

一、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

二、实验内容与实验要求

1实验内容

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

2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

三、实验原理

1路由器基本结构

路由器由存储器、处理器、网络接口等组成；路由器型号不同，端口数目和类型也不尽相同。

2路由器的接口类型

网络接口：局域网接口，广域网接口等，其中局域网接口包括以太网接口，快速以太网接口、千兆以太网接口、串口、光纤接口等。管理接口：控制台接口，辅助接口

3路由器的配置模式

4 种基本模式：

1. 用户模式 `>`
2. 特权模式 `#`
3. 配置模式 `(config)#`
4. 端口配置模式 `(config-if)#`

4路由器一般步骤

创建拓扑图: 设备：路由器，交换机，主机等。连接：类型，端口。

配置路由器端口：路由器 LAN 端口的配置（以太网端口）或路由器WAN 端口的配置（串口 serial0， serial1）

路由协议的配置: 配置 RIP， OSPF 注意：对于路由协议的配置是在路由器端口正确配置的前提下进行的。

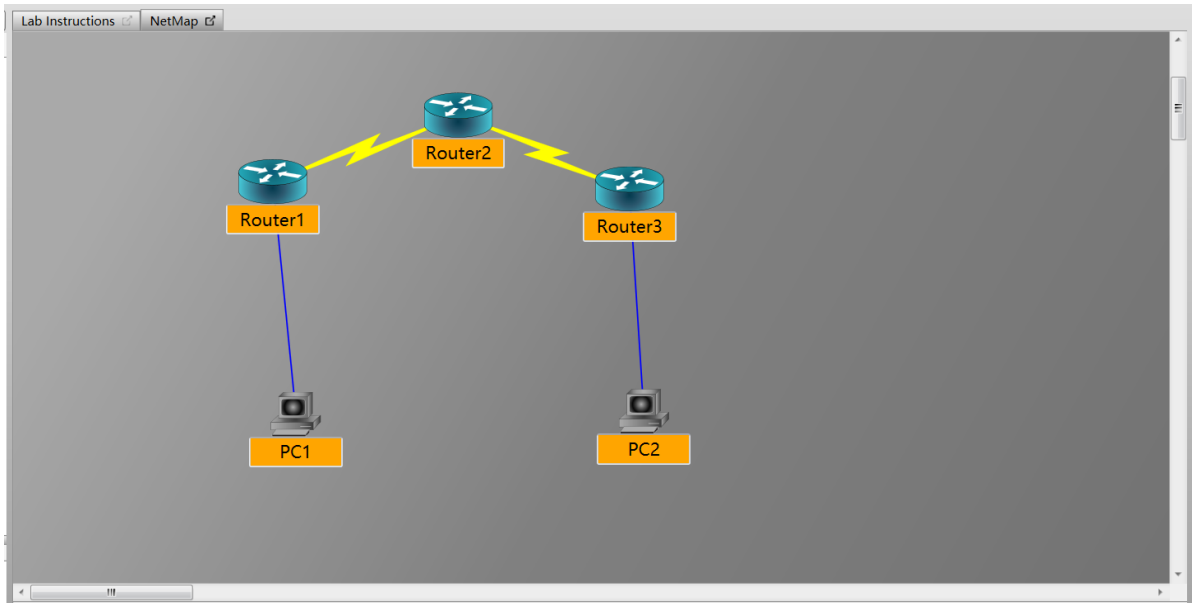
路由测试: 在 PC 机或路由器上使用 ping 命令 ping 其它路由器以太网端口，从而判断路由协议是否正确。

四、静态配置

实验过程

1创建拓扑图

根据实验要求的网络拓扑结构，选择网络设备，并把这些网络设备连接起来。



2配置路由器

配置各路由器和 PC 的接口, 为了能够使非直连的网络可以互通，通过手工配置的方法来添加静态路由。

	PC1	Route1	Route2	Route3	PC2
Ethernet 0	192.168.2.1	192.168.1.1	/	192.168.4.1	192.168.4.2
Serial 0	/	192.168.2.1	192.168.2.2	192.168.3.2	/
Serial 1	/	/	192.168.3.1	/	/

本实验采用RIP方法，端口参数如下

Route1

```
1 enable
2 configure terminal
3 hostname Route1
4
5 %connect to PC1
6
7 interface ethernet 0
8 ip address 192.168.1.1 255.255.255.0
9 no shutdown
10
```

```
11 %connect to route2
12 interface serial 0
13 ip address 192.168.2.1 255.255.255.0
14 clock rate 64000
15 no shutdown
16
17 ip route 192.168.3.0 255.255.255.0 192.168.2.2
18 ip route 192.168.4.0 255.255.255.0 192.168.2.2
```

Route2

```
1 enable
2 configure terminal
3 hostname Route2
4
5 %connect to route1
6 interface serial 0
7 ip address 192.168.2.2 255.255.255.0
8 clock rate 64000
9 no shutdown
10
11 %connect to route3
12 interface serial 1
13 ip address 192.168.3.1 255.255.255.0
14 clock rate 64000
15 no shutdown
16
17 ip route 192.168.1.0 255.255.255.0 192.168.2.1
18 ip route 192.168.4.0 255.255.255.0 192.168.3.2
```

Route3

```
1 enable
2 configure terminal
3 hostname Route1
4
5 %connect to route2
6 interface serial 0
7 ip address 192.168.3.2 255.255.255.0
8 clock rate 64000
9 no shutdown
10
11 %connect to PC2
12 interface ethernet 0
13 ip address 192.168.4.1 255.255.255.0
14 no shutdown
15
16 ip route 192.168.2.0 255.255.255.0 192.168.3.1
17 ip route 192.168.1.0 255.255.255.0 192.168.3.1
```

3配置PC

PC1

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

PC2

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

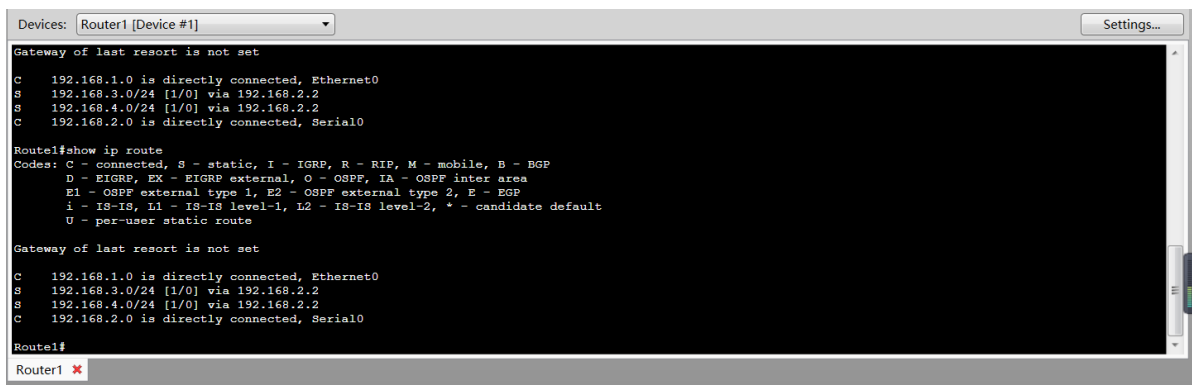
然后再测试设备之间的连通性

实验结果

1路由器信息

通过 `show ip route`，可以看到非直连的网络可以互通。

Route1



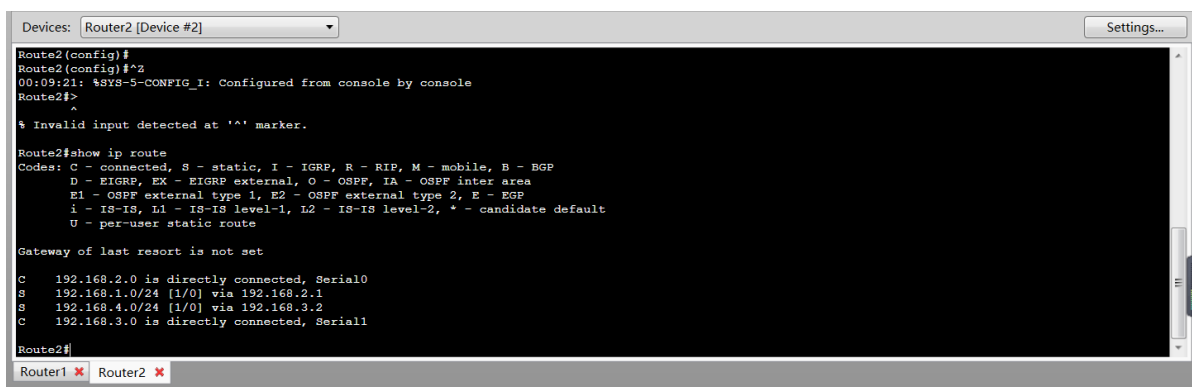
```
Devices: Router1 [Device #1] Settings...
Gateway of last resort is not set
C 192.168.1.0 is directly connected, Ethernet0
S 192.168.3.0/24 [1/0] via 192.168.2.2
S 192.168.4.0/24 [1/0] via 192.168.2.2
C 192.168.2.0 is directly connected, Serial0

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
S 192.168.3.0/24 [1/0] via 192.168.2.2
S 192.168.4.0/24 [1/0] via 192.168.2.2
C 192.168.2.0 is directly connected, Serial0

Router1#
```

Route2



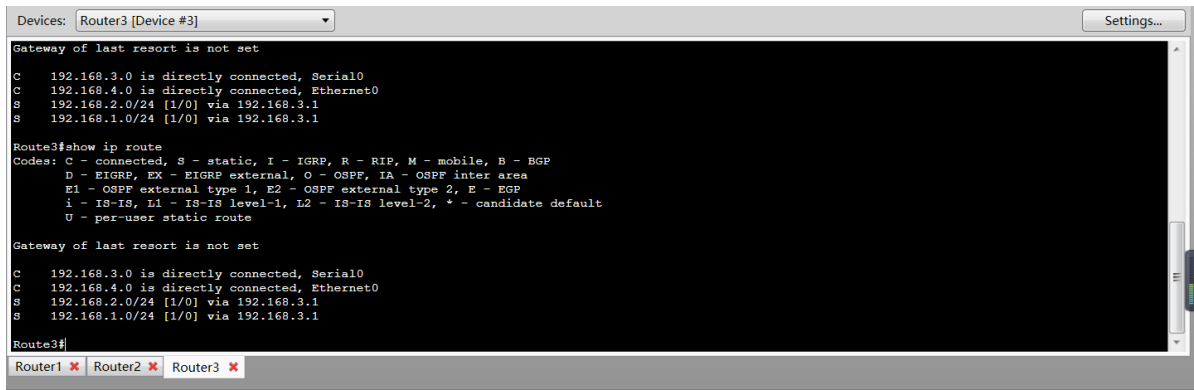
```
Devices: Router2 [Device #2] Settings...
Route2(config)#
Route2(config)#^Z
00:09:21: %SYS-5-CONFIG_I: Configured from console by console
Route2#>
^
% Invalid input detected at '^' marker.

Route2#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
S 192.168.1.0/24 [1/0] via 192.168.2.1
S 192.168.4.0/24 [1/0] via 192.168.3.2
C 192.168.3.0 is directly connected, Serial1

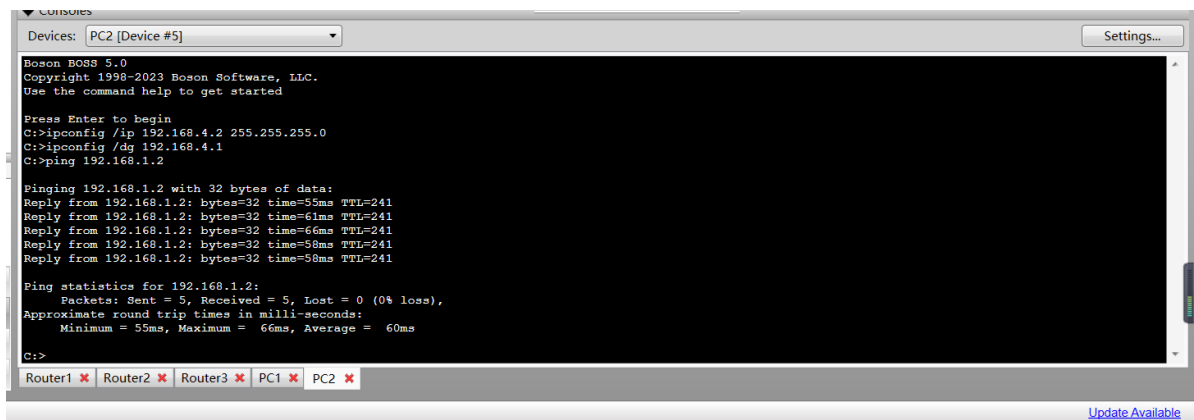
Route2#
```

Route3



2连通情况

PC1可以ping到PC2，PC2可以ping到PC1



3说明

此外，通过 `show running-config` 也可以看到各路由器配置正确。

五、动态配置

拓扑图信息和路由器信息与静态配置相同，只是与静态配置时在命令行代码上有一些差异

实验过程

Route1

- 1 enable
- 2 configure terminal
- 3 hostname Route1
- 4
- 5 %connect to PC1

```
6
7 interface ethernet 0
8 ip address 192.168.1.1 255.255.255.0
9 no shutdown
10
11 %connect to route2
12 interface serial 0
13 ip address 192.168.2.1 255.255.255.0
14 clock rate 64000
15 no shutdown
16 exit
17
18 router rip
19 network 192.168.1.0
20 network 192.168.2.0
21 exit
22 exit
23 copy running startup-config
```

Route2

```
1 enable
2 configure terminal
3 hostname Route2
4
5 %connect to route1
6 interface serial 0
7 ip address 192.168.2.2 255.255.255.0
8 clock rate 64000
9 no shutdown
10
11 %connect to route3
12 interface serial 1
13 ip address 192.168.3.1 255.255.255.0
14 clock rate 64000
15 no shutdown
16 exit
17
18 router rip
19 network 192.168.2.0
20 network 192.168.3.0
21 exit
22 exit
23 copy running startup-config
```

Route3

```
1 enable
2 configure terminal
3 hostname Route3
4
5 %connect to PC2
6
7 interface ethernet 0
```

```

 8 ip address 192.168.4.1 255.255.255.0
 9 no shutdown
10
11 %connect to route2
12 interface serial 0
13 ip address 192.168.3.2 255.255.255.0
14 clock rate 64000
15 no shutdown
16 exit
17
18 router rip
19 network 192.168.3.0
20 network 192.168.4.0
21 exit
22 exit
23 copy running startup-config

```

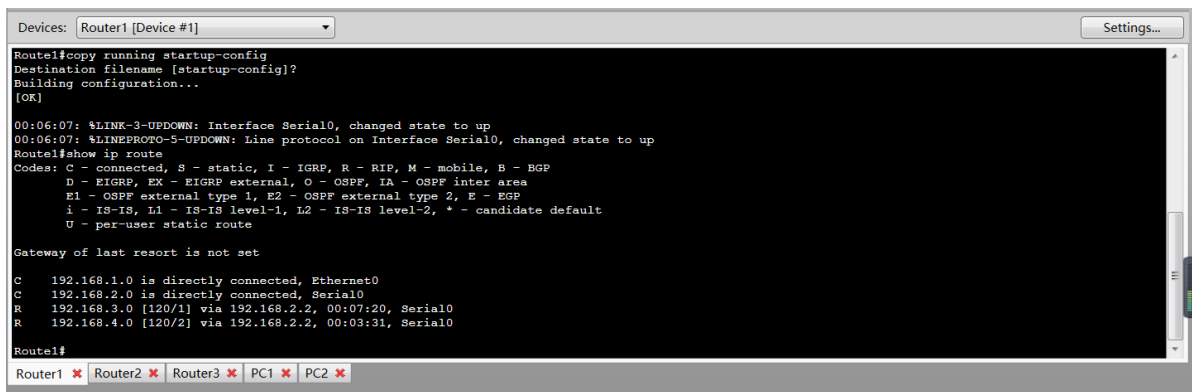
PC1和PC2不变

实验结果

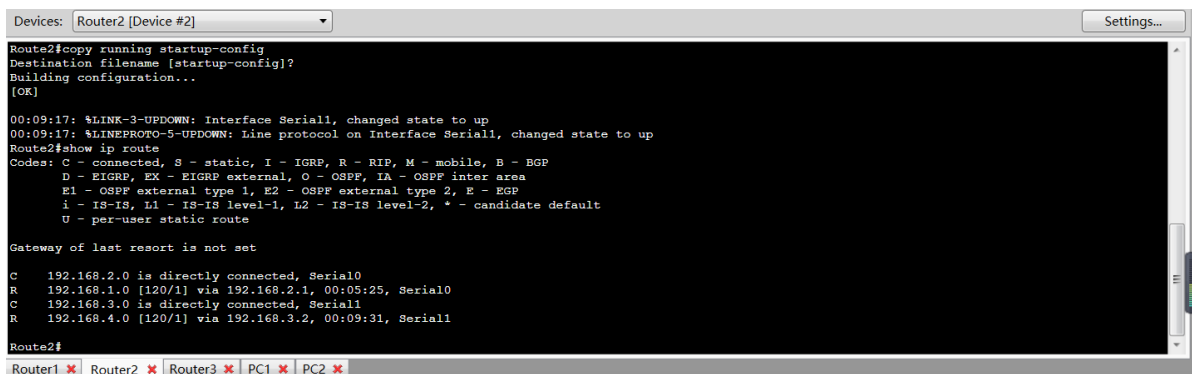
1路由器信息

通过 `show ip route` , 可以看到非直连的网络可以互通。

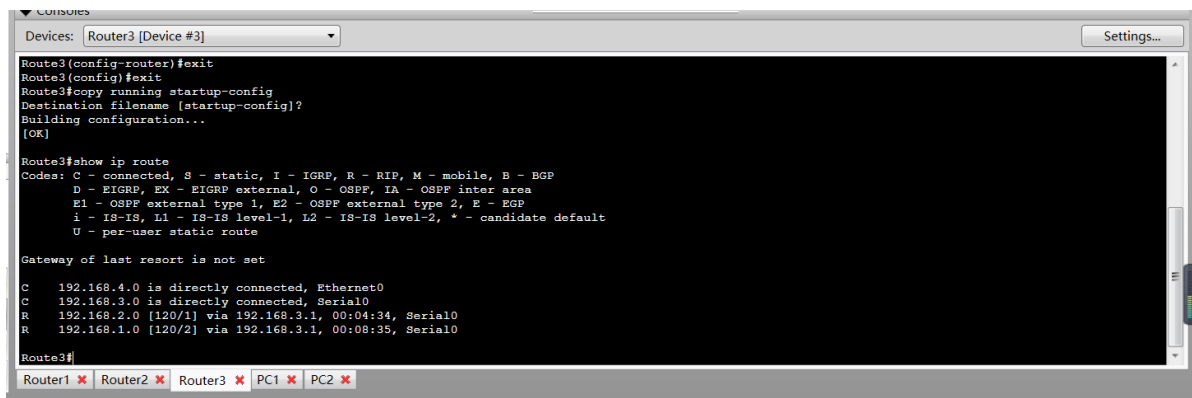
Route1



Route2



Route3



```
Router3[config-router]#exit
Router3#copy running startup-config
Destination filename [startup-config]?
Building configuration...
[OK]

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    192.168.4.0 is directly connected, Ethernet0
C    192.168.3.0 is directly connected, Serial0
R    192.168.2.0 [120/1] via 192.168.3.1, 00:04:34, Serial0
R    192.168.1.0 [120/2] via 192.168.3.1, 00:08:35, Serial0

Router3#
```

2连通情况

PC1可以ping到PC2，PC2可以ping到PC1



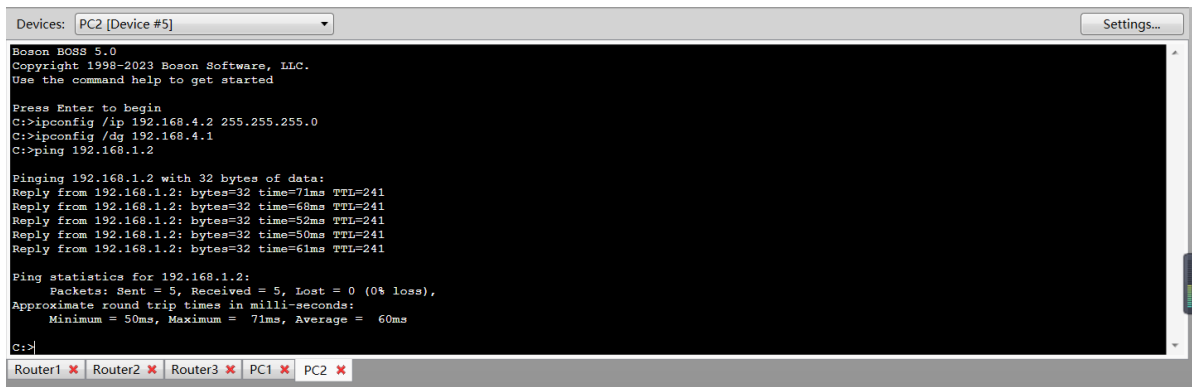
```
Boson BOSS 5.0
Copyright 1998-2023 Boson Software, LLC.
Use the command help to get started

Press Enter to begin
C:>ipconfig /ip 192.168.1.2 255.255.255.0
C:>ipconfig /dg 192.168.1.1
C:>ping 192.168.4.2

Pinging 192.168.4.2 with 32 bytes of data:
Reply from 192.168.4.2: bytes=32 time=58ms TTL=241
Reply from 192.168.4.2: bytes=32 time=51ms TTL=241
Reply from 192.168.4.2: bytes=32 time=53ms TTL=241
Reply from 192.168.4.2: bytes=32 time=65ms TTL=241
Reply from 192.168.4.2: bytes=32 time=60ms TTL=241

Ping statistics for 192.168.4.2:
    Packets: Sent = 5, Received = 5, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 51ms, Maximum = 65ms, Average = 57ms

C:>
```



```
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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
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=71ms TTL=241
Reply from 192.168.1.2: bytes=32 time=68ms TTL=241
Reply from 192.168.1.2: bytes=32 time=52ms TTL=241
Reply from 192.168.1.2: bytes=32 time=50ms TTL=241
Reply from 192.168.1.2: bytes=32 time=61ms 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 = 50ms, Maximum = 71ms, Average = 60ms

C:>
```

3说明

此外，通过 `show running-config` 也可以看到各路由器配置正确。

以route1为例子


```
Router1#show running-config
Building configuration...

Current configuration : 1073 bytes
!
Version 15.b
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Router1
!
!
!
!
ip subnet-zero
!
ip cef
no ip domain-lookup
!
!
!
!
Router1#
```

Router1 ✖

Router2 ✖

Router3 ✖

PC1 ✖

PC2 ✖