OSPF 动态网络路由配置

学生姓名：李俊杰 1850668 **合作学生：无**

实验地点：济事楼 330 **实验时间：2020 年 11 月 12 日 78 节**

【实验目的】

1.了解动态路由表生成基本原理。

2.了解最短路径优先算法基本思想。

3.了解掌握 OSPF 动态路由技能。

【实验原理】

1.OSPF 协议原理（Open Shortest Path First，OSPF）

OSPF 路由协议是一种典型的链路状态的路由协议，一般用于同一个路由域内。路由域是指一个自治系统（Autonomous System，AS），它是指一组通过统一的路由政策或路由协议互相交换路由信息的网络。在这个 AS 中所有的 OSPF 路由都维护**同一个**相同的描述这个 AS 结构的数据库，该数据库中存放的是路由域中相应链路的状态信息，OSPF 路由器正是通过这个数据库计算出其 OSPF 路由表。

作为一种链路状态的路由协议，OSPF 将链路状态组播数据（Link State Advertisement，LSA）传送给在某一区域内的**所有**路由器，这一点与距离矢量路由协议不同，运行距离矢量路由协议的路由器是将部分或全部的路由表传递给与其相邻的路由器。

2 路径优先算法

路径优先算法可以为图中任意两个节点，找出一条**最短路径**。SPF 算法原理：用路由器相互连接的拓扑图构建一个图，在图中以所在路由器为源点，寻求到其他路由器节点的所有最短路径，最终找到若干条最短路径，网络中所有路由器节点都分布在这些最短路径上，由最短路径很容易计算获得下一跳路由。

3.OSPF 路由协议工作步骤

广播链路状态信息->每台路由器使用 SPF 算法计算路由表->路由器将定时监测链接状态。

【实验设备】

1.一台运行 Windows 系统的计算机。

2.虚拟终端模拟软件 Cisco Packet Tracer。

【实验步骤】

1.首先规划网络地址及拓扑图。

2.配置 PC 机、服务器及路由器端口 IP 地址。

3.配置 OSPF 之前检查各台 PC 之间能否连通。

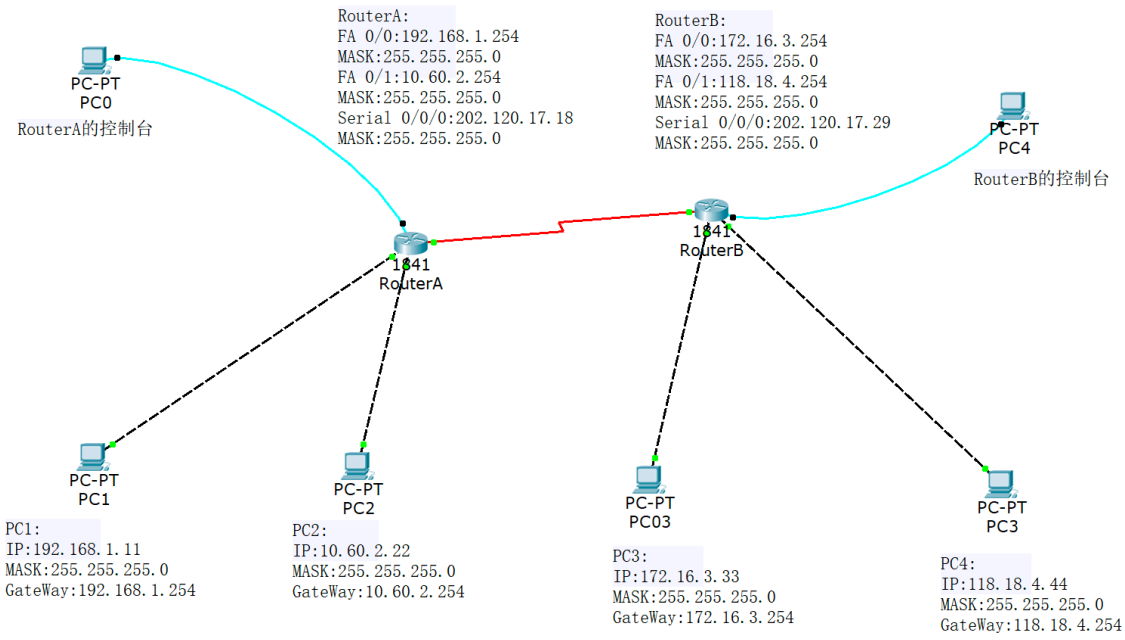
4.在 RA 上配置 OSPF。

5.在 RB 上配置 OSPF。

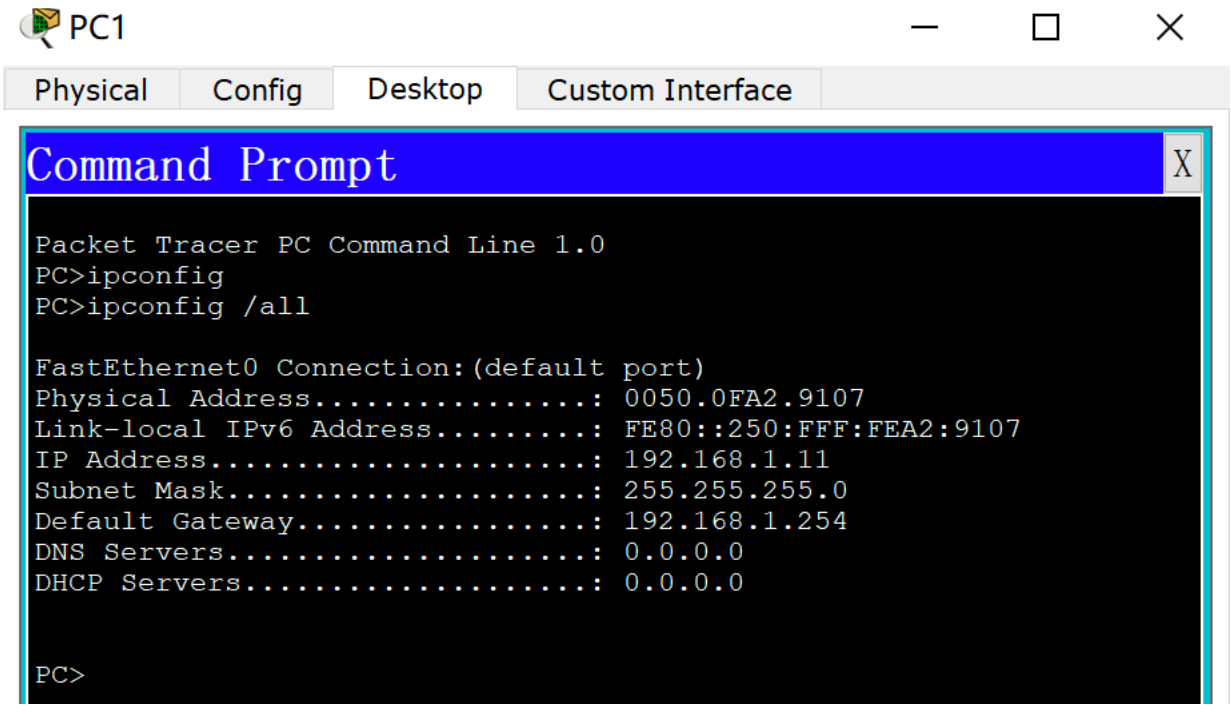
6.验证各主机之间的连通性。

【实验现象】

1.网络地址拓扑图 如图所示。



2.配置好 PC 的地址、网关、掩码等信息。



配置路由器的端口地址，相关配置操作命令如下：

Router A：

interface FastEthernet 0/0

ip address 192.168.1.254 255.255.255.0

no shutdown

interface FastEthernet 0/1

ip address 10.60.2.254 255.255.255.0

no shutdown

Router B:

interface FastEthernet 0/0

ip address 172.16.3.254 255.255.255.0

no shutdown

interface FastEthernet 0/1

ip address 118.18.4.44 255.255.255.0

no shutdown

配置路由器的串口端口地址：

Router A:

interface Serial 0/0/0

ip address 202.120.17.18 255.255.255.0

Clock rate 56000

no shutdown

Router B:

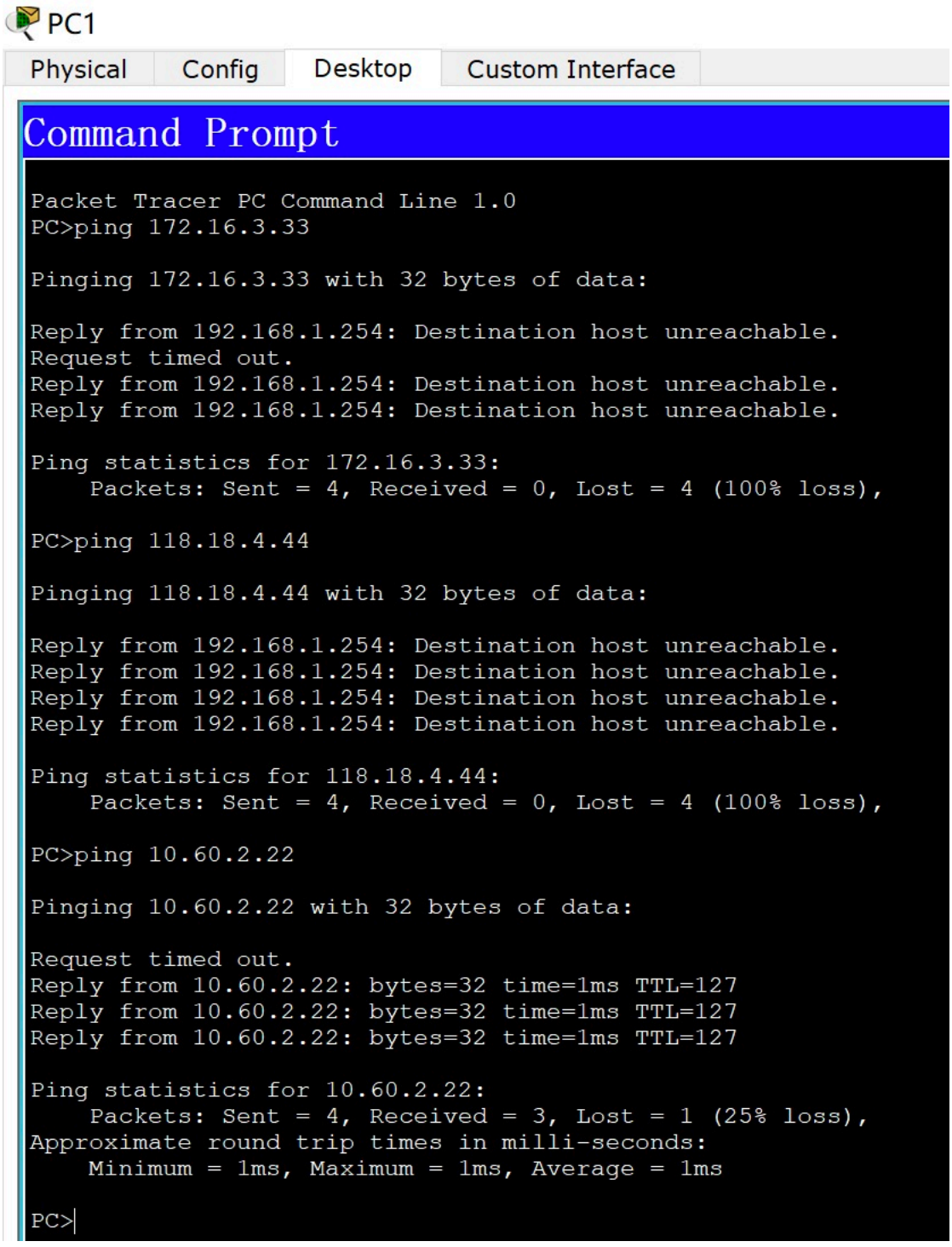
interface Serial 0/0/0

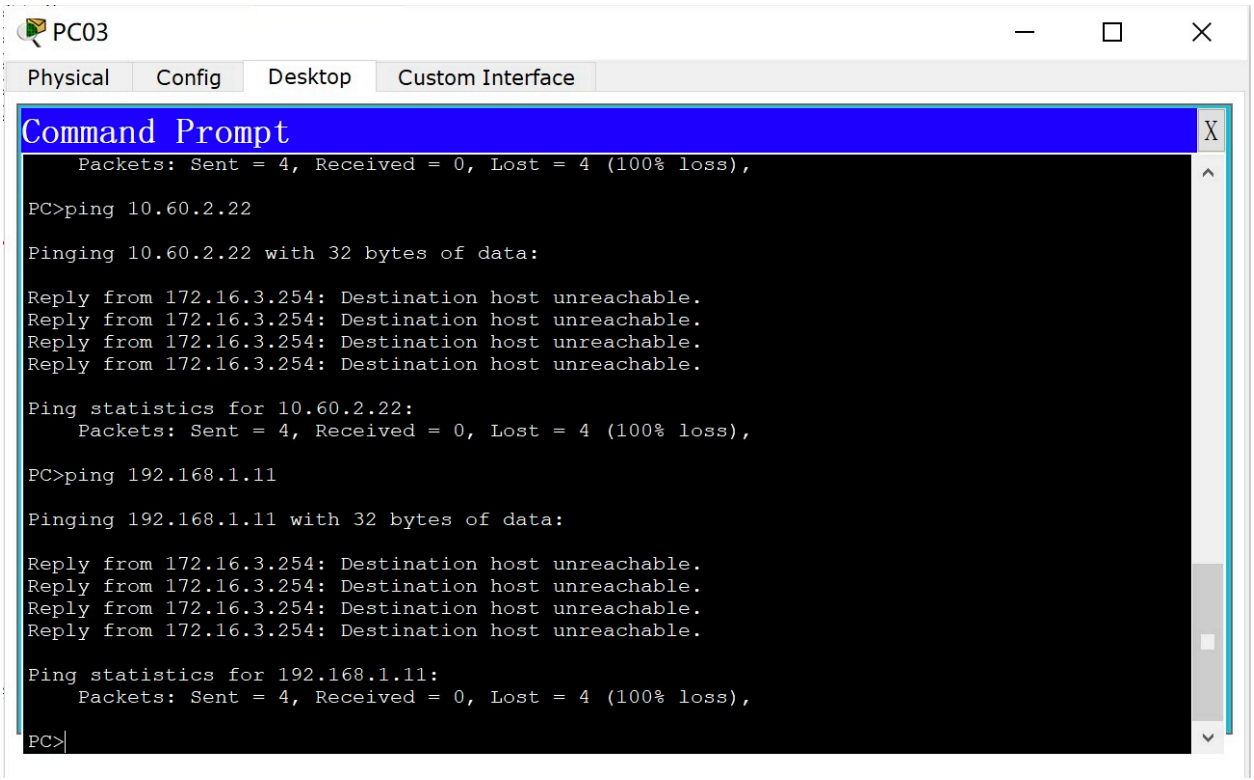
ip address 202.120.17.29 255.255.255.0

Clock rate 56000

no shutdown

3.在配置路由器 A 和 B 的 OSPF 之前测试各台 PC 的连通性：


PC1
Physical
Config
Desktop
Custom Interface
Command Prompt
Packet Tracer PC Command Line 1.0
PC>ping 172.16.3.33
Pinging 172.16.3.33 with 32 bytes of data:
Reply from 192.168.1.254: Destination host unreachable.
Request timed out.
Reply from 192.168.1.254: Destination host unreachable.
Reply from 192.168.1.254: Destination host unreachable.
Ping statistics for 172.16.3.33:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>ping 118.18.4.44
Pinging 118.18.4.44 with 32 bytes of data:
Reply from 192.168.1.254: Destination host unreachable.
Reply from 192.168.1.254: Destination host unreachable.
Reply from 192.168.1.254: Destination host unreachable.
Reply from 192.168.1.254: Destination host unreachable.
Ping statistics for 118.18.4.44:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>ping 10.60.2.22
Pinging 10.60.2.22 with 32 bytes of data:
Request timed out.
Reply from 10.60.2.22: bytes=32 time=1ms TTL=127
Reply from 10.60.2.22: bytes=32 time=1ms TTL=127
Reply from 10.60.2.22: bytes=32 time=1ms TTL=127
Ping statistics for 10.60.2.22:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 1ms, Maximum = 1ms, Average = 1ms
PC>



4.配置路由器 RA 的 OSPF 路由表。

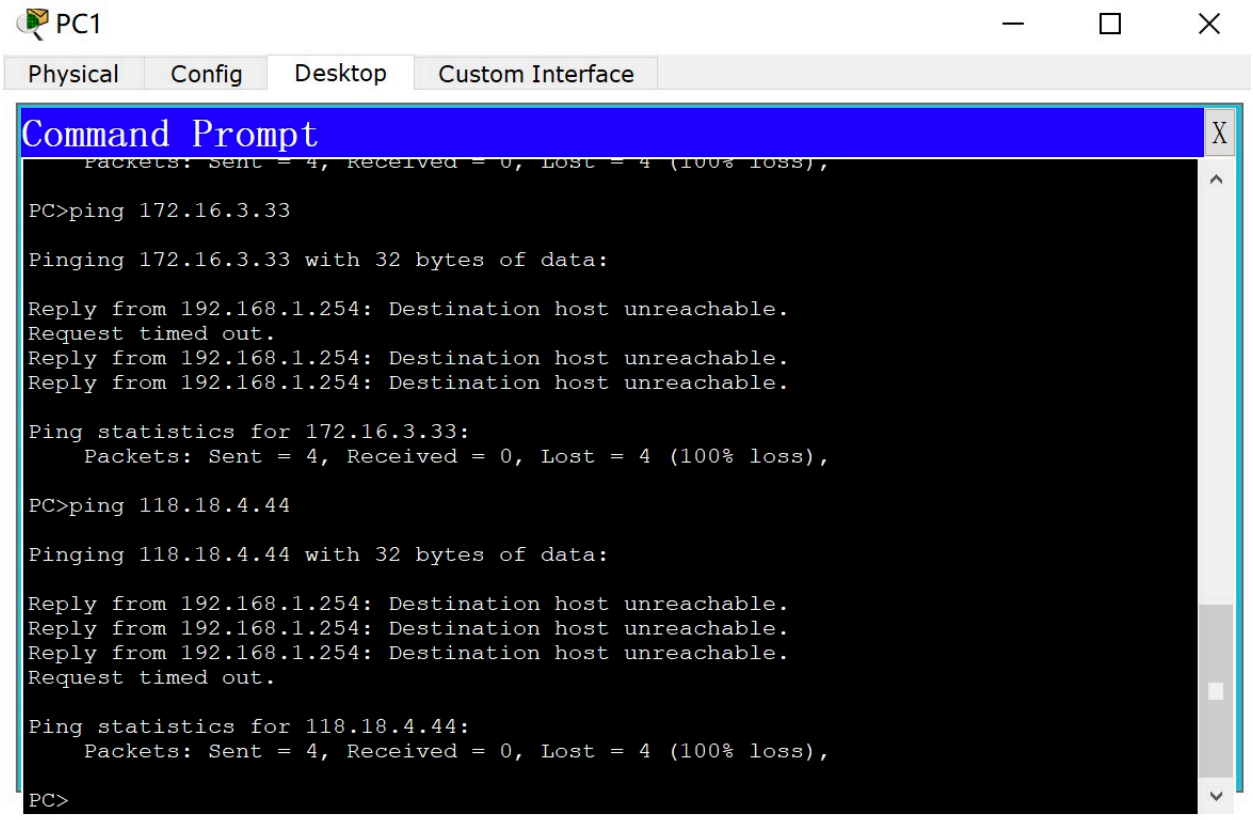
router ospf 1

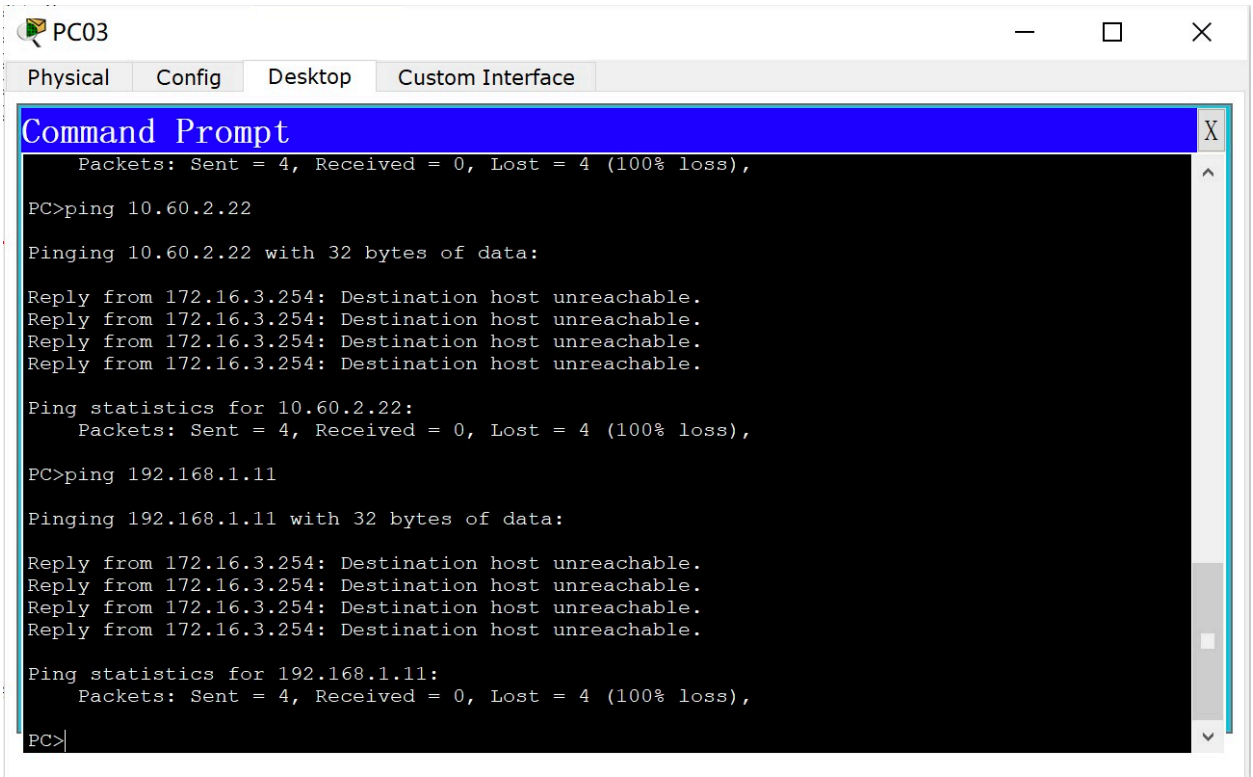
network 192.168.1.0 0.0.0.255 area 0

network 10.60.2.0 0.0.0.255 area 0

network 202.120.17.0 0.0.0.255 area 0

5.在配置路由器 A 或 B 的 OSPF 之后，检测各台 PC 之间的连通性。


PC1
Physical
Config
Desktop
Custom Interface
Command Prompt
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>ping 172.16.3.33
Pinging 172.16.3.33 with 32 bytes of data:
Reply from 192.168.1.254: Destination host unreachable.
Request timed out.
Reply from 192.168.1.254: Destination host unreachable.
Reply from 192.168.1.254: Destination host unreachable.
Ping statistics for 172.16.3.33:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>ping 118.18.4.44
Pinging 118.18.4.44 with 32 bytes of data:
Reply from 192.168.1.254: Destination host unreachable.
Reply from 192.168.1.254: Destination host unreachable.
Reply from 192.168.1.254: Destination host unreachable.
Request timed out.
Ping statistics for 118.18.4.44:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>


PC03
Physical
Config
Desktop
Custom Interface
Command Prompt
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>ping 10.60.2.22
Pinging 10.60.2.22 with 32 bytes of data:
Reply from 172.16.3.254: Destination host unreachable.
Reply from 172.16.3.254: Destination host unreachable.
Reply from 172.16.3.254: Destination host unreachable.
Reply from 172.16.3.254: Destination host unreachable.
Ping statistics for 10.60.2.22:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>ping 192.168.1.11
Pinging 192.168.1.11 with 32 bytes of data:
Reply from 172.16.3.254: Destination host unreachable.
Reply from 172.16.3.254: Destination host unreachable.
Reply from 172.16.3.254: Destination host unreachable.
Reply from 172.16.3.254: Destination host unreachable.
Ping statistics for 192.168.1.11:
Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
PC>

6.配置路由器 RB 的 OSPF。

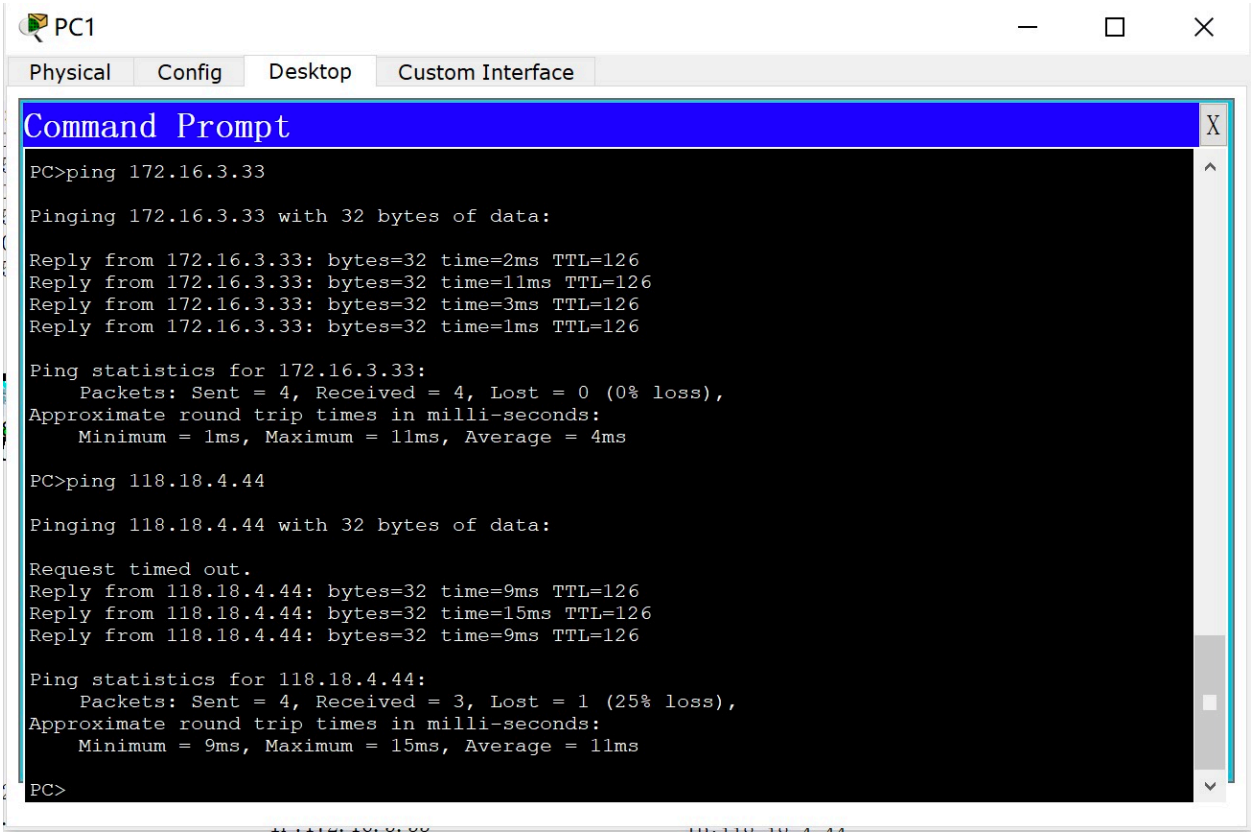
router ospf 1

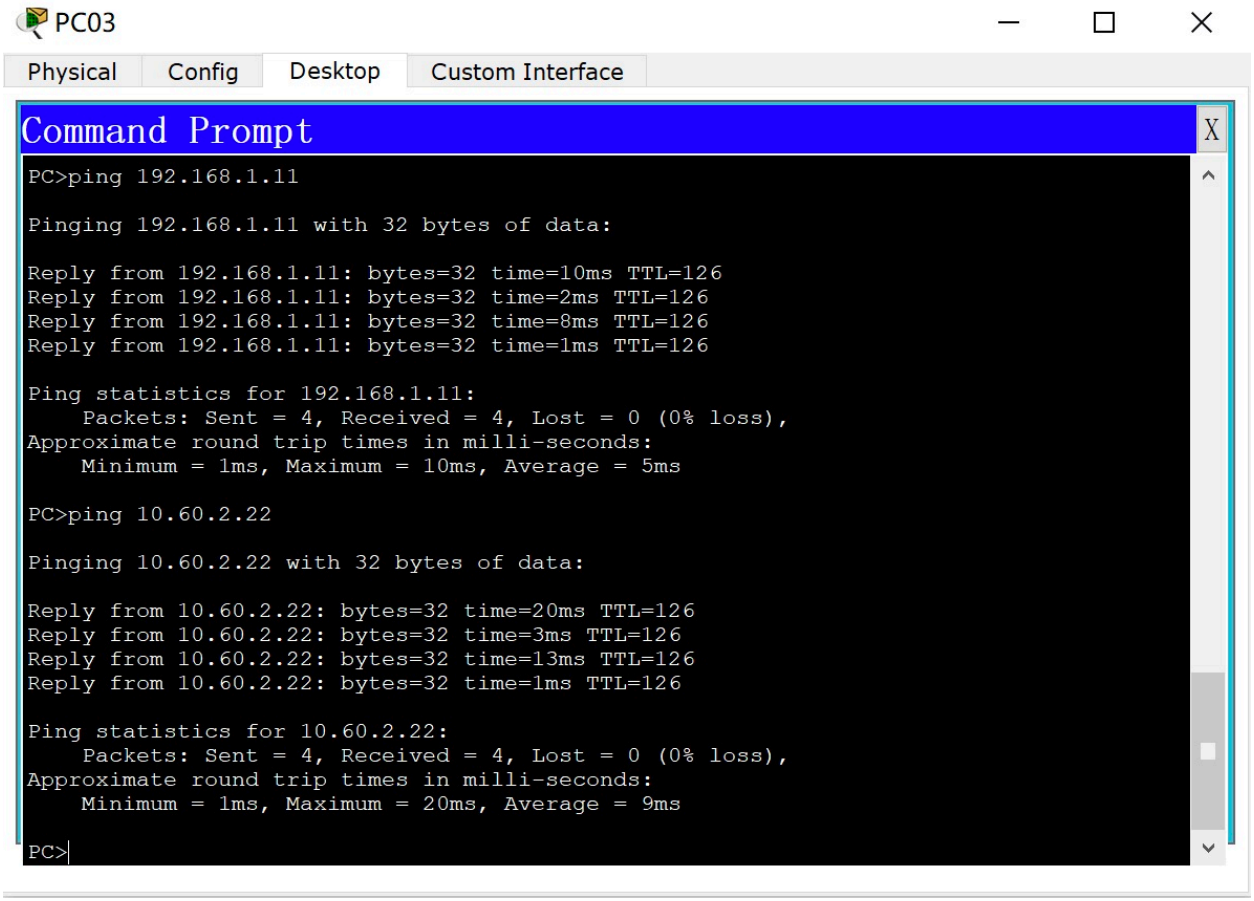
network 172.16.3.0 0.0.0.255 area 0

network 118.18.4.0 0.0.0.255 area 0

network 202.120.17.0 0.0.0.255 area 0

7.在配置路由器 A 和 B 的 OSPF 之后，检查各台 PC 之间的连通性。

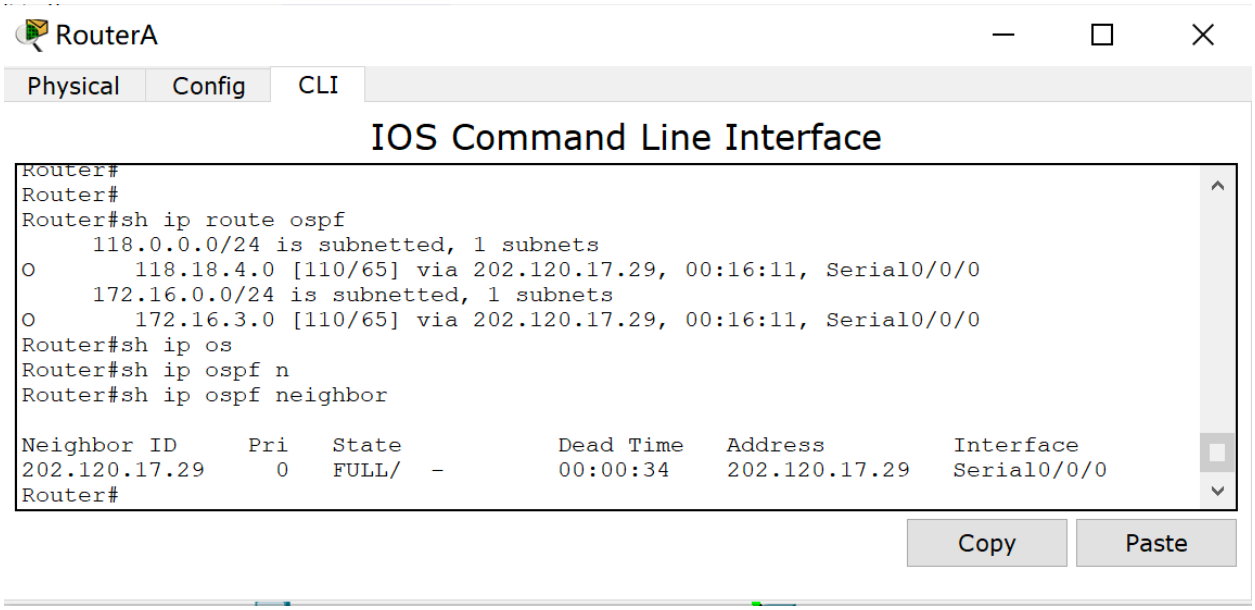


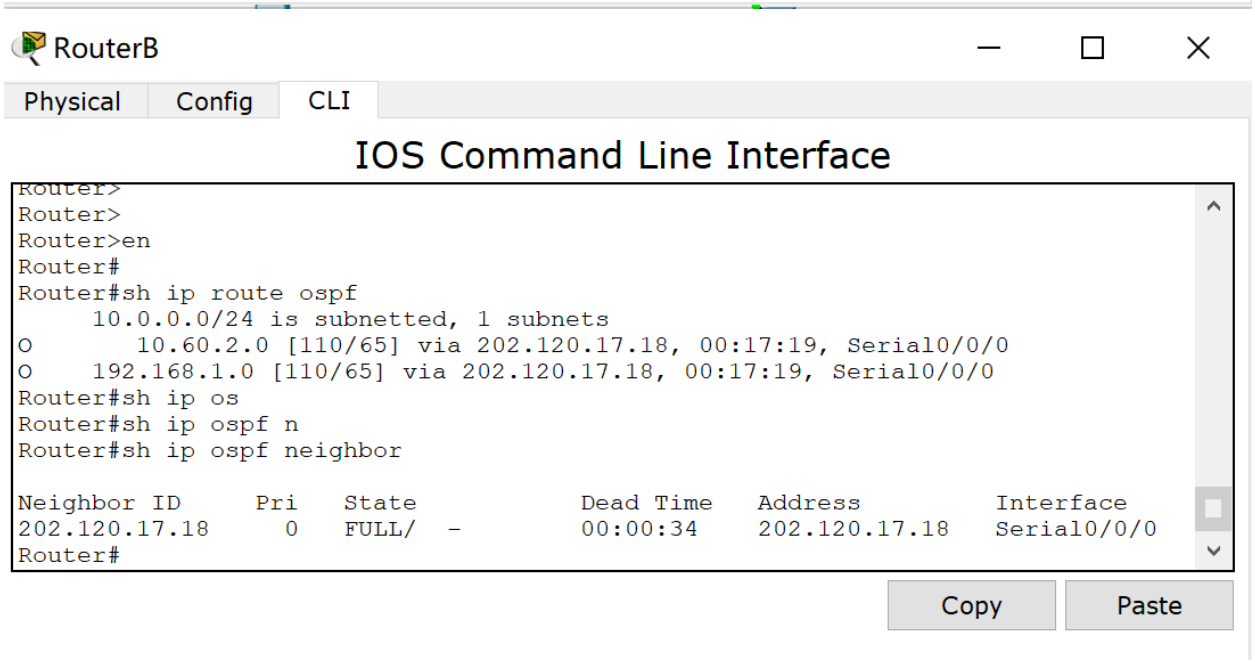


8.查看路由器的网络邻居。

相关命令：show ip route ospf（查看路由表）

show ip ospf nei（查看网络邻居）


RouterA
Physical
Config
CLI
IOS Command Line Interface
Router#
Router#
Router#sh ip route ospf
118.0.0.0/24 is subnetted, 1 subnets
O 118.18.4.0 [110/65] via 202.120.17.29, 00:16:11, Serial0/0/0
172.16.0.0/24 is subnetted, 1 subnets
O 172.16.3.0 [110/65] via 202.120.17.29, 00:16:11, Serial0/0/0
Router#sh ip os
Router#sh ip ospf n
Router#sh ip ospf neighbor
Neighbor ID Pri State Dead Time Address Interface
202.120.17.29 0 FULL/ - 00:00:34 202.120.17.29 Serial0/0/0
Router#
Copy
Paste


RouterB
Physical
Config
CLI
IOS Command Line Interface
Router>
Router>
Router>en
Router#
Router#sh ip route ospf
10.0.0.0/24 is subnetted, 1 subnets
O 10.60.2.0 [110/65] via 202.120.17.18, 00:17:19, Serial0/0/0
O 192.168.1.0 [110/65] via 202.120.17.18, 00:17:19, Serial0/0/0
Router#sh ip os
Router#sh ip ospf n
Router#sh ip ospf neighbor
Neighbor ID Pri State Dead Time Address Interface
202.120.17.18 0 FULL/ - 00:00:34 202.120.17.18 Serial0/0/0
Router#
Copy
Paste

【分析讨论】