

一、实验名称

动态路由RIP/OSPF配置

二、实验目的

学习配置动态路由协议, 使得

三、实验内容

1. 熟悉路由器的基本配置指令;
2. 了解RIP工作的原理与配置指令;
3. 了解OSPF工作的原理与配置指令;
4. 对照实验指导书中的实验12、实验13的要求, 配置相应RIP及OSPF, 实现不同网段下主机的通信。

四、实验仪器

Cisco Packet Tracer Version:8.2.2.0400

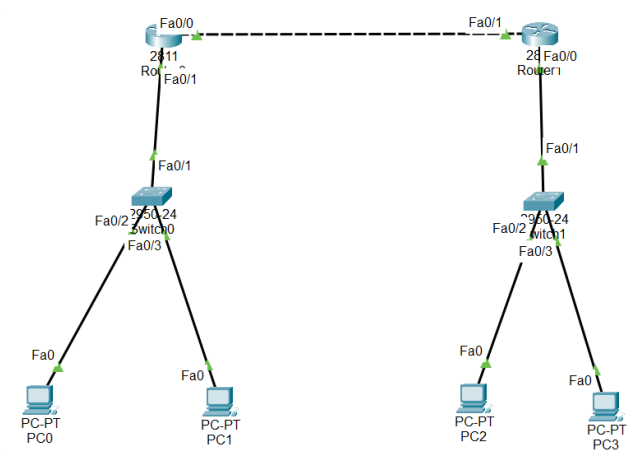
五、实验原理

- **RIP (Routing Information Protocol)** : 基于距离矢量算法, 通过跳数来决定最佳路径。其优点是简单易用, 但不适用于大型网络, 因为它的最大跳数限制为15。
- **OSPF (Open Shortest Path First)** : 基于链路状态算法, 使用最短路径优先 (SPF) 算法计算最优路径。OSPF支持更复杂的网络拓扑, 能够更好地适应大规模网络环境, 具有更高的效率和更好的扩展性。

六、实验过程及实验结果

1. RIP

1.1 基础拓扑连接与IP地址配置



其中接口, IP, 网关信息如下

名称	接口	IP 地址	网关
Router A	F0/0	192.168.1.1/24	
Router A	F0/1	172.1.1.1/24	
Router B	F0/0	172.2.2.1/24	
Router B	F0/1	192.168.1.2/24	
PC0		172.1.1.2/24	172.1.1.1
PC1		172.1.1.3/24	172.1.1.1
PC2		172.2.2.2/24	172.2.2.1
PC3		172.2.2.3/24	172.2.2.1

1.2 配置路由器接口IP地址

在 Router0 中进行如下配置

```
Router>en
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#no ip domain-look
Router(config)#int f0/0
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#int f0/1
Router(config-if)#ip address 172.1.1.1 255.255.255.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Router(config-if)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
```

在 Router1 中配置与上述类似

1.3 RIP路由配置

在 Router0 中进行如下配置

```
Router#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 172.1.1.0
Router(config-router)#network 192.168.1.0
Router(config-router)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
```

在 Router1 中配置与上述类似

进行上述配置之后, 使用 `show ip route` 得到输出如下

```
Router#show ip route
Codes: L - local, C - connected, S - static, 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

    172.1.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       172.1.1.0/24 is directly connected, FastEthernet0/1
L       172.1.1.1/32 is directly connected, FastEthernet0/1
R       172.2.0.0/16 [120/1] via 192.168.1.2, 00:00:08, FastEthernet0/0
    192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, FastEthernet0/0
L       192.168.1.1/32 is directly connected, FastEthernet0/0

Router#
```

1.4 连通性测试

在PC0中对其他三台主机使用ping命令, 三者均能ping通

```
C:\>ping 172.1.1.3

Pinging 172.1.1.3 with 32 bytes of data:

Reply from 172.1.1.3: bytes=32 time<1ms TTL=128
Reply from 172.1.1.3: bytes=32 time<1ms TTL=128
Reply from 172.1.1.3: bytes=32 time<1ms TTL=128
Reply from 172.1.1.3: bytes=32 time<1ms TTL=128

Ping statistics for 172.1.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 172.2.2.2

Pinging 172.2.2.2 with 32 bytes of data:

Request timed out.
Reply from 172.2.2.2: bytes=32 time<1ms TTL=126
Reply from 172.2.2.2: bytes=32 time=10ms TTL=126
Reply from 172.2.2.2: bytes=32 time<1ms TTL=126

Ping statistics for 172.2.2.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 3ms

C:\>ping 172.2.2.3

Pinging 172.2.2.3 with 32 bytes of data:

Request timed out.
Reply from 172.2.2.3: bytes=32 time<1ms TTL=126
Reply from 172.2.2.3: bytes=32 time<1ms TTL=126
Reply from 172.2.2.3: bytes=32 time=1ms TTL=126

Ping statistics for 172.2.2.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>|
```

1.5 思考题(1)

1. 首先给两个路由器装上串口模块 WIC-1T
2. 使用 Serial DCE 线讲router0的 Se0/0/0 与router1的 Se0/0/0 相连
3. 在router0中配置DCE接口

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int s0/0/0
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown
Router(config-if)#exit
```

4. 在router0中重新配置 RIP

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 172.1.1.0
Router(config-router)#network 192.168.1.0
Router(config-router)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

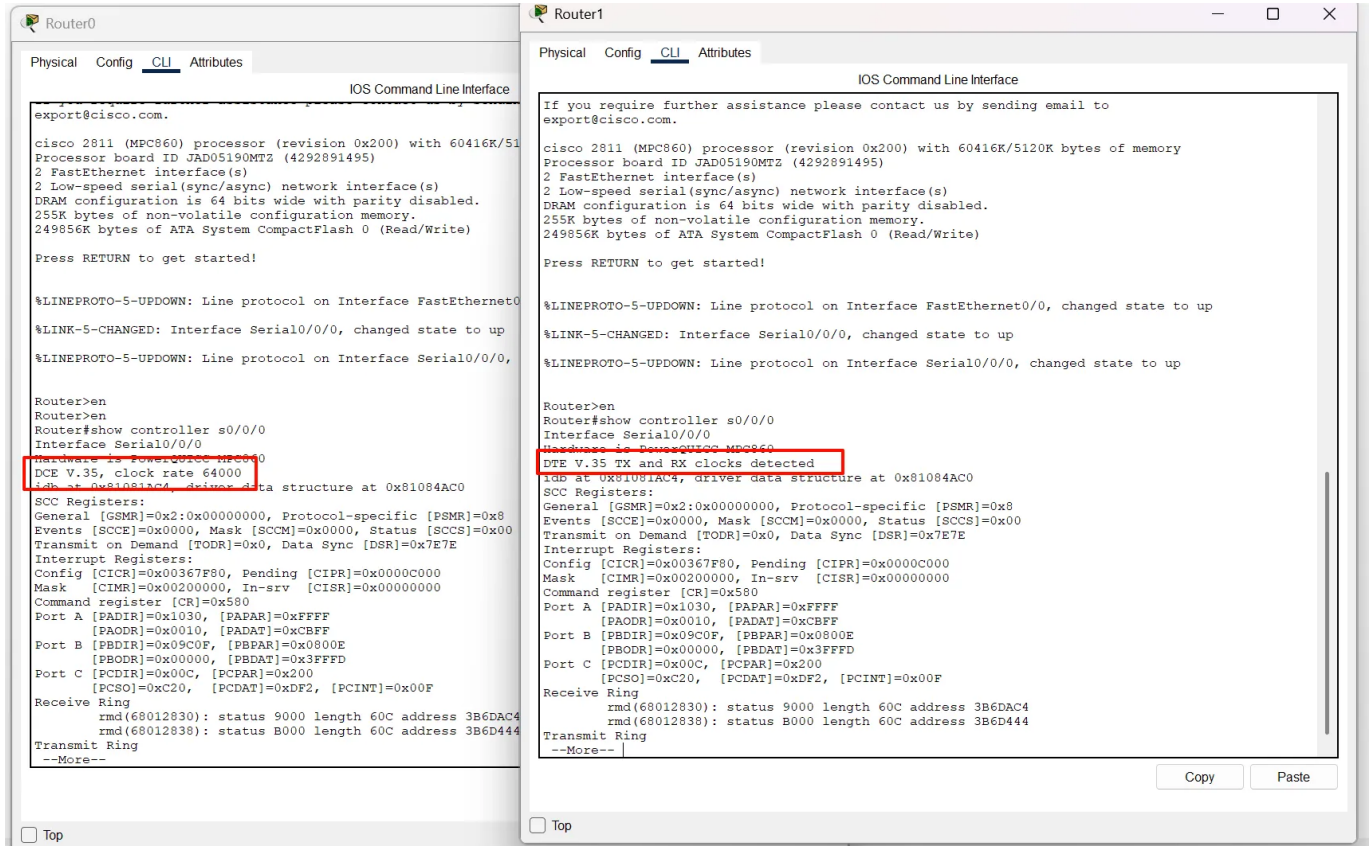
Router#
```

5. router1中重新配置 RIP

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#network 172.2.2.0
Router(config-router)#network 192.168.1.0
Router(config-router)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

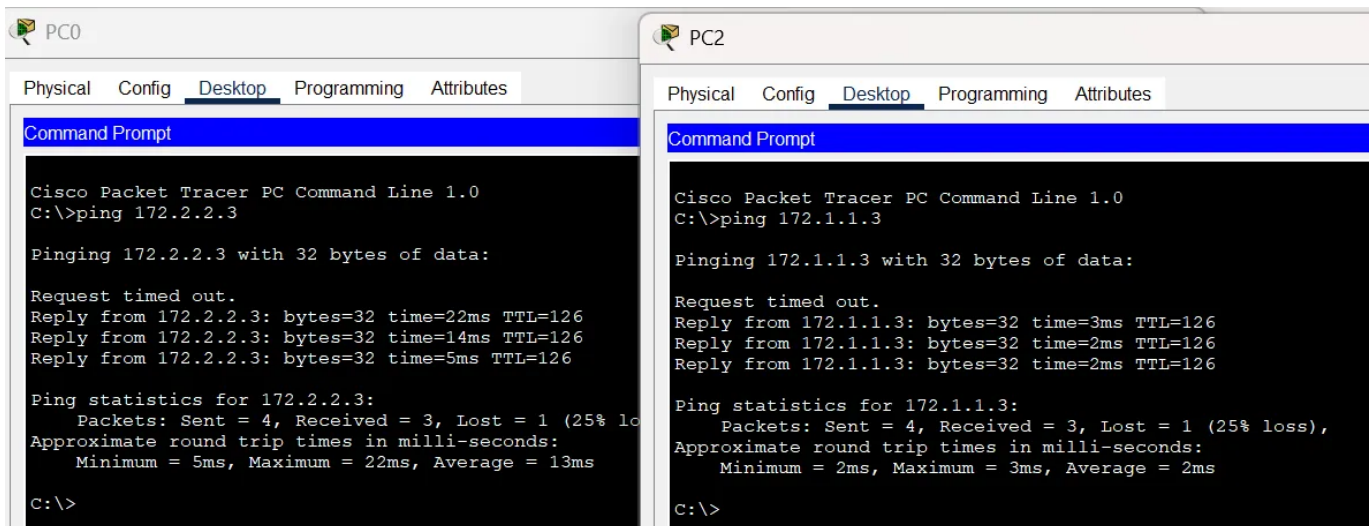
Router#
```

6. 分别在router0, router1中使用 show controller s0/0/0 查看接口配置



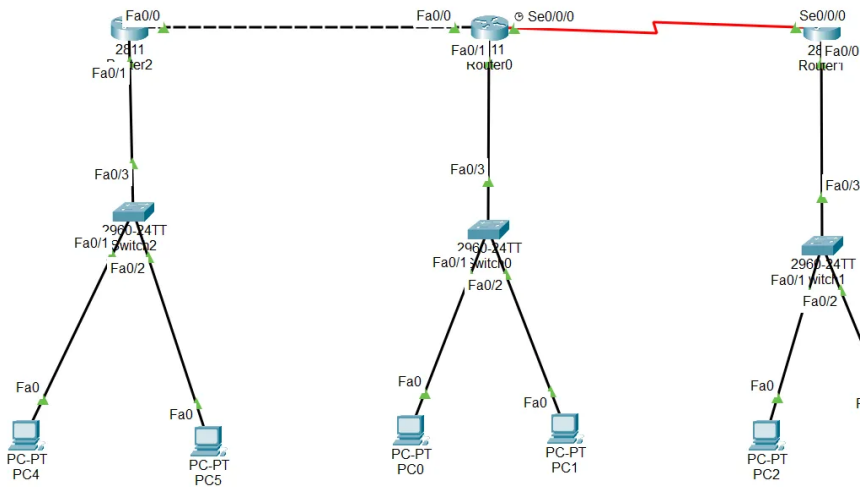
router0中的s0/0/0为DCE, router1中为DTE

6. 再次测试主机间的连通性, 发现此时不同网段下主机可以通信



1.6 思考题(2)

1. 在最左方添加好新的网络拓扑



2. 分配新添加网段涉及到的IP

设备	接口	IP地址	子网掩码	网关
Router 2	F0/0	192.168.2.1/24	255.255.255.0	
	F0/1	172.3.3.1/24	255.255.255.0	
Router 1	F0/2	192.168.2.2/24	255.255.255.0	
PC4		172.3.3.2/24	255.255.255.0	172.3.3.1
PC5		172.3.3.3/24	255.255.255.0	172.3.3.1

3. 路由配置

在router0上进行如下配置

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#no auto-summary
Router(config-router)#network 192.168.2.0
Router(config-router)#exit
Router(config)#
```

在router2上进行如下配置

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int f0/0
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up

Router(config-if)#end
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#no auto-summary
Router(config-router)#network 192.168.2.0
Router(config-router)#network 172.3.3.0
Router(config-router)#exit
Router(config)#
```

在router1上进行如下配置

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#router rip
Router(config-router)#version 2
Router(config-router)#no auto-summary
Router(config-router)#network 192.168.1.0
Router(config-router)#network 192.168.2.0
Router(config-router)#exit
Router(config)#
```

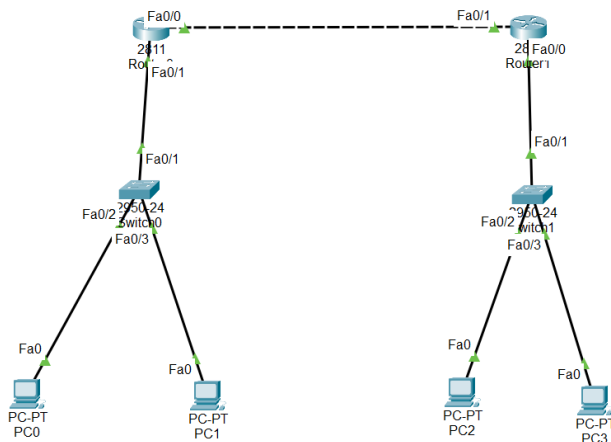
4. 进行连通性测试

分别在不同子网的设备下尝试ping其他子网的主机, 发现均成功. 此时不同网段下主机可以通信

PC0	PC4	PC3
<pre> Cisco Packet Tracer PC Command Line 1.0 C:\>ping 172.2.2.3 Pinging 172.2.2.3 with 32 bytes of data: Request timed out. Reply from 172.2.2.3: bytes=32 time=14ms TTL=126 Reply from 172.2.2.3: bytes=32 time=1ms TTL=126 Reply from 172.2.2.3: bytes=32 time=19ms TTL=126 Ping statistics for 172.2.2.3: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 1ms, Maximum = 19ms, Average = 11ms C:\>ping 172.3.3.3 Pinging 172.3.3.3 with 32 bytes of data: Request timed out. Reply from 172.3.3.3: bytes=32 time<1ms TTL=126 Reply from 172.3.3.3: bytes=32 time<1ms TTL=126 Reply from 172.3.3.3: bytes=32 time<1ms TTL=126 Ping statistics for 172.3.3.3: Packets: Sent = 4, Received = 3, Lost = 1 (25% loss), Approximate round trip times in milli-seconds: Minimum = 0ms, Maximum = 0ms, Average = 0ms C:\> </pre>	<pre> Cisco Packet Tracer PC Command Line 1.0 C:\>ping 172.1.1.3 Pinging 172.1.1.3 with 32 bytes of data: Request timed out. Reply from 172.1.1.3: bytes=32 time<1ms TTL=126 Reply from 172.1.1.3: bytes=32 time<1ms TTL=126 Ping statistics for 172.1.1.3: Packets: Sent = 4, Received = 2, Lost = 2 (50% loss), Approximate round trip times in milli-seconds: Minimum = 0ms, Maximum = 0ms, Average = 0ms C:\>ping 172.2.2.3 Pinging 172.2.2.3 with 32 bytes of data: Reply from 172.2.2.3: bytes=32 time=16ms TTL=125 Reply from 172.2.2.3: bytes=32 time=19ms TTL=125 Reply from 172.2.2.3: bytes=32 time=2ms TTL=125 Reply from 172.2.2.3: bytes=32 time=7ms TTL=125 Ping statistics for 172.2.2.3: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 2ms, Maximum = 19ms, Average = 11ms C:\> </pre>	<pre> Cisco Packet Tracer PC Command Line 1.0 C:\>ping 172.1.1.2 Pinging 172.1.1.2 with 32 bytes of data: Reply from 172.1.1.2: bytes=32 time=15ms TTL=126 Reply from 172.1.1.2: bytes=32 time=11ms TTL=126 Reply from 172.1.1.2: bytes=32 time=20ms TTL=126 Reply from 172.1.1.2: bytes=32 time=14ms TTL=126 Ping statistics for 172.1.1.2: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 11ms, Maximum = 20ms, Average = 15ms C:\>ping 172.3.3.2 Pinging 172.3.3.2 with 32 bytes of data: Reply from 172.3.3.2: bytes=32 time=14ms TTL=125 Reply from 172.3.3.2: bytes=32 time=13ms TTL=125 Reply from 172.3.3.2: bytes=32 time=9ms TTL=125 Reply from 172.3.3.2: bytes=32 time=14ms TTL=125 Ping statistics for 172.3.3.2: Packets: Sent = 4, Received = 4, Lost = 0 (0% loss), Approximate round trip times in milli-seconds: Minimum = 9ms, Maximum = 14ms, Average = 12ms C:\> </pre>

2. OSPF

2.1 基础拓扑连接与IP地址配置



其中接口, IP, 网关信息如下

名称	接口	IP 地址	网关
Router A	F0/0	192.168.1.1/24	
Router A	F0/1	172.1.1.1/24	
Router B	F0/0	172.2.2.1/24	
Router B	F0/1	192.168.1.2/24	
PC0		172.1.1.2/24	172.1.1.1
PC1		172.1.1.3/24	172.1.1.1
PC2		172.2.2.2/24	172.2.2.1
PC3		172.2.2.3/24	172.2.2.1

2.2 配置路由器接口IP地址

在 Router0 中进行如下配置

```
Router>en
Router#config t
Enter configuration commands, one per line.  End with CNTL/Z.
Router(config)#no ip domain-look
Router(config)#int f0/0
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

Router(config-if)#exit
Router(config)#int f0/1
Router(config-if)#ip address 172.1.1.1 255.255.255.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/1, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/1, changed state to up

Router(config-if)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
```

在 Router1 中配置与上述类似

2.3 OSPF路由配置

```
在 Router0 中进行如下配置### Router0

Router(config)#router ospf 100
Router(config-router)#net 172.1.1.0 0.0.0.255 area 0
Router(config-router)#net 192.168.1.0 0.0.0.255 area 0
Router(config-router)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#
```

在 Router1 中配置与上述类似

进行上述配置之后, 使用 `show ip route` 得到输出如下

```
Router>en
Router#show ip route
Codes: L - local, C - connected, S - static, 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

    172.1.0.0/16 is variably subnetted, 2 subnets, 2 masks
C       172.1.1.0/24 is directly connected, FastEthernet0/1
L       172.1.1.1/32 is directly connected, FastEthernet0/1
O       172.2.0.0/24 is subnetted, 1 subnets
        172.2.2.0/24 [110/2] via 192.168.1.2, 00:02:26, FastEthernet0/0
C       192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, FastEthernet0/0
L       192.168.1.1/32 is directly connected, FastEthernet0/0

Router#
```

1.4 连通性测试

在PC0中对其他三台主机使用ping命令,三者均能ping通

```
C:\>ping 172.1.1.3

Pinging 172.1.1.3 with 32 bytes of data:

Reply from 172.1.1.3: bytes=32 time<1ms TTL=128
Reply from 172.1.1.3: bytes=32 time<1ms TTL=128
Reply from 172.1.1.3: bytes=32 time<1ms TTL=128
Reply from 172.1.1.3: bytes=32 time<1ms TTL=128

Ping statistics for 172.1.1.3:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 0ms, Average = 0ms

C:\>ping 172.2.2.2

Pinging 172.2.2.2 with 32 bytes of data:

Request timed out.
Reply from 172.2.2.2: bytes=32 time<1ms TTL=126
Reply from 172.2.2.2: bytes=32 time=10ms TTL=126
Reply from 172.2.2.2: bytes=32 time<1ms TTL=126

Ping statistics for 172.2.2.2:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 10ms, Average = 3ms

C:\>ping 172.2.2.3

Pinging 172.2.2.3 with 32 bytes of data:

Request timed out.
Reply from 172.2.2.3: bytes=32 time<1ms TTL=126
Reply from 172.2.2.3: bytes=32 time<1ms TTL=126
Reply from 172.2.2.3: bytes=32 time=1ms TTL=126

Ping statistics for 172.2.2.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms

C:\>
```

1.5 思考题(1)

1. 首先给两个路由器装上串口模块 WIC-1T

2. 使用 Serial DCE 线将router0的 se0/0/0 与router1的 se0/0/0 相连

3. 在router0中配置DCE接口

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int s0/0/0
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown
Router(config-if)#exit
```

4. 在router0中重新配置 OSPF

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.

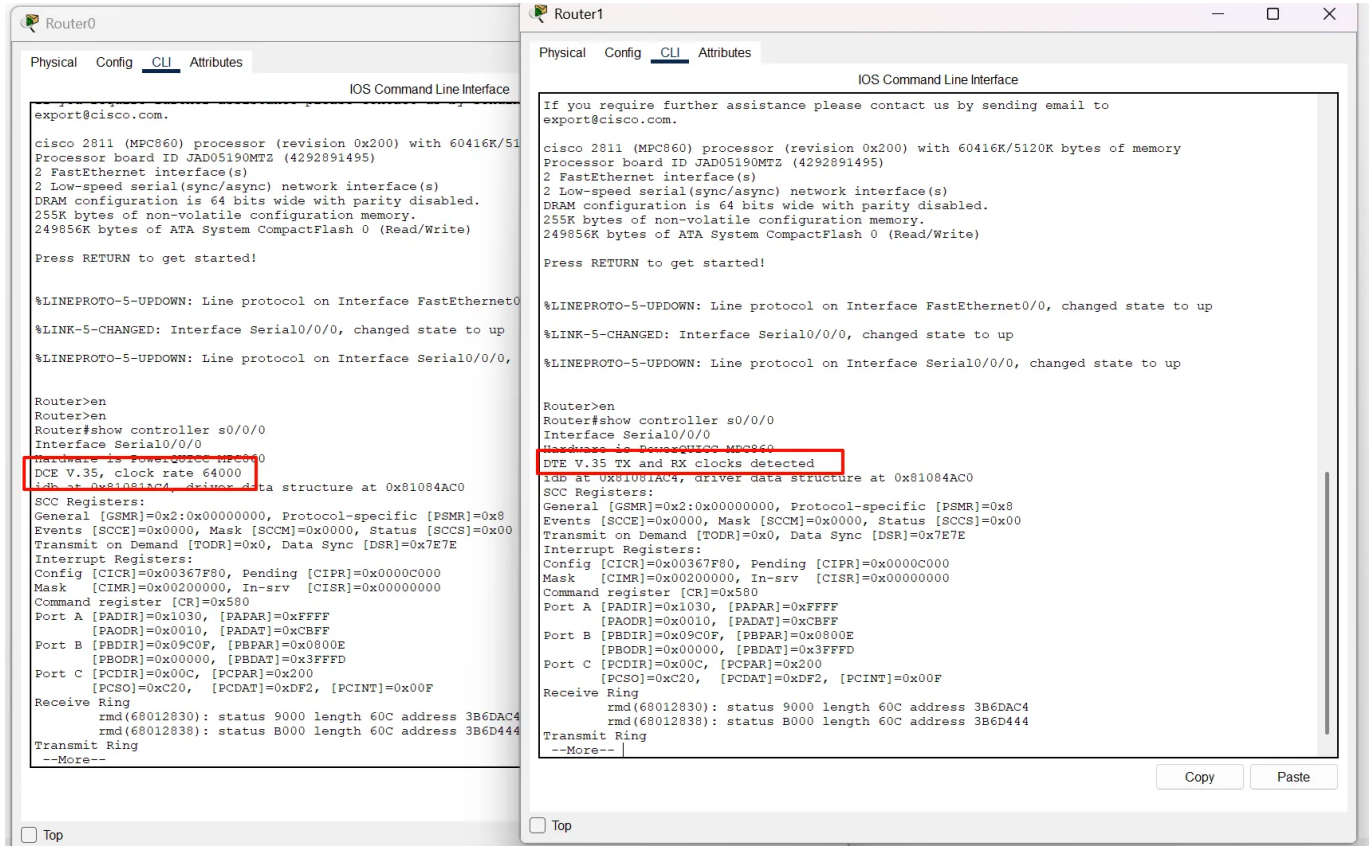
Router(config)#router ospf 1
Router(config-router)#network 172.1.1.0 0.0.0.255 area 0
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

5. router1中重新配置 OSPF

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.

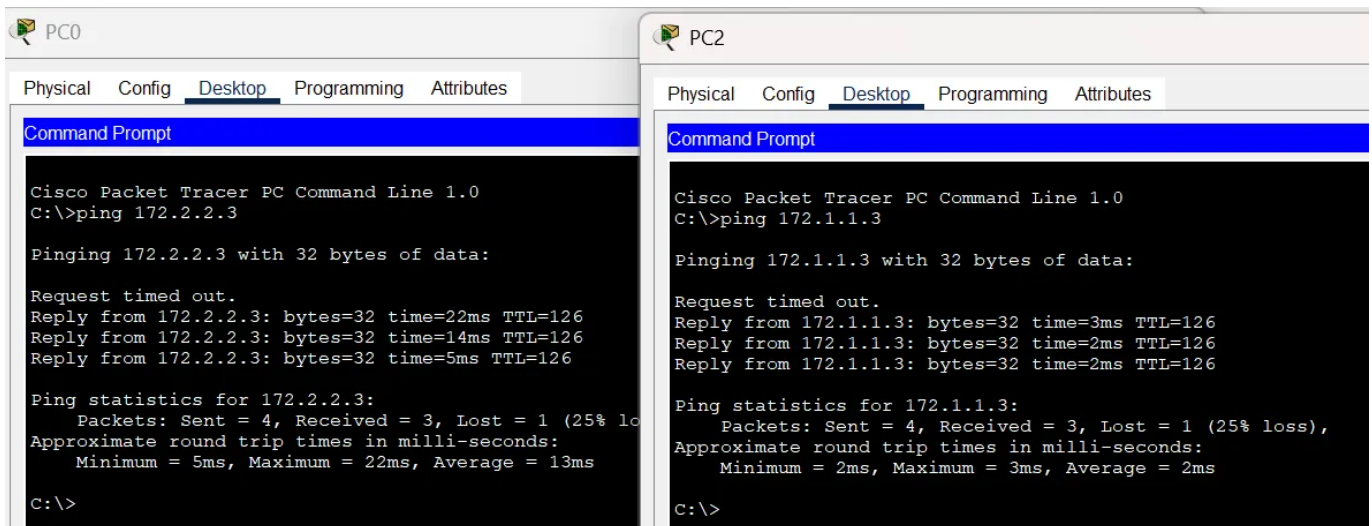
Router(config)#router ospf 1
Router(config-router)#network 172.2.2.0 0.0.0.255 area 0
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#end
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

6. 分别在router0, router1中使用 show controller s0/0/0 查看接口配置



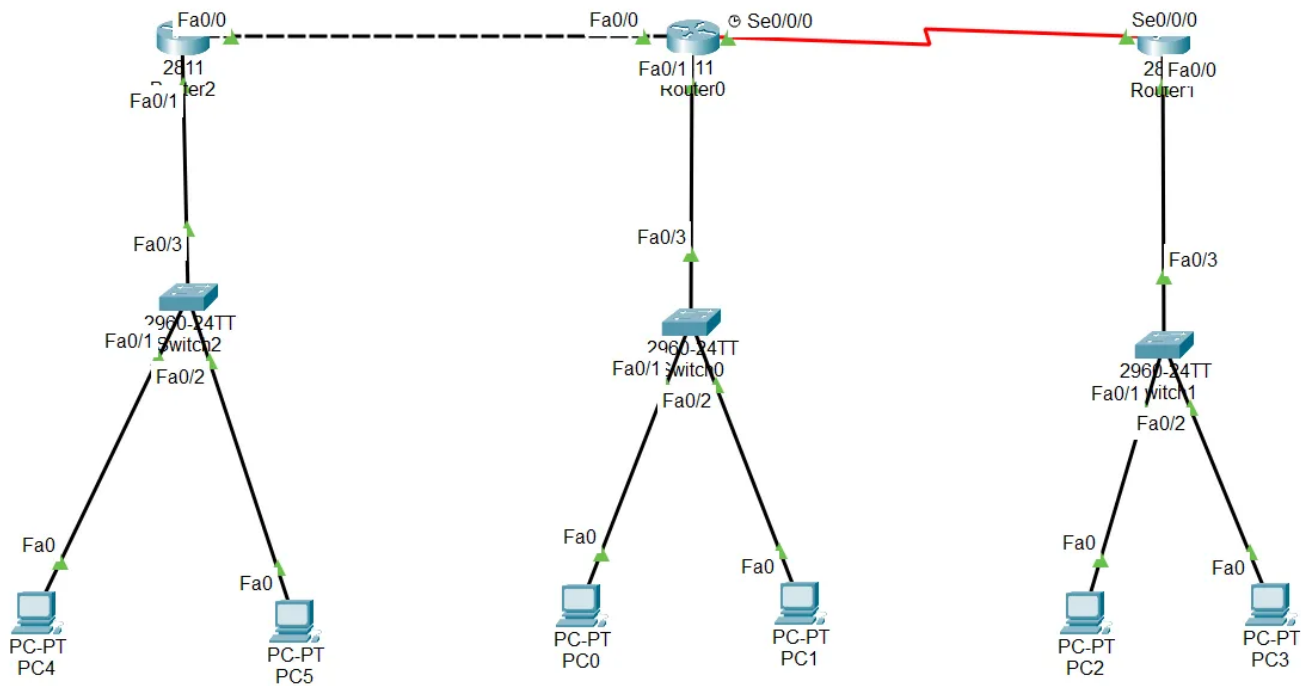
router0中的s0/0/0为DCE, router1中为DTE

6. 再次测试主机间的连通性, 发现此时不同网段下主机可以通信



1.6 思考题(2)

1. 在最左方添加好新的网络拓扑



2. 分配新添加网段涉及到的IP

设备	接口	IP地址	子网掩码	网关
Router 2	F0/0	192.168.2.1/24	255.255.255.0	
	F0/1	172.3.3.1/24	255.255.255.0	
Router 1	F0/2	192.168.2.2/24	255.255.255.0	
PC4		172.3.3.2/24	255.255.255.0	172.3.3.1
PC5		172.3.3.3/24	255.255.255.0	172.3.3.1

3. 路由配置

在router0上进行如下配置

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#router ospf 1
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#
```

在router2上进行如下配置

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.

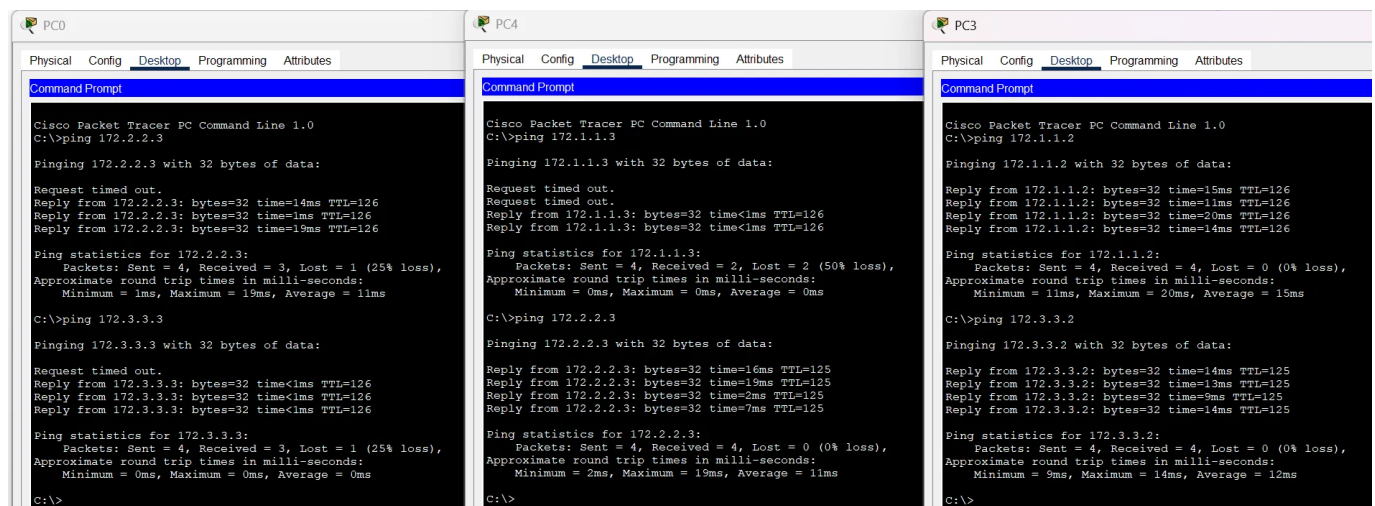
Router(config)#router ospf 1
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#network 172.3.3.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#
```

在router1上进行如下配置

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#router ospf 1
Router(config-router)#network 192.168.1.0 0.0.0.255 area 0
Router(config-router)#network 192.168.2.0 0.0.0.255 area 0
Router(config-router)#exit
Router(config)#进行连通性测试
```

分别在不同子网的设备下尝试ping其他子网的主机,发现均成功.此时不同网段下主机可以通信



七、讨论与结论

讨论

RIP vs OSPF:

- RIP由于其实现简单，适合小型网络部署，但对于较复杂的网络环境，其性能和可扩展性有限。相比之下，OSPF因其高效性和灵活性，更适合于大型企业网络。
- RIP的最大跳数限制使其不适合跨越多个路由器的网络架构，而OSPF则没有这种限制。

结论

本实验通过配置RIP和OSPF两种动态路由协议，深入理解了它们的工作机制及其适用场景。实验结果表明：

- RIP协议虽然易于配置，但由于其固有的局限性，在处理复杂网络时表现不佳。
- OSPF协议展示了更强的适应能力，能够有效应对较大规模的网络环境，提供更优化的路由选择。

通过本次实验，我们不仅掌握了如何在Cisco Packet Tracer中配置这两种路由协议，还加深了对网络路由概念的理解，同时也认识到合理选择路由协议对于构建高效、可靠的网络至关重要。