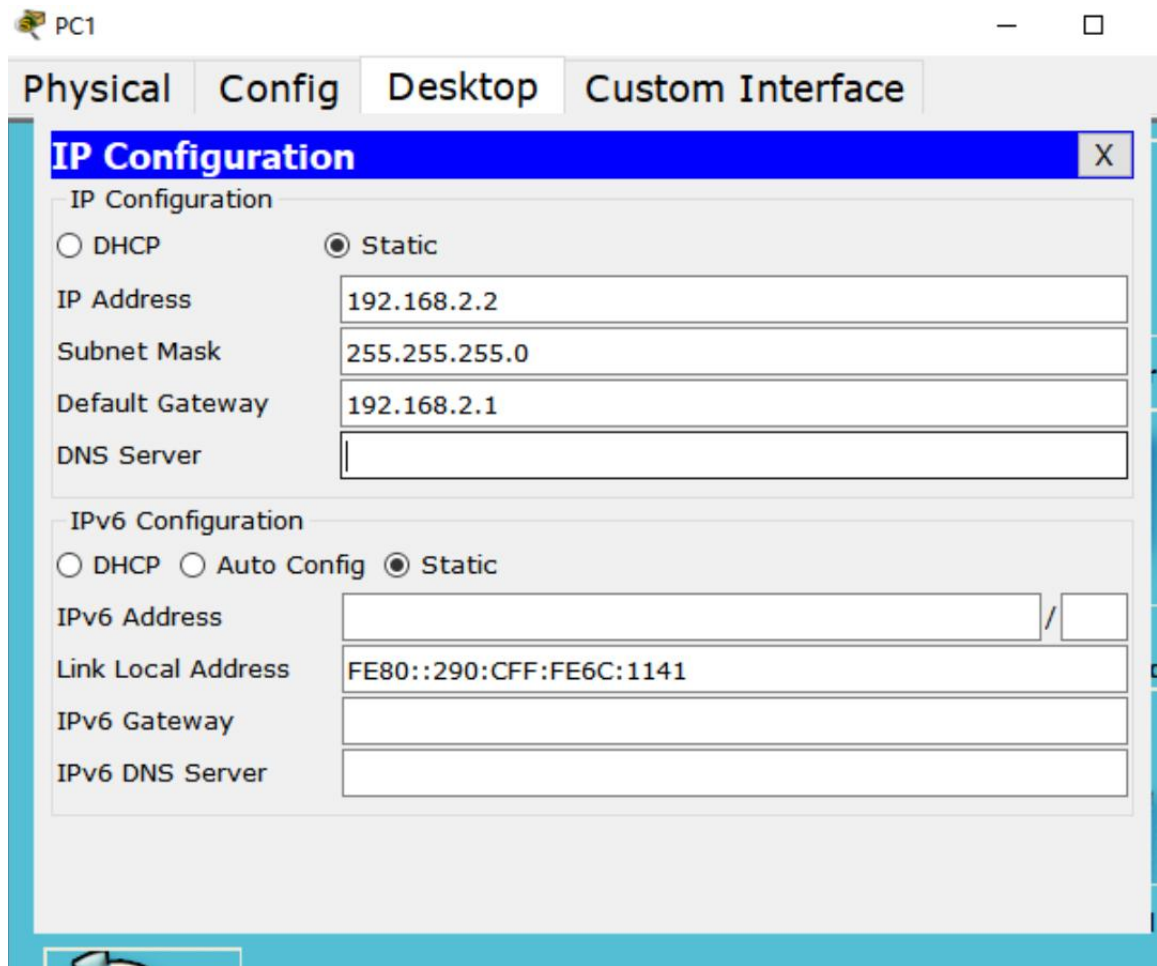
☐ DHCP ☐ Auto Config ☒ Static

IPv6 Address: /

Link Local Address: FE80::260:3EFF:FE0C:AE5D

IPv6 Gateway:

IPv6 DNS Server:



2) 配置路由器接口的 IP 地址

```

Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname R1
R1(config)#int f0/0
R1(config-if)#ip add 192.168.1.1 255.255.255.0
R1(config-if)#no shut
R1(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
R1(config-if)#exit
R1(config)#int s0/3/0
R1(config-if)#ip add 192.168.3.1 255.255.255.0
R1(config-if)#clock rate 64000
R1(config-if)#exit

Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname R2
R2(config)#int f0/0
R2(config-if)#ip add 192.168.2.1 255.255.255.0
R2(config-if)#no shut
Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up
R2(config-if)#int s0/3/0
R2(config-if)#ip add 192.168.3.2 255.255.255.0
R2(config-if)#clock rate 64000
R2(config-if)#no shut
%LINK-5-CHANGED: Interface Serial0/3/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/3/0, changed state to up
R2(config-if)#exit
R2(config)#

```

3) 分别给 R1 和 R2 配置静态路由

```

R1(config)#ip route 192.168.2.0 255.255.255.0 192.168.3.2
R1(config)#exit
R1#sh 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, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

```

Gateway of last resort is not set

```

C 192.168.1.0/24 is directly connected, FastEthernet0/0
S 192.168.2.0/24 [1/0] via 192.168.3.2
C 192.168.3.0/24 is directly connected, Serial0/3/0

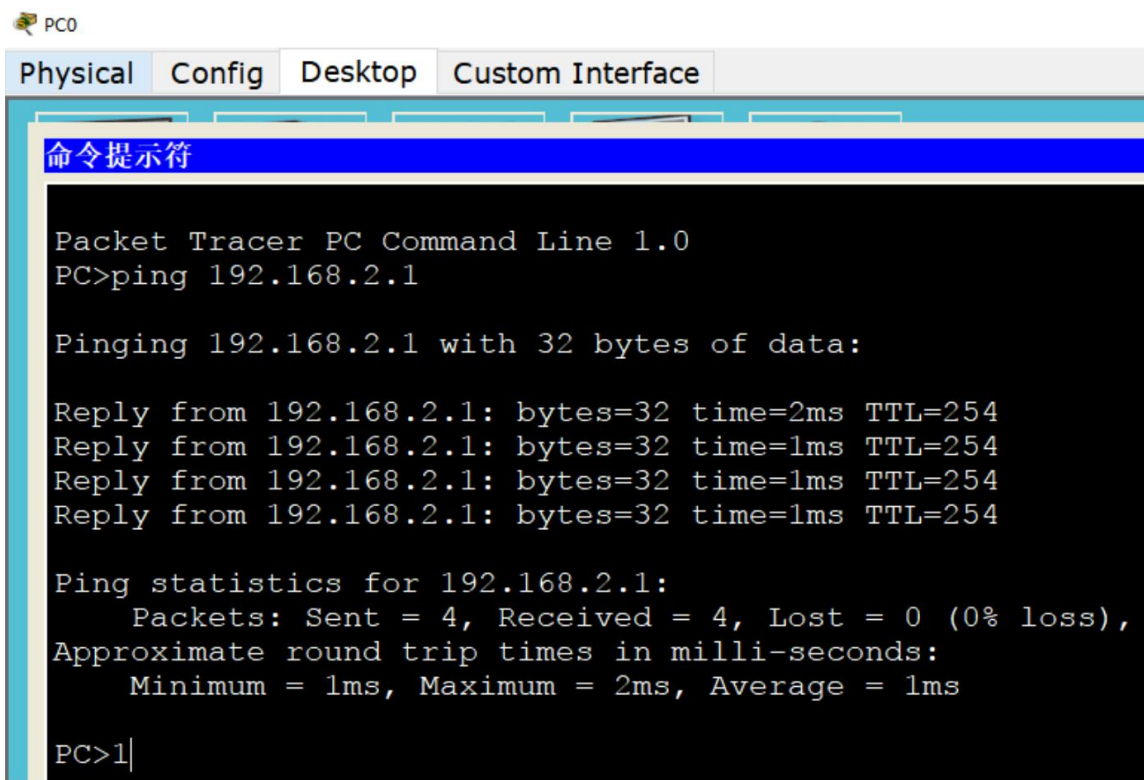
```

```
R2(config)#ip route 192.168.1.0 255.255.255.0 192.168.3.1
R2(config)#exit
R2#sh 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, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route
```

Gateway of last resort is not set

```
S 192.168.1.0/24 [1/0] via 192.168.3.1
C 192.168.2.0/24 is directly connected, FastEthernet0/0
C 192.168.3.0/24 is directly connected, Serial0/3/0
```

4) ping 测试连通性



4 实验代码

本次实验的代码已上传于以下代码仓库：<https://www.gitee.com/xxx/xxx>。（注意：建议使用码云，并设置公开权限；本学期暂不推荐使用 GitHub；如使用厦门大学私有 Git 服务，应将 whuang@xmu.edu.cn 加入项目成员备查，本段话删除。）

5 课后思考题

5.2 思考题：

四、思考题

怎样对路由器设置密码保护？利用 `show` 命令如何判定网络故障？路由器有几种配置模式？如何在各个配置模式之间进行切换？如何判定路由器的串口是广域网的 DTE 端还是 DCE 端？

答：1. 怎样对路由器设置密码保护？

设置特权模式密码：

明文密码：在全局配置模式下（`configure terminal` 进入），使用命令 `enable password [password]`，例如 `enable password cisco123`。

加密密码：在全局配置模式下，使用命令 `enable secret [password]`，如 `enable secret cisco456`，此密码会被加密存储，安全性更高。

设置控制台（Console）密码：进入线路配置模式，命令为 `line console 0`，然后使用 `password [password]` 命令设置密码，如 `password consolepass`，再用 `login` 命令启用登录验证。

设置虚拟终端（Telnet/SSH）密码：

Telnet：进入线路配置模式，命令为 `line vty 0 4`（0 - 4 表示允许同时连接的虚拟终端线路数），使用 `password [password]` 设置密码，如 `password telnetpass`，并使用 `login` 启用登录验证。

SSH：首先要配置设备域名（`ip domain - name [domain]`），生成密钥对（`crypto key generate rsa`），进入线路配置模式 `line vty 0 4`，使用 `transport input ssh` 只允许

SSH 连接，再用 `login local` 并配合本地用户名密码进行认证（需先配置用户名和密码，如 `username [username] password [password]`）。

2. 利用 `show` 命令如何判定网络故障？

查看接口状态：使用 `show interfaces [interface]`，如 `show interfaces FastEthernet0/0`。若接口状态显示为 `down / down`，可能是物理连接问题（如网线没插好、端口硬件故障等）；若显示为 `up / down`，可能是链路层协议配置问题（如封装不匹配）。

查看路由表：通过 `show ip route` 命令。若目的网络不在路由表中，可能是路由协议配置错误、静态路由未正确配置等，导致无法找到到达目的网络的路径。

查看 ARP 表：用 `show arp` 命令。若 ARP 表中没有对应 IP 地址的 MAC 地址映射，可能导致无法进行二层转发，可能是 ARP 学习失败，如网络中存在 ARP 欺骗等情况。

查看接口统计信息：`show interfaces [interface] statistics`，可查看接口的错误统计，如输入输出错误包数量等，若错误包数量持续增加，可能存在链路质量问题、接口冲突等。

3. 路由器有几种配置模式？如何在各个配置模式之间进行切换？

用户模式：路由器启动后默认进入，提示符为 `Router>`。此模式权限低，只能执行少量查看命令。

特权模式：从用户模式输入 `enable` 命令并输入正确密码（若设置了）可进入，提示符为 `Router#`，可执行更多查看设备状态、调试等高级命令。

全局配置模式：在特权模式下输入 `configure terminal` 进入，提示符为 `Router(config)#`，用于对路由器整体进行配置，如设置主机名、密码等。

接口配置模式：在全局配置模式下，使用 `interface [interface - type] [interface - number]` 进入，如 `interface FastEthernet0/0`，提示符变为 `Router(config-if)#`，用于配置接口相关参数，如 IP 地址、封装协议等。

线路配置模式：在全局配置模式下，使用 `line [line - type] [line - number]` 进入，如 `line console 0` 或 `line vty 0 4`，提示符为 `Router(config-line)#`，用于配置线路相关参数，如设置密码、超时时间等。

路由协议配置模式：在全局配置模式下，启用相应路由协议进入，如 `router ospf 1` 进入 OSPF 路由协议配置模式，提示符为 `Router(config-router)#`，用于配置路由协议相关参数，如宣告网络等。

切换方式总结：从低权限模式向高权限模式切换，使用对应命令（如 `enable`、`configure terminal` 等）；从高权限模式返回低权限模式，使用 `exit` 命令，若要直接回到用户模式，使用 `end` 命令。

4. 如何判定路由器的串口是广域网的 DTE 端还是 DCE 端？

查看接口配置：使用 `show interfaces [serial - interface]` 命令，如 `show interfaces Serial0/0`，如果显示信息中有 `clock rate`（时钟速率）相关配置，说明该接口是 DCE 端，因为 DCE 设备负责提供时钟信号；若没有 `clock rate` 配置，则为 DTE 端。

查看线缆连接：如果路由器串口连接的是 CSU/DSU（信道服务单元 / 数据服务单元）设备，一般路由器端为 DTE，CSU/DSU 为 DCE；若直接连接调制解调器等设备，也可根据设备角色判断，调制解调器常作为 DCE 提供时钟信号，路由器为 DTE。

5.3 思考题

四、思考题

如何实现如图 5.49 所示的网络 10.0.0.0 与 172.16.1.0 的互通，给出你的配置方案，其中路由器各端口的 IP 地址可以自己设定（在设计配置方案时，可将路由器 A、B、C 的常规配置也考虑进去，比如说路由器的口令、名字、各端口描述，等等）。

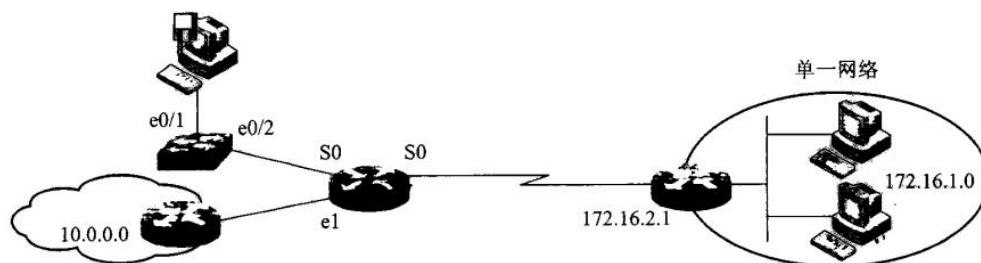


图 5.49 思考题的网络拓扑

答：以下是实现网络 10.0.0.0 与 172.16.1.0 互通的配置方案：

路由器命名与口令设置

路由器 A

```
enable secret cisco
```

```
hostname RouterA
```

路由器 B

```
enable secret cisco
```

```
hostname RouterB
```

路由器 C

```
enable secret cisco
```

```
hostname RouterC
```

接口 IP 地址配置

假设各路由器接口 IP 地址规划如下：

路由器 A：

e0/1 连接 10.0.0.0 网络，设 IP 为 10.0.0.1/24

e0/2 连接路由器 B，设 IP 为 192.168.1.1/24

```
interface Ethernet0/1
```

```
ip address 10.0.0.1 255.255.255.0
```

```
description Connect to 10.0.0.0 network
```

```
no shutdown
```

```
interface Ethernet0/2
```

```
ip address 192.168.1.1 255.255.255.0
```

```
description Connect to RouterB
```

```
no shutdown
```

路由器 B:

S0 连接路由器 A，设 IP 为 192.168.1.2/24

S1 连接路由器 C，设 IP 为 192.168.2.1/24

```
interface Serial0
```

```
ip address 192.168.1.2 255.255.255.0
```

```
description Connect to RouterA
```

```
no shutdown
```

```
interface Serial1
```

```
ip address 192.168.2.1 255.255.255.0
```

```
description Connect to RouterC
```

```
no shutdown
```

路由器 C:

S0 连接路由器 B，设 IP 为 192.168.2.2/24

连接 172.16.1.0 网络的接口设 IP 为 172.16.1.1/24

```
interface Serial0
```

```
ip address 192.168.2.2 255.255.255.0
```

```
description Connect to RouterB
```

```
no shutdown
```

```
interface Ethernet0/1
```

```
ip address 172.16.1.1 255.255.255.0
```

```
description Connect to 172.16.1.0 network
```

```
no shutdown
```

路由配置

这里采用静态路由配置：

路由器 A

```
ip route 172.16.1.0 255.255.255.0 192.168.1.2
```

路由器 B

```
ip route 10.0.0.0 255.255.255.0 192.168.1.1
```

```
ip route 172.16.1.0 255.255.255.0 192.168.2.2
```

路由器 C

```
ip route 10.0.0.0 255.255.255.0 192.168.2.1
```

通过以上配置，完成路由器命名、口令设置、接口 IP 配置以及静态路由配置，可实现 10.0.0.0 与 172.16.1.0 网络的互通。

6 实验总结

通过模拟器学习并巩固了路由器配置的相关知识技能。