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　路由器基本配置

班　　级　数字媒体技术

姓　　名　陈海玲

学　　号　35820212203215

实验时间　2024 年 10 月 25 日

2024 年 10 月 25 日

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，勿超过 5MB；

4、应将材料清单上传在代码托管平台上；

5、在学期最后一节课前按要求打包发送至 cni21@qq.com。

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、P 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

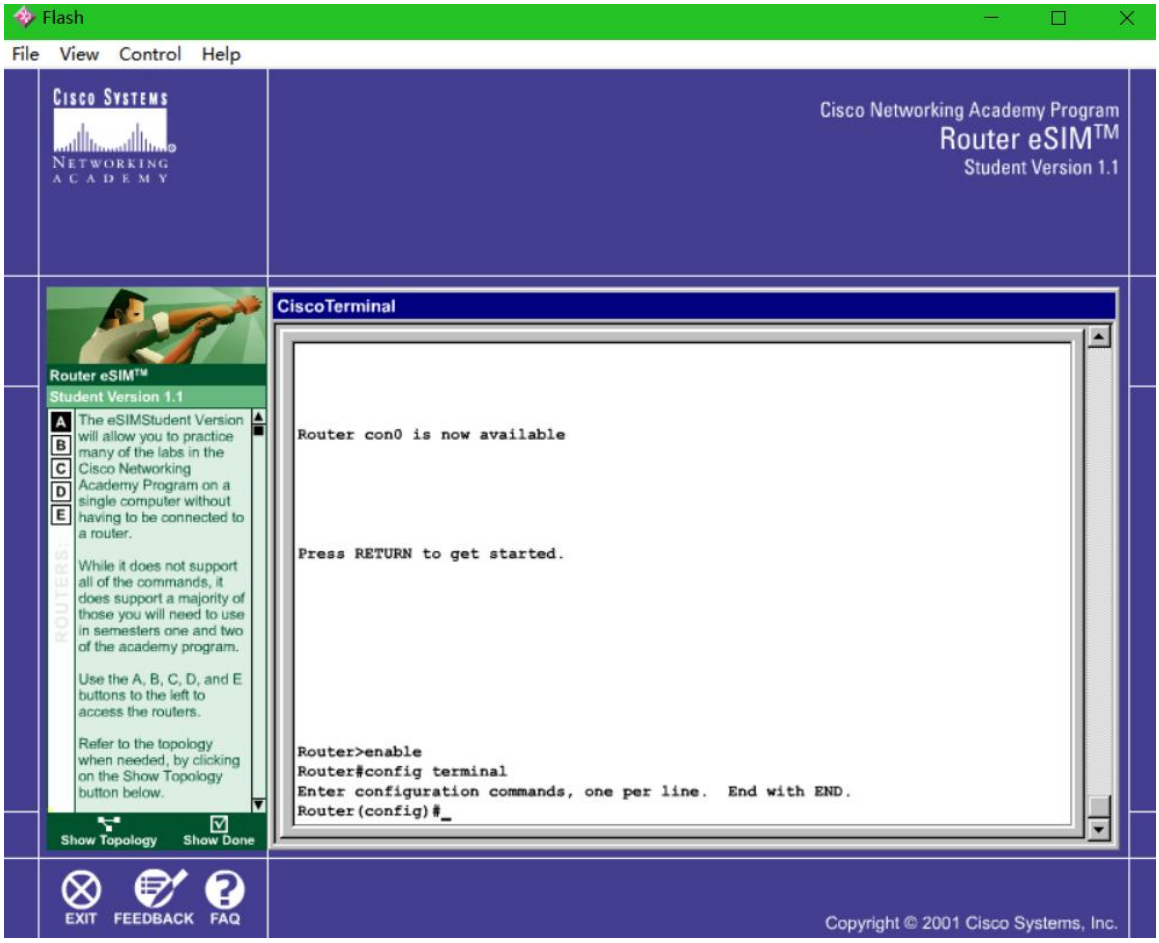
Windows10

3 实验结果

（一）cisco ios 的基本操作和路由器的常规配置

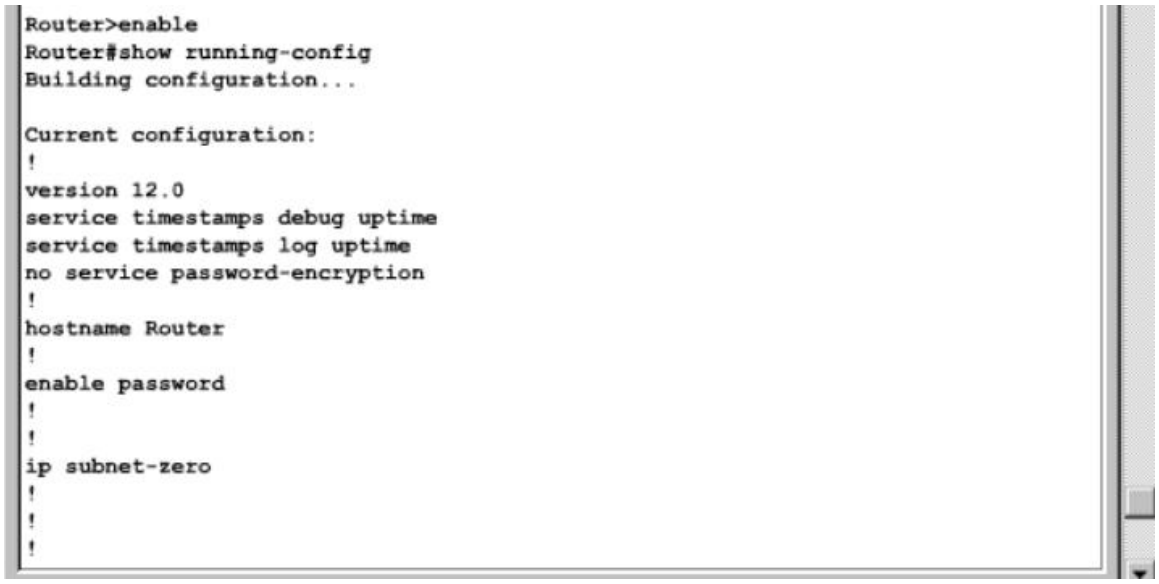
1. 路由器配置模式切换

输入“enable”进入超级用户模式，输入“config terminal”进入全局配置模式



2. 查看路由器的运行状态

① show running-config 显示当前运行状态的配置



② show startup-confg 显示保存在路由器 NVRAM 里的配置

```
Router#show startup-config
 %% Non-volatile configuration memory is not present
Router#_
```

③ show interfaces 命令显示了各接口的配置参数和工作数据

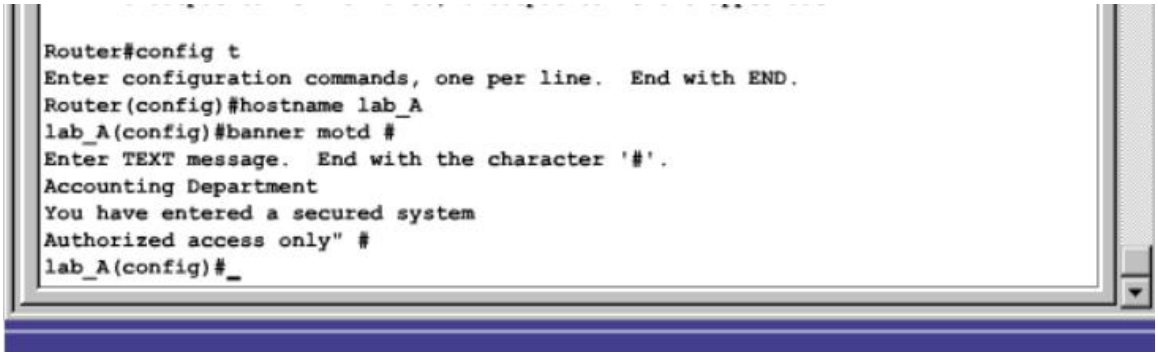
```
Router#show interfaces
Ethernet0 is administratively down, line protocol is down
   Hardware is Lance, address is 00d0.58ac.ec1f(bia 00d0.58ac.ec1f)
   MTU 1500 bytes, BW 10000 Kbit, DLY 1000 usec,
      reliability 252/255, txload 1/255, rxload 1/255
   Encapsulation ARPA, loopback not set
   Keepalive set (10 sec)
   ARP type: ARPA, ARP Timeout 04:00:00
   Last input never, output 00:00:20, output hang never
   Last clearing of "show interface" counters never
   Queueing strategy: fifo
   Output queue 0/40, 0 drops; input queue 0/75, 0 drops
   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 input packets with dribble condition detected
      6 packets output, 360 bytes, 0 underruns
```

④ show version 显示当前运行在路由器上的 Cisco IOS 的版本号、路由器的型号。

```
Router>show history
  show running-config
  show history
Router>show version
Cisco Internetwork Operating System Software
IOS (tm) 2500 Software (C2500-IS-L), Version 12.0(5), RELEASE SOFTWARE (fc1)
Copyright (c) 1986-1999 by cisco Systems, Inc.
Copyright (c) 1986-1999 by cisco Systems, Inc.
Image text-base: 0x0303D744, data-base: 0x00001000

ROM: System Bootstrap, Version 5.2(8a), RELEASE SOFTWARE
BOOTFLASH: 3000 Bootstrap Software (IGS-RXBOOT), Version 10.2(8a), RELEASE SOFTW
ARE (fc1)

Router uptime is 0 hours, 24 minutes
System restarted by power-on
System image file is "flash:ip.plus.c2500-is-l_120-5.bin"

cisco 2500 (68030) processor (revision D) with 4096K/2048K bytes of memory.
Processor board ID 02930235, with hardware revision 00000000
Bridging software.
```

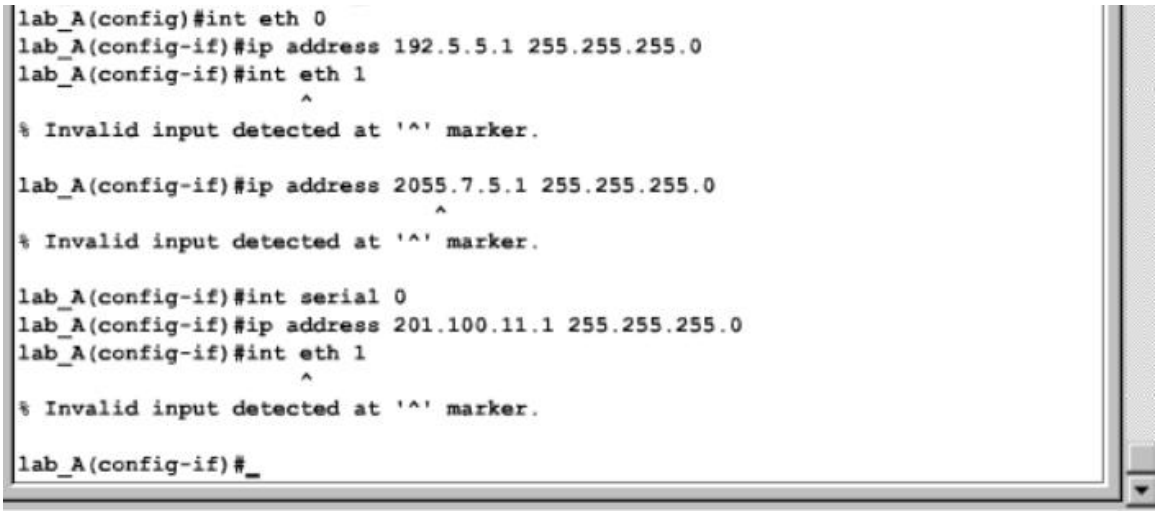
3. 路由器的一些常规配置

（1）修改路由器名字，以及用“banner mod 设置当日消息标题”



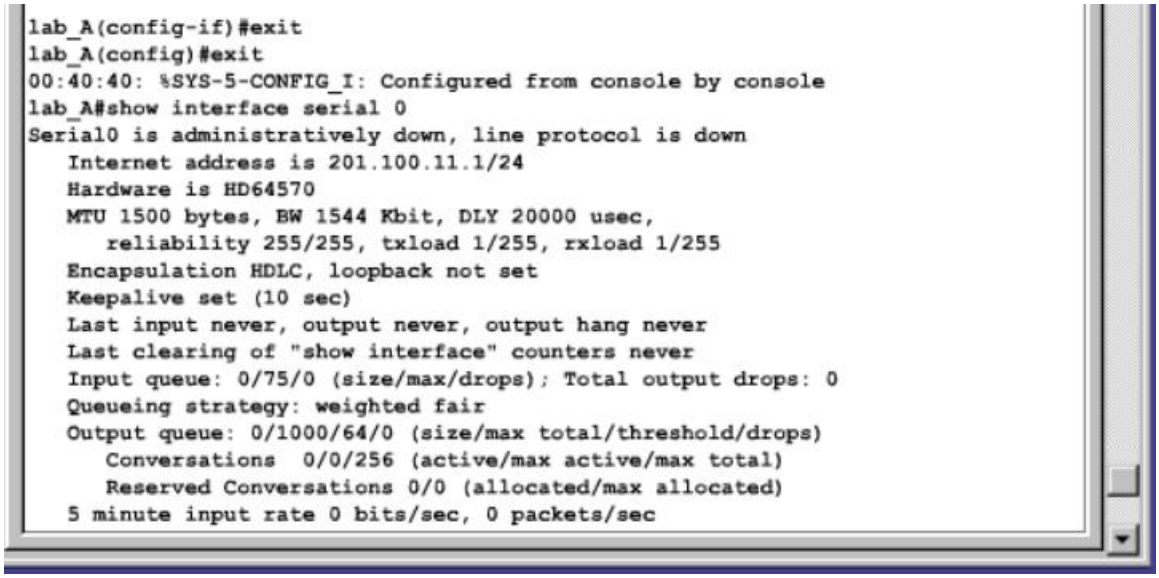
（2）在路由器内简历一份 ip 地址的映射表

（3）为路由器的一个接口配置 ip 地址，在该接口上启动 ip 进程的方法

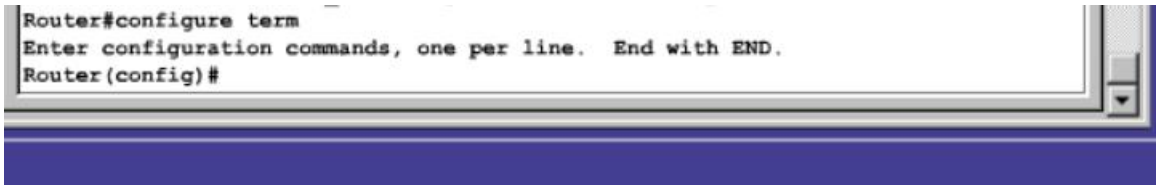


（4）查看串行端口的类型，配置充当 dce 端的串行端口

（5）使用 show 命令查看串口的配置情况

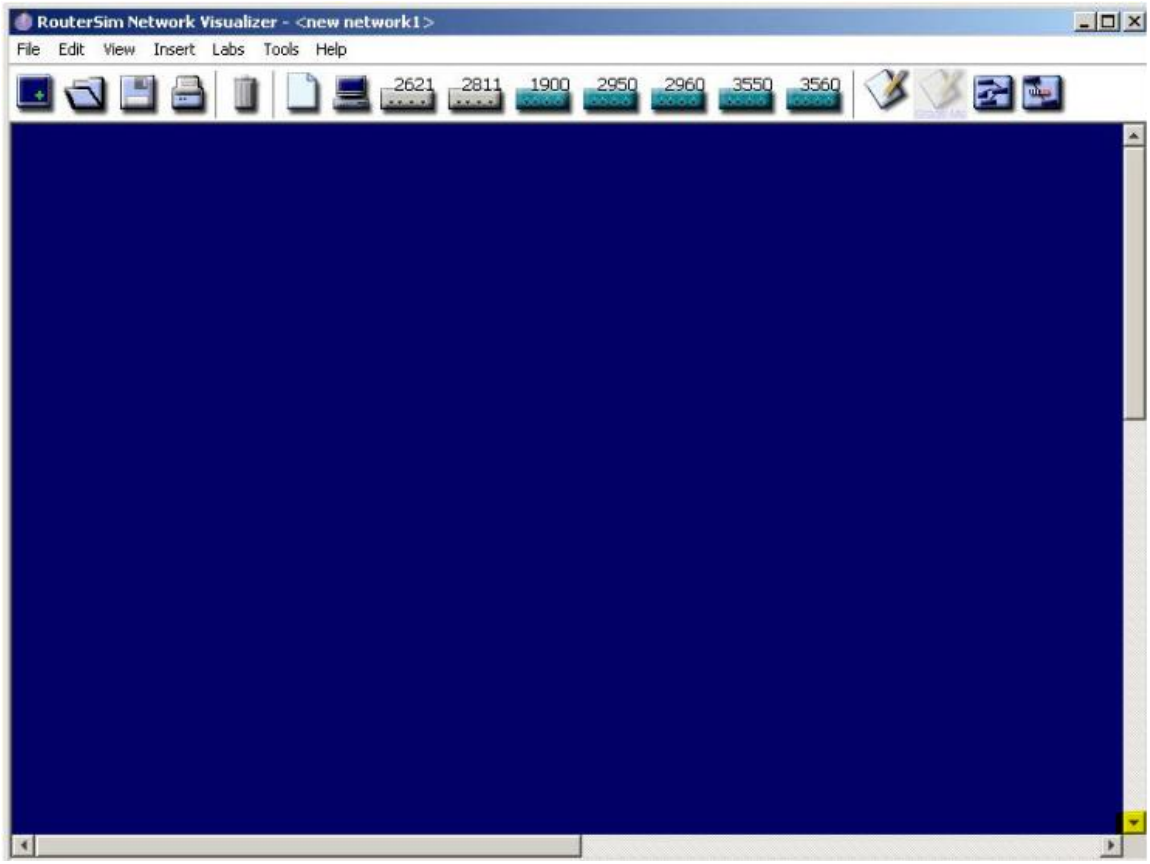


（6）手工开启和关闭端口

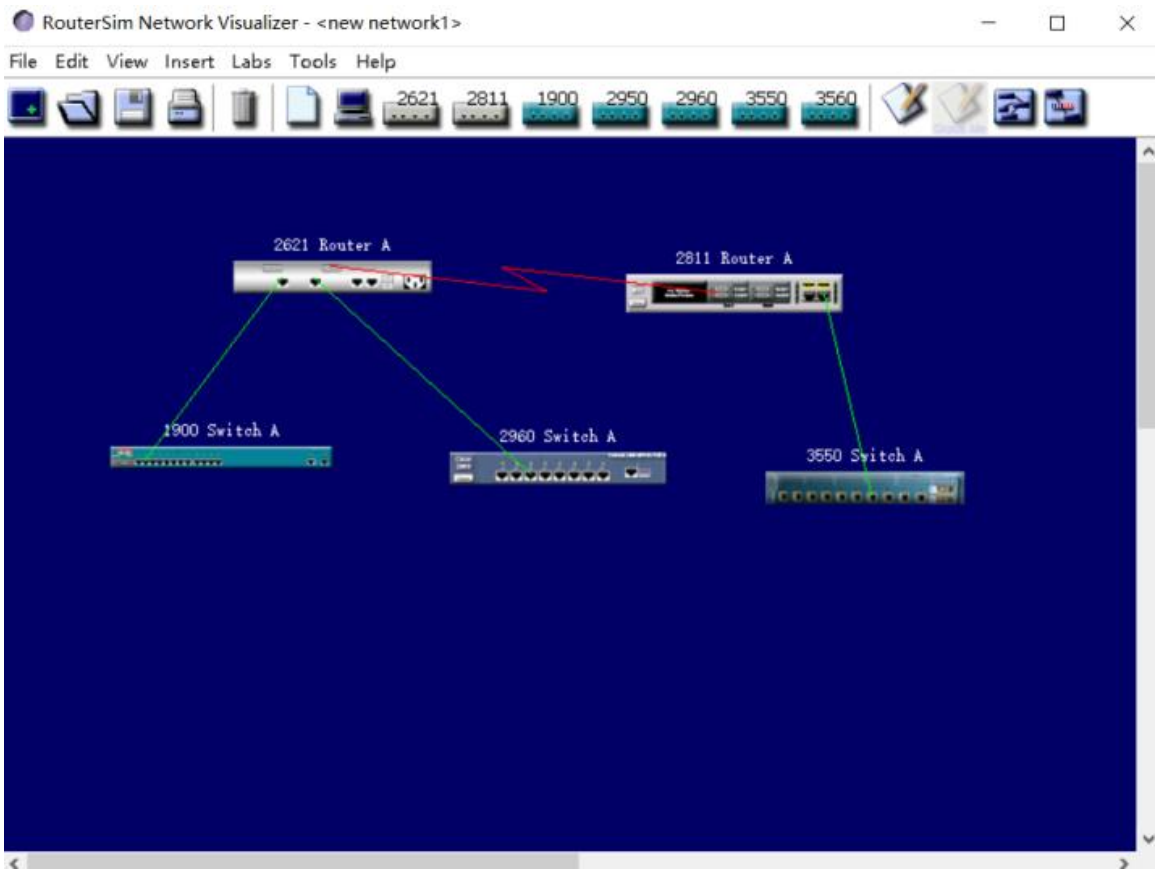


（二）静态路由配置

1. routersim ccna 下载：[CCNA Network Visualizer 8.0]

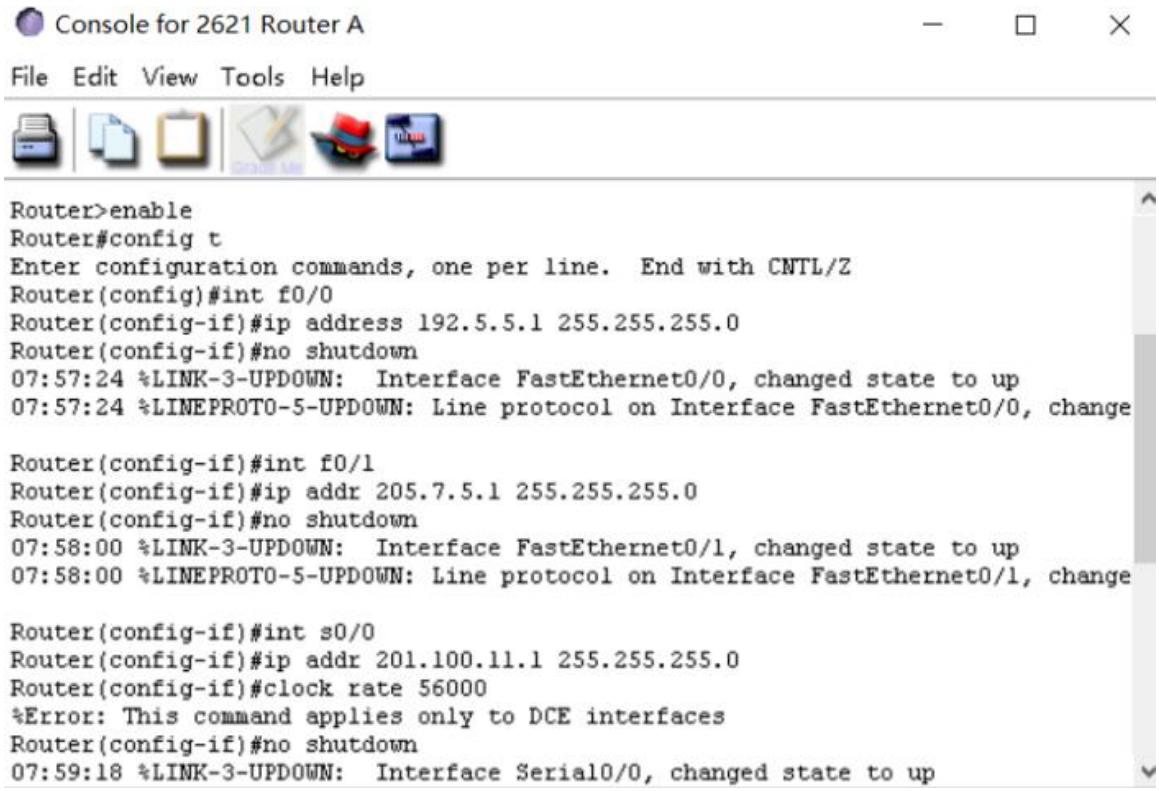


2. 模拟器上实验设备的连接图



3. 静态路由配置之前的工作

配置路由器各个端口的 ip 地址，使用命令 no shutdown 激活端口



查看路由 a 的路由表

```
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
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#_
```

查看路由 b 的路由表：

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

4. 配置静态路由

```
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>
```

（三）动态路由协议 RIP 的配置

查看 rip 协议的路由信息

```
Router#sh ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds, next due in 18 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
  Automatic network summarization is in effect
  Maximum path: 4
  Routing for networks:
    10.0.0.0
    192.168.1.0
  Routing information sources:
    Gateway         Distance      Last Update
  Distance: <default is 120>
```

```
Router Con0 is now available


Press RETURN to get started!


Router>enable
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z
Router(config)#router rip
Router(config-router)#network 10.0.0.0
Router(config-router)#network 192.168.1.0
```

（四）cisco 路由器访问列表配置

1. 配置访问列表之前对环境的配置

模拟器上计算机 ip 地址的配置

路由器 routerb 的基本配置

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z
Router(config)#hostname RouterB
RouterB(config)#line console 0
RouterB(config-line)#password koalaB
RouterB(config-line)#login
RouterB(config-line)#exit
RouterB(config)#line vty 0 4
RouterB(config-line)#password tigerB
RouterB(config-line)#exit
RouterB(config)#enable secret ciscoB
RouterB(config)#int f0/0
RouterB(config-if)#ip addr 192.5.5.1 255.255.255.0
RouterB(config-if)#no shutdown
10:56:17 %LINK-3-UPDOWN:  Interface FastEthernet0/0, changed state to up
10:56:17 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

RouterB(config-if)#int f0/1
RouterB(config-if)#ip addr 205.7.5.1 255.255.255.0
RouterB(config-if)#no shutdown
10:58:42 %LINK-3-UPDOWN:  Interface FastEthernet0/1, changed state to up
10:58:42 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

RouterB(config-if)#int s0/0
RouterB(config-if)#ip addr 201.100.11.1 255.255.255.0
RouterB(config-if)#clock rate 56000
RouterB(config-if)#no shutdown
10:59:48 %LINK-3-UPDOWN:  Interface Serial0/0, changed state to up
10:59:48 %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to up

RouterB(config-if)#
```

路由器 routera 的基本配置

```
RouterA(config)#line vty 0 4
RouterA(config-line)#password tigerA
RouterA(config-line)#exit
RouterA(config)#enable secret ciscoA
RouterA(config)#int f0/0
RouterA(config-if)#ip addr 199.6.13.1 255.255.255.0
RouterA(config-if)#no shutdown
11:06:34 %LINK-3-UPDOWN:  Interface FastEthernet0/0, changed state to up
11:06:34 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, chang

RouterA(config-if)#int s0/1
RouterA(config-if)#ip addr 201.100.11.2 255.255.255.0
RouterA(config-if)#no shutdown
11:07:08 %LINK-3-UPDOWN:  Interface Serial0/1, changed state to up
11:07:08 %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1, changed sta

RouterA(config-if)#

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

2. 配置标准访问列表

限制 hostb 可以访问子网 205.7.5.0

```
C:\>ping 205.7.5.8

Pinging 205.7.5.8 with 32 bytes of data:

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

Ping Statistics for 205.7.5.8:
    Packets Sent = 4, Received = 0, Lost = 4 (100% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

对主机的访问列表控制

```
RouterB>en
Password:
Password:
Password:
RouterB#config t
Enter configuration commands, one per line.  End with CNTL/Z
RouterB(config)#access-list 51deny 192.5.5.8 255.255.255.248
                                ^
% Invalid input detected at '^' marker.
RouterB(config)#access-list 51 deny 192.5.5.8 255.255.255.248
RouterB(config)#access-list 51 permit any
RouterB(config)#int s0/0
RouterB(config-if)#ip access-group 51 out
RouterB(config-if)#exit
RouterB(config)#
```

限制主机 hostb 已不能访问子网 205.7.5.0

```
C:\>ping 205.7.5.8

Pinging 205.7.5.8 with 32 bytes of data:

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

Ping Statistics for 205.7.5.8:
    Packets Sent = 4, Received = 0, Lost = 4 (100% loss),
Approximate round trip times in milli-seconds:
    Minimum = 0ms, Maximum = 0ms, Average = 0ms
```

对子网进行访问列表控制

```
RouterB(config)#access-list 51 deny 192.5.5.8 255.255.255.248
RouterB(config)#access-list 51 permit any
RouterB(config)#int s0/0
RouterB(config-if)#ip access-group 51 out
RouterB(config-if)#exit
RouterB(config)#
```

配置 routera， 使得 hosta 不能 telebnt 到 routera 上

```
Enter configuration commands, one per line.  End with CNTL/Z
RouterA(config)#access-list 50 deny host 205.7.5.8
RouterA(config)#access-list 50 permit any
RouterA(config)#line vty 0 4
RouterA(config-line)#access-class 50 in
RouterA(config-line)#exit
RouterA(config)#
```

配置完成后的验证结果

```
C:\>telnet 201.100.11.2
Connecting To 201.100.11.2 ...Could not open a connection to host: Connect failed
```

（五）基于端口的 vlan 配置

配置 3550a 的 vtp

```
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 Vl1 (lowest numbered VLAN interface
found)
3550A#
```

配置 2590a 的 vtp

```
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       Set the device to client mode.
  server       Set the device to server mode.
  transparent  Set the device to transparent mode.

2950A(config)#vtp mode?
mode
2950A(config)#vtp mode ?
  client       Set the device to client mode.
  server       Set the device to server mode.
  transparent  Set the device to transparent mode.

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 Vl1 (lowest numbered VLAN interface
found)
```

配置 2950b 的 vtp

```
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#
```

设置 3550a 的 trunk 端口

```
3550A>en
3550A#conf t
Enter configuration commands, one per line.  End with CNTL/Z
3550A(config)#interface 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
                                                ^
% Invalid input detected at '^' marker.
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
12:51:23: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state
to down
12:51:23: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
3550A(config-if)#switchport mode trunk
3550A(config-if)#interface fa0/3
3550A(config-if)#switchport trunk encapsulation dot1q
12:53:22: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state
to down
12:53:22: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/3, changed state to up
3550A(config-if)#switchport mode trunk
3550A(config-if)#
```

设置 2590a 和 2950b 的 trunk 端口

```
2950A>en
2950A#conf 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>en
2950B#conf 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)#
```

创建 vlan 并验证

```
3550A>en
3550A#conf t
Enter configuration commands, one per line.  End with CNTL/Z
3550A(config)#vlan 10
3550A(config-vlan)#vlan 20
3550A(config-vlan)#exit
3550A(config)#sh vlan
               ^
% Invalid input detected at '^' marker.
3550A(config)#exit
3550A#sh 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--
```

将交换机端口加入 vlan

```
2950A>en
2950A#conf t
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)#
```

```
2950B>en
2950B#conf t
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

```
3550A>en
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 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)#
```

启动路由

```
3550A(config)#ip routing
```

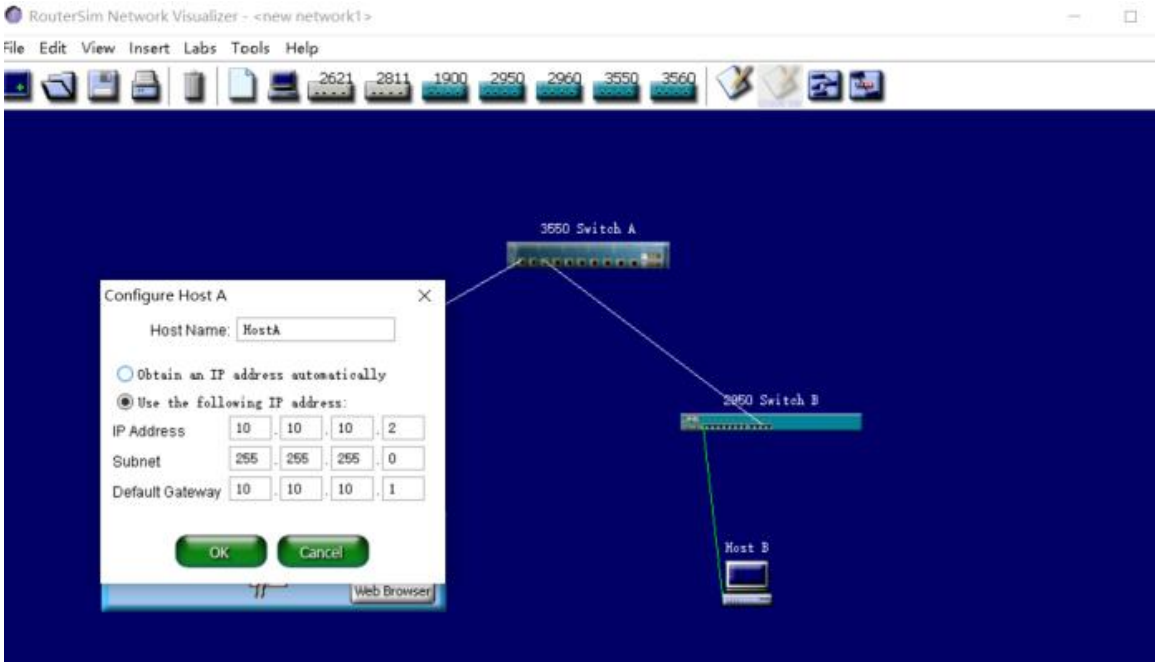
设置管理 ip

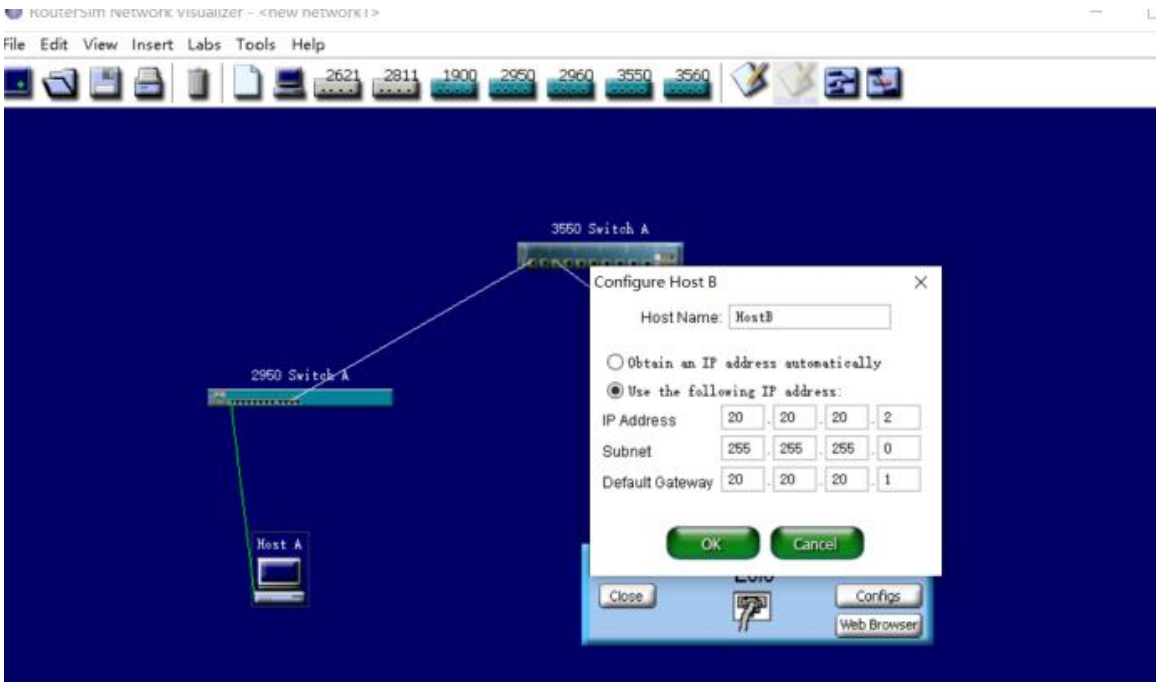
```
3550A(config)#int vlan 1
3550A(config-if)#ip address 192.168.10.1 255.255.255.0
3550A(config-if)#no shut
```

```
2950A>en
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
2950A(config-if)#
```

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

配置主机 hostA 和 hostB 并进行测试






```
3550A>en
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#
```

```
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#
```

4 实验代码

本次实验的代码已上传于以下代码仓库：https://github.com/abanumber2/Computer-Network-and-Internet/tree/master

5 实验总结

本次实验通过模拟器对网络设备的配置操作，系统地学习了路由器的基本操作、静态和动态路由协议配置、访问控制列表（ACL）的应用以及 VLAN 的配置等内容。通过实践，进一步加深了对网络层、路由和数据包转发等概念的理解。以下是本次实验的几点总结：

1.路由器配置与管理

实验中学习了 Cisco 路由器的不同模式和常用命令，熟悉了如何在超级用户模式和全局配置模式之间切换，并通过配置接口、启用 IP 进程等操作，掌握了基本的路由器设置方法。

2.静态与动态路由的差异

通过分别配置静态路由和 RIP 动态路由，理解了二者的工作原理。静态路由适合于小规模网络环境，而 RIP 等动态路由协议能够自动更新路由表，更适合于大型网络。

3.访问控制列表（ACL）

使用访问列表控制主机或子网的访问权限，使网络更具安全性。通过配置 ACL 实现了主机和子网之间的访问控制，进一步理解了 ACL 在网络安全中的作用。

4.VLAN 的配置与管理

实验还涉及了基于端口的 VLAN 划分，使各个子网隔离，提高了网络的安全性和性能。通过创建 VLAN、设置 Trunk 端口等配置，对 VLAN 的原理和作用有了更直观的理解。

本次实验通过配置和管理网络设备，使我对网络层和路由协议有了更全面的认识。掌握了基础配置技能，为日后深入学习网络技术打下了坚实的基础。