

廈門大學



信息学院软件工程系

《计算机网络》实验报告

题 目 实验四 CISCOIOS 路由器基本配置

班 级 软件工程 2021 级卓越班

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填写说明

- 1、本文件为 Word 模板文件，建议使用 Microsoft Word 2021 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、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

操作系统：Windows11 家庭中文版；

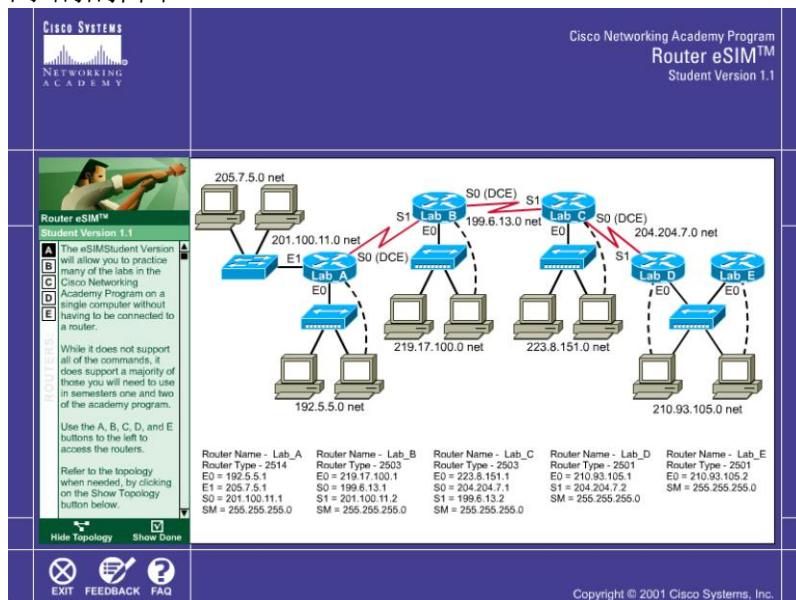
使用 Router eSIMv1.1 模拟器来模拟路由器的配置环境

使用 CCNA NetworkVisualizer 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）

3 实验结果

1、使用 Router eSIMv1.1 模拟器来模拟路由器的配置环境

打开软件通过左下角的 show topology 可以看到目前 5 个默认提供的路由器的网络拓扑图



使用 `enable` 命令切换为超级用户模式之后通过命令 `config t` 对路由器 A 进行配

置，修改其名称为 lab_X

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

设置其当日消息标题

```
lab_A(config)#banner motd #
Enter TEXT message. End with the character '#'.
Accounting message.
You have enter a secure system.#
```

手动建立 ip 地址映射表，以便可以通过机器名和 ip 地址指定路由器、交换机和主机接口

```
You have enter a secure system.#
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
lab_A(config)#end
00:09:29: %SYS-5-CONFIG_I: Configured from console by console
```

配置路由器的接口的 IP 地址与时钟周期

```
lab_A(config)#int eth 0
lab_A(config-if)#ip addr 192.5.5.1 255.255.255.0
lab_A(config-if)#int eth 1
lab_A(config-if)#ip addr 205.7.5.1 255.255.255.0
lab_A(config-if)#int serial 0
lab_A(config-if)#ip addr 201.100.11.1 255.255.255.0
lab_A(config-if)#exit
lab_A(config)#int serial 0
lab_A(config-if)#clock rate 56000
```

激活端口（S1 为例），设置控口命令和虚拟终端命令

```
lab_A(config-if)#exit
lab_A(config)#int serial 0
lab_A(config-if)#no shutdown
lab_A(config-if)#exit
lab_A(config)#int eth 0
lab_A(config-if)#description Engineering LAN Bldg,18
lab_A(config-if)#exit
lab_A(config)#line console 0
lab_A(config-line)#login
lab_A(config-line)#password cisco
lab_A(config-line)#line vty 0 4
lab_A(config-line)#login
lab_A(config-line)#password tiger
```

配置动态路由

```
lab_A(config-line)#exit
lab_A(config)#router rip
lab_A(config-router)#network 192.5.5.1
lab_A(config-router)#network 205.7.5.1
lab_A(config-router)#network 201.100.11.1
```

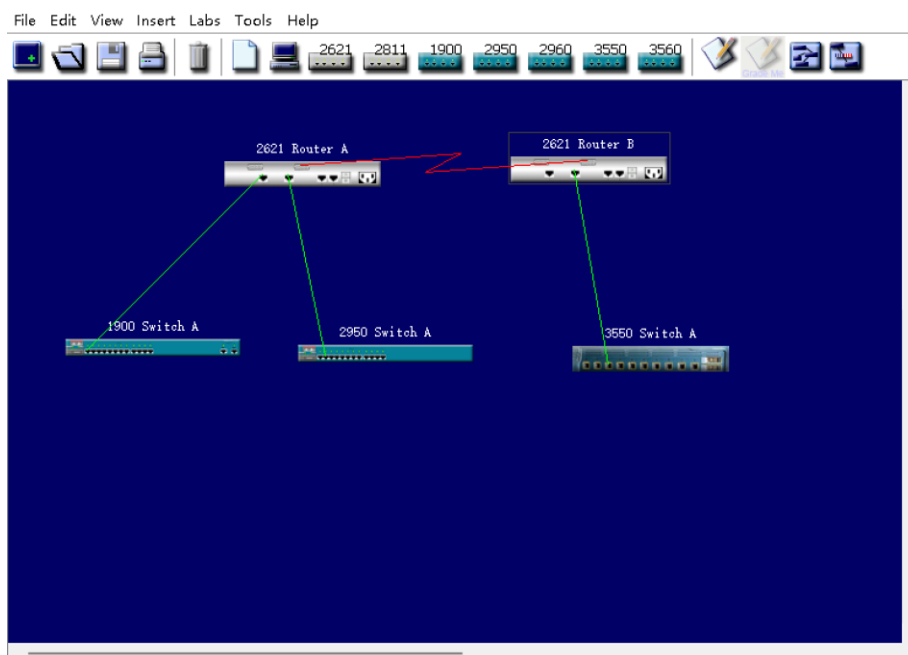
点击 show done 展示结果

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	46:30

2、使用 CCNANetworkVisualizer6.0 配置静态路由、动态路由和交换机端口的 VLAN（虚拟局域网）。

a) 配置静态路由前的准备

连接路由器和交换机并完成前期准备工作，包括配置路由器 A 各端口的 IP 地址（需要使用 no shutdown 激活），其中对于 S0/0 还需要设置时钟频率



```

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
00:32:21 %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
00:32:21 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#int f0/1
Router(config-if)#ip address 205.5.5.1 255.255.255.0
Router(config-if)#no shutdown
00:32:43 %LINK-3-UPDOWN: Interface FastEthernet0/1, changed state to up
00:32:43 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Router(config-if)#int s0/0
Router(config-if)#ip address 201.100.11.1 255.255.255.0
Router(config-if)#clock rate 56000
Router(config-if)#no shutdown
00:33:21 %LINK-3-UPDOWN: Interface Serial0/0, changed state to up
00:33:21 %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/0, changed state to up

```

经过 show ip route 检查配置的正确性，发现 A 的 IP 地址成功正确配置，按同样步骤配置路由器 B 后再次检验

```

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    205.5.5.0/24 is directly connected, FastEthernet0/1
C    201.100.11.0/24 is directly connected, Serial0/0
C    192.5.5.0/24 is directly connected, FastEthernet0/0

Router(config)#int f0/0
Router(config-if)#ip address 199.6.13.1 255.255.255.0
Router(config-if)#no shutdown
00:37:48 %LINK-3-UPDOWN: Interface FastEthernet0/0, changed state to up
00:37:48 %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#int s0/1
Router(config-if)#ip address 201.100.11.2 255.255.255.0
Router(config-if)#no shutdown
00:38:05 %LINK-3-UPDOWN: Interface Serial0/1, changed state to up
00:38:05 %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1, changed state to up

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

```

使用 ping 检测直连的地址是否连通，发现成功率是 0%，故配置静态路由

b) 配置静态路由

在路由器 A 终端输入 ip 地址、子网掩码和下一跳地址

```
Router(config)#ip route 199.6.13.0 255.255.255.0 201.100.11.2
```

使用 show ip route 和 ping 检测配置正确性和网络连通状态，发现配置正确且成功率达到 1，静态路由配置成功。

```

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    205.5.5.0/24 is directly connected, FastEthernet0/1
C    201.100.11.0/24 is directly connected, Serial0/0
C    192.5.5.0/24 is directly connected, FastEthernet0/0

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

```

c) 配置动态路由

为 A 和 B 先后配置动态路由协议，启动协议后输入与路由器直接相连的子网的地址

```

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)#network 205.7.5.0
Router(config-router)#network 201.100.11.0
Router(config-router)#exit

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

```

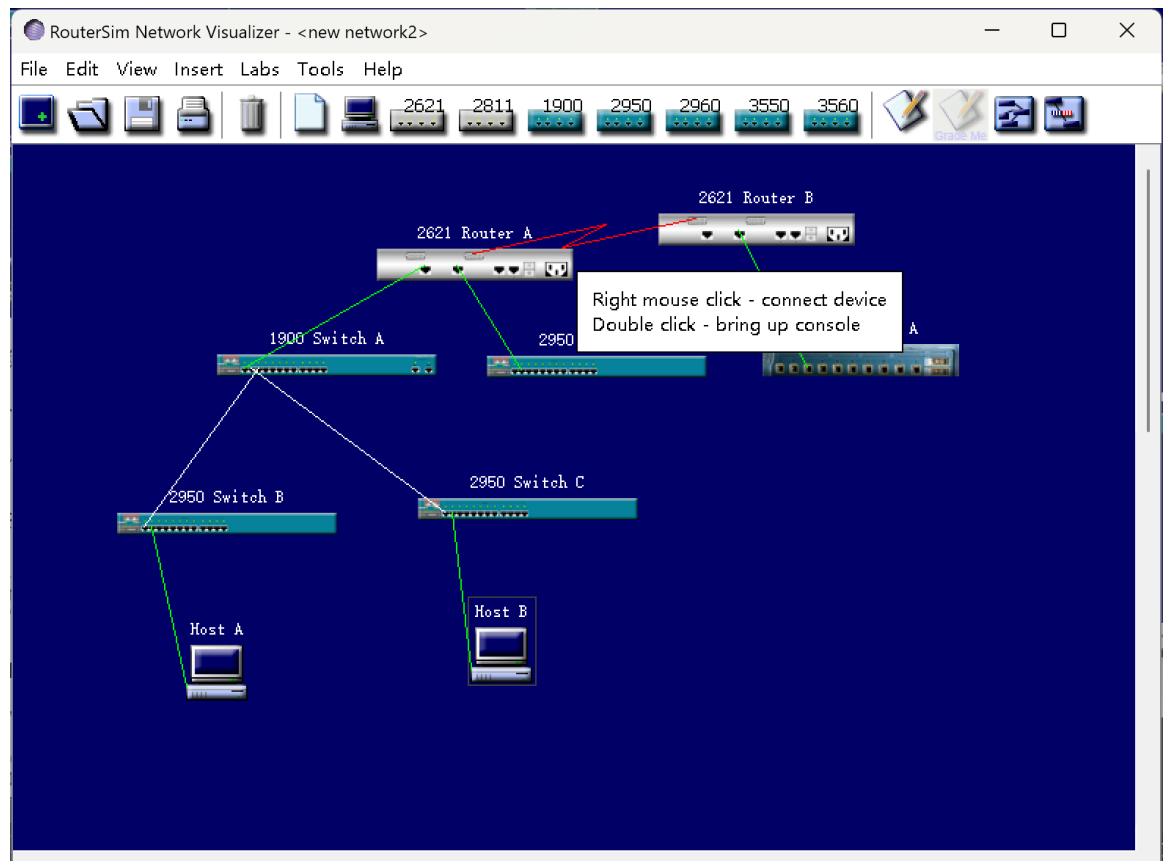
此时观察 B 的路由表可以观察到通过 RIP 协议的方式添加的新的路由

```

C    201.100.11.0/24 is directly connected, Serial0/1
C    199.6.13.0/24 is directly connected, FastEthernet0/0
R    192.5.5.0 [120/1] via 201.100.11.1, 00:00:07, Serial0/1

```


添加两台交换机和主机



（由于发现 1900A 的交换机配置出现问题，将 1900A 使用 3550B 替换）配置 VTP 域并查看 2550B 的配置情况（下图以 3550B 为例，2950B 和 2959C 的配置方式同流程，但需要将模式修改为 client）

```
switch(config)#hostname 3550B
3550B(config)#vtp domain Cisco
Changing VTP domain name from NULL to Cisco

3550B#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 Vll (lowest numbered VLAN interface found)
```

```
2950B(config)#vtp domain Cisco
Changing VTP domain name from NULL to Cisco
2950B(config)#vtp mode client
Setting device to VTP CLIENT mode.

2950C(config)#vtp domain Cisco
Changing VTP domain name from NULL to Cisco
2950C(config)#vtp mode client
Setting device to VTP CLIENT mode.

2950B#show vtp status
VTP Version                : 2
Configuration Revision     : 0
Maximum VLANs supported locally : 64
Number of existing VLANs   : 4
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: 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

2950C#show vtp status
VTP Version                : 2
Configuration Revision     : 0
Maximum VLANs supported locally : 64
Number of existing VLANs   : 4
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: 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)
```

配置 trunk, 将 3550B 与 2950BC 相连的端口配置为 trunk 端口, 同时配置 2950BC 的端口

```

3550B(config)#int f0/1
3550B(config-if)#switchport trunk encapsulation dot1q
% Invalid input detected at '^' marker.
3550B(config-if)#switchport trunk encapsulation
% Incomplete command.
3550B(config-if)#switchport trunk encapsulation dot1q
02:38:11: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state
to down
02:38:11: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up
3550B(config-if)#switchport mode trunk
3550B(config-if)#int f0/2
3550B(config-if)#switchport trunk encapsulation dot1q
02:38:48: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state
to down
02:38:48: %LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/2, changed state to up
3550B(config-if)#switchport mode trunk

2950B(config)#int f0/1
2950B(config-if)#switchport mode trunk

2950C(config)#int f0/1
2950C(config-if)#switchport mode trunk

```

最后配置煮鸡蛋 ip 地址、子网掩码与网关。完成后通过 ping 检测 3550B, 2950BC 三者之间是否相互连通, 最后在则是 hostAB 是否连通

测试结果成功连通:

```

3550B>ping 205.5.5.3

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 205.5.5.3, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms

3550B>ping 205.5.5.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 205.5.5.4, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms

```

```

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

```

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/MidiAug/Codes/exp4>

5 实验总结

更加深入底层的让我认识到路由及路由表，书本上的理论知识在现实的实际运用，能更好的让我了解网络层和路由的基本原理。