# 路由器基本配置大作业

## 实验平台

1. Windows 11 下的 Boson Netsim 10

## 实验目的

1. 掌握路由器的基本知识
2. 掌握路由器端口的配置
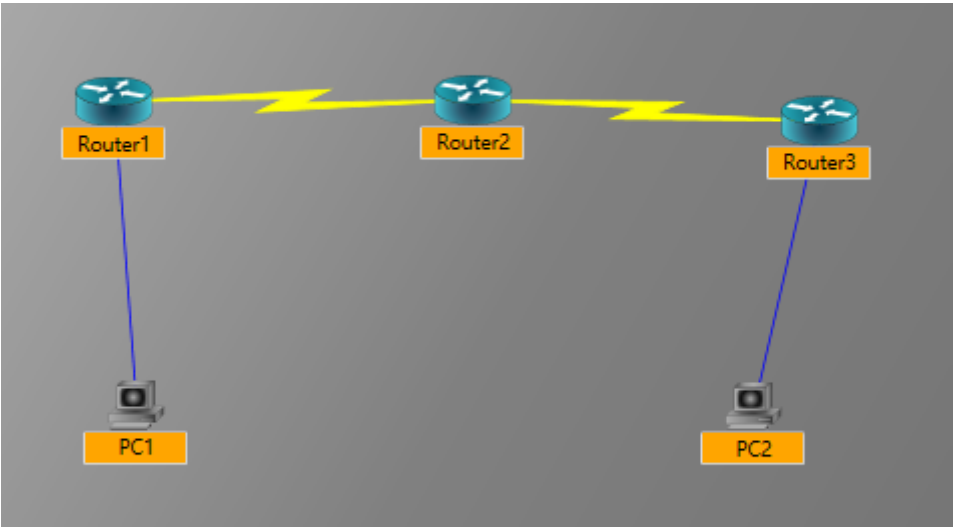3. 掌握路由协议的基本配置
4. 熟悉使用Boson Netsim模拟器

## 实验内容

1. 使用IOS命令配置路由器
2. 掌握握静态路由和动态路由（RIP、OSPF）的配置方法

## 实验要求

1. 本实验要求自行构建一个网络拓扑，要求包括3个以上路由器（路由器采用串行连接），用于连接两个以太网，每个以太网至少包括1台主机；
2. 完成路由器、主机等设备的配置；使用RIP或OSPF来维护路由器的路由表。
3. 实验配置完成后，两台主机要能够相互ping通
4. 实验报告要包括网络拓扑、配置以及结果

## 实验步骤

1. 构建网络拓扑

其中，路由器型号为Cisco 2514。各设备接口的IP地址如下：

| 设备 | 接口 | IP地址 |
|------|------|--------|
| Router1 | Ethernet0 | 192.168.1.1/24 |
| Router1 | Serial0 | 192.168.2.1/24 |
| Router2 | Serial0 | 192.168.2.2/24 |
| Router2 | Serial1 | 192.168.3.1/24 |
| Router3 | Serial0 | 192.168.3.2/24 |
| Router3 | Ethernet0 | 192.168.4.1/24 |
| PC1 | Ethernet0 | 192.168.1.2/24 |
| PC2 | Ethernet0 | 192.168.4.2/24 |

2. 配置路由器

   1. Router1

```
enable
configure terminal
hostname Router1

interface ethernet 0
ip address 192.168.1.1 255.255.255.0
no shutdown

interface serial 0
ip address 192.168.2.1 255.255.255.0
clock rate 64000
no shutdown


end
```

```
Press Enter to Start

Router>enable
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname Router1
Router1(config)#int e0
Router1(config-if)#ip add 192.168.1.1 255.255.255.0
Router1(config-if)#no shut
00:01:03: %LINK-3-UPDOWN: Interface Ethernet0, changed state to up
00:01:03: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0, changed state to up
Router1(config-if)#int s0
Router1(config-if)#encapsulation hdlc
Router1(config-if)#ip add 192.168.2.1 255.255.255.0
Router1(config-if)#no shut
00:01:50: %LINK-3-UPDOWN: Interface Serial0, changed state to up
```

## 2. Router2

```
enable
configure terminal
hostname Router2


interface serial 0
ip address 192.168.2.2 255.255.255.0
clock rate 64000
no shutdown



interface serial 1
ip address 192.168.3.1 255.255.255.0
clock rate 64000
no shutdown


end
```

```
Press Enter to Start

Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname Router2
Router2(config)#interface serial 0
Router2(config-if)#ip address 192.168.2.2 255.255.255.0
Router2(config-if)#clock rate 64000
Router2(config-if)#no shutdown
00:05:24: %LINK-3-UPDOWN: Interface Serial0, changed state to up
00:05:25: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0, changed state to up
Router2(config-if)#interface serial 1
Router2(config-if)#ip address 192.168.3.1 255.255.255.0
Router2(config-if)#clock rate 64000
Router2(config-if)#no shutdown
00:05:51: %LINK-3-UPDOWN: Interface Serial1, changed state to up
00:05:51: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1, changed state to up
00:05:57: %LINK-3-UPDOWN: Interface Serial1, changed state to down
00:05:57: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial1, changed state to down
Router2(config-if)#end
```
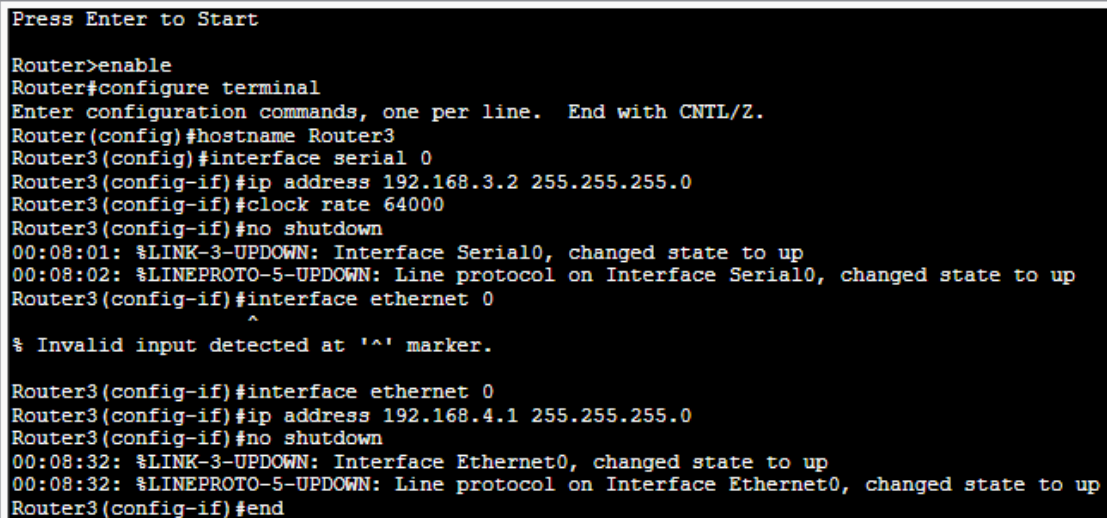
## 3. Router3

```
enable
configure terminal
hostname Router3

interface serial 0
ip address 192.168.3.2 255.255.255.0
clock rate 64000
no shutdown

interface ethernet 0
ip address 192.168.4.1 255.255.255.0
no shutdown

end
```

```
Press Enter to Start

Router>enable
Router#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#hostname Router3
Router3(config)#interface serial 0
Router3(config-if)#ip address 192.168.3.2 255.255.255.0
Router3(config-if)#clock rate 64000
Router3(config-if)#no shutdown
00:08:01: %LINK-3-UPDOWN: Interface Serial0, changed state to up
00:08:02: %LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0, changed state to up
Router3(config-if)#interface ethernet 0
                             ^
% Invalid input detected at '^' marker.

Router3(config-if)#interface ethernet 0
Router3(config-if)#ip address 192.168.4.1 255.255.255.0
Router3(config-if)#no shutdown
00:08:32: %LINK-3-UPDOWN: Interface Ethernet0, changed state to up
00:08:32: %LINEPROTO-5-UPDOWN: Line protocol on Interface Ethernet0, changed state to up
Router3(config-if)#end
```

3. 命令解析（以Router1为例）

   1. `enable`：进入特权模式

   2. `configure terminal`：进入全局配置模式

   3. `hostname Router1`：设置路由器名称

   4. `interface ethernet 0`：进入以太网0接口配置模式

   5. `ip address 192.168.1.1 255.255.255.0`：设置以太网0接口的IP地址

   6. `no shutdown`：开启以太网0接口

   7. `interface serial 0`：进入串行0接口配置模式

   8. `ip address 192.168.2.1 255.255.255.0`：设置串行0接口的IP地址

   9. `clock rate 64000`：设置时钟速率

   10. `no shutdown`：开启串行0接口

   11. `end`：退出全局配置模式

4. 配置PC

1. PC1

```
ipconfig /ip 192.168.1.2 255.255.255.0
ipconfig /dg 192.168.1.1
```

```
Boson BOSS 5.0
Copyright 1998-2023 Boson Software, LLC.
Use the command help to get started

Press Enter to begin
C:>ipconfig /ip 192.168.1.2 255.255.255.0
C:>ipconfig /dg 192.168.1.1
```

2. PC2

```
ipconfig /ip 192.168.4.2 255.255.255.0
ipconfig /dg 192.168.4.1
```

```
Boson BOSS 5.0
Copyright 1998-2023 Boson Software, LLC.
Use the command help to get started

Press Enter to begin
C:>ipconfig /ip 192.168.4.2 255.255.255.0
C:>ipconfig /dg 192.168.4.1
```

5. 命令解析
   1. `ipconfig /ip 192.168.1.2 255.255.255.0`：设置IP地址
   2. `ipconfig /dg 192.168.1.1`：设置默认网关
6. 配置路由协议
   1. Router1

```
enable
configure terminal
router rip
network 192.168.1.0
network 192.168.2.0
end
run copy start
```

```
Enter configuration commands, one per line. End with CNTL/Z.
Router1(config)#router rip
Router1(config-router)#network 192.168.1.0
Router1(config-router)#network 192.168.2.0
Router1(config-router)#end
Router1#copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
```

2. Router2

```
enable
configure terminal
router rip
network 192.168.1.0
network 192.168.2.0
end
run copy start
```

```
Enter configuration commands, one per line.  End with
Router2(config)#router rip
Router2(config-router)#network 192.168.2.0
Router2(config-router)#network 192.168.3.0
Router2(config-router)#end
Router2#copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
```

3. Router3

```
enable
configure terminal
router rip
network 192.168.1.0
network 192.168.2.0
end
run copy start
```

```
Enter configuration commands, one per line.  End with Cntl/Z.
Router3(config)#router rip
Router3(config-router)#network 192.168.3.0
Router3(config-router)#network 192.168.4.0
Router3(config-router)#end
```

```
Router3#copy run start
Destination filename [startup-config]?
Building configuration...
[OK]
```

7. 命令解析
   1. `router rip`：进入RIP路由协议配置模式
   2. `network 192.168.1.0`：将192.168.1.0/24网段加入RIP路由协议
   3. `network 192.168.2.0`：将192.168.2.0/24网段加入RIP路由协议
   4. `end`：退出RIP路由协议配置模式
   5. `run copy start`：将当前配置保存到NVRAM中
8. 验证，查看各个路由器的路由表

```
Router1#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
       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

Gateway of last resort is not set

C    192.168.1.0 is directly connected, Ethernet0
C    192.168.2.0 is directly connected, Serial0
R    192.168.3.0 [120/1] via 192.168.2.2, 00:04:12, Serial0
R    192.168.4.0 [120/2] via 192.168.2.2, 00:01:26, Serial0
```

```
Router2#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
       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

Gateway of last resort is not set

C    192.168.2.0 is directly connected, Serial0
C    192.168.3.0 is directly connected, Serial1
R    192.168.1.0 [120/1] via 192.168.2.1, 00:09:23, Serial0
R    192.168.4.0 [120/1] via 192.168.3.2, 00:01:26, Serial1
```

```
Router3#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
       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

Gateway of last resort is not set

C    192.168.3.0 is directly connected, Serial0
C    192.168.4.0 is directly connected, Ethernet0
R    192.168.2.0 [120/1] via 192.168.3.1, 00:08:29, Serial0
R    192.168.1.0 [120/2] via 192.168.3.1, 00:06:33, Serial0
```

可以看到，各个路由器的路由表中都有到达其他网段的路由。说明RIP路由协议配置成功。

9. 验证，PC1和PC2能否相互ping通

PC1 ping PC2

.

PC2 ping PC1

```
C:>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:
Reply from 192.168.1.2: bytes=32 time=49ms TTL=241
Reply from 192.168.1.2: bytes=32 time=67ms TTL=241
Reply from 192.168.1.2: bytes=32 time=69ms TTL=241
Reply from 192.168.1.2: bytes=32 time=57ms TTL=241
Reply from 192.168.1.2: bytes=32 time=51ms TTL=241

Ping statistics for 192.168.1.2:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 49ms, Maximum =  69ms, Average =  59ms
```

可以看到，PC1和PC2能够相互ping通。说明RIP路由协议配置成功。

# 实验总结

1. 本次实验主要是通过配置路由器，实现了PC1和PC2的互相通信。在配置路由器的过程中，我学会了如何配置路由器的端口，如何配置路由协议，如何查看路由表，如何查看路由器的配置等等。通过本次实验，我对路由器的配置有了更深的理解。

2. 本次实验中，我使用的是RIP路由协议。RIP路由协议是一种距离矢量路由协议，它的工作原理是：路由器通过广播自己的路由表，将自己所知道的路由信息告诉其他路由器，其他路由器收到路由信息后，将其加入到自己的路由表中。RIP路由协议的优点是：实现简单，占用带宽小。缺点是：收敛速度慢，不适合大型网络。

3. 本次实验加深了我对路由器的理解，如路由器的端口分为以太网端口和串行端口，以太网端口用于连接以太网，串行端口用于连接串行链路。