

实验八、静态路由的配置

一、实验目的

1. 掌握路由器的主要功能。
2. 掌握静态路由的配置方法。

二、实验内容

1. 安装 CISCO 模拟器；
2. 画出网络拓扑图；
3. 进行静态路由的配置；
4. 测试网络的通信效果。

三、实验原理

在不同网络之间进行通信时，需要用到路由器这种设备。路由器的两个主要功能就是路由选择和数据转发。路由选择的方法有很多，最简单的一种就是静态路由，通过对路由器进行路径规定，使得数据可以跨不同网段进行通信。

一般来说，可通过五种方式来设置路由器：

1. 控制台（Console 口）接终端，或运行终端仿真软件的微机；
2. 辅助端口（AUX 口）接 MODEM，通过电话线与远方的终端或运行终端仿真软件的微机相连；
3. 通过 Ethernet 上的简单文件传输协议（TFTP）服务器；
4. 通过 Ethernet 上的 TELNET 程序；
5. 通过 Ethernet 上的简单网络管理协议（SNMP），路由器可通过运行网络管理软件的工作站配置。

但路由器的第一次设置必须通过第一种方式进行，此时终端的硬件设置如下：

波特率：9600

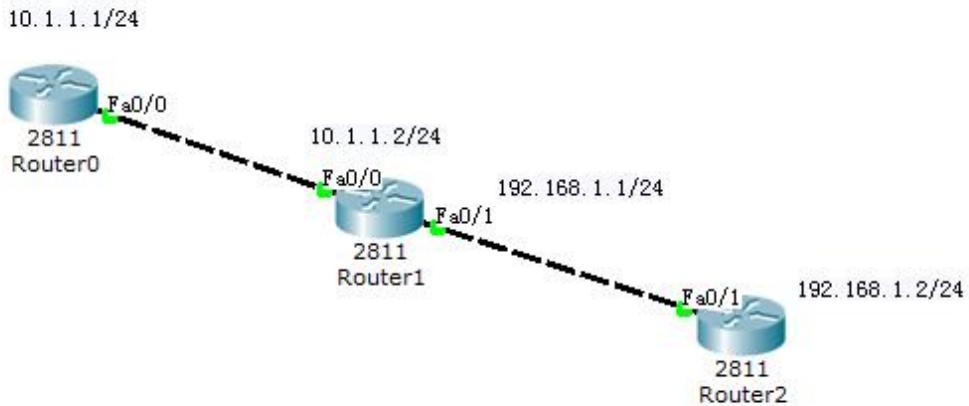
数据位：8

停止位：1

奇偶校验：无

四、实验步骤

为简化步骤，我们可以直接在路由器上写命令。



Router0:

```

Router>
Router>enable      //进入特权模式
Router#conf t      //进入全局配置模式
Router(config)#no ip domain-look //关闭域名解析,原因假如你在 CLI 下输入了 1 个 Cisco 设备
不能识别的命令,它会默认通过 DNS 来进行解析(它认为是主机名).这个不好的地方是要花费
额外的时间等待 DNS 解析完.可以在全局配置模式下使用 no ip domain-look 命令关闭它
Router(config)#int f0/0      //即 interface fastEthernet 0/0 进入路由器接口配置模式
Router(config-if)#ip address 10.1.1.1 255.255.255.0 //配置路由器管理接口的 IP 地址
Router(config-if)#no shutdown //开启路由器的 fastEthernet 0/0 接口。注意,给端口配置 IP
的命令也可以在图形界面上实现,配完别忘记打开端口
Router(config-if)#exit
Router(config)#ip route 192.168.1.0 255.255.255.0 10.1.1.2 //先不写这句话,在 Router0 上
ping 192.168.1.1, 是否可以 ping 通? 写完之后再试一试
Router(config)#end

```

Router1:

```

Router>enable
Router#conf t
Router#conf t
Router(config)#no ip domain-look
Router(config)#int f0/0
Router(config-if)#ip address 10.1.1.2 255.255.255.0
Router(config-if)#no shutdown
Router(config-if)#
Router(config-if)#exit
Router(config)#int f0/1
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shut
Router(config-if)#exit

```

Router2:

Router>enable

Router#conf t

Router(config)#int f0/1

```
Router(config-if)#ip address 192.168.1.2 255.255.255.0
```

Router(config-if)#no shut

Router(config-if)#

Router(config-if)#exit

Router(config)#ip route 10.1.1.0 255.255.255.0 192.168.1.1 //这句命令先不要写，实验一下在 Router0 上 ping 其它 IP 的结果，是不是除了 192.168.1.2 外都可以 ping 通？写完这句话后再试一下是不是都可以了？原因是什么？在实验结果 1 中回答。

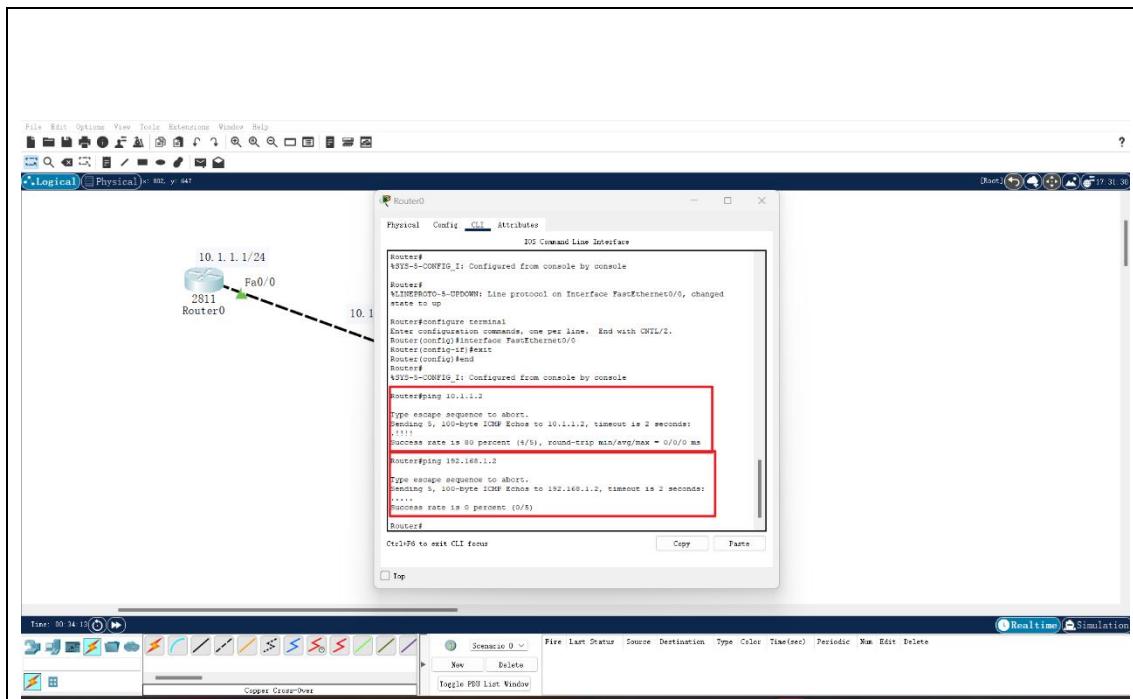
Router(config)#end

五、实验结果

实验八

1、在 Router2 设置路由表之前之后，用 Router0 分别和其他的两台路由器进行测试，看一下网络是否联通，并思考为什么会出现这种情况。

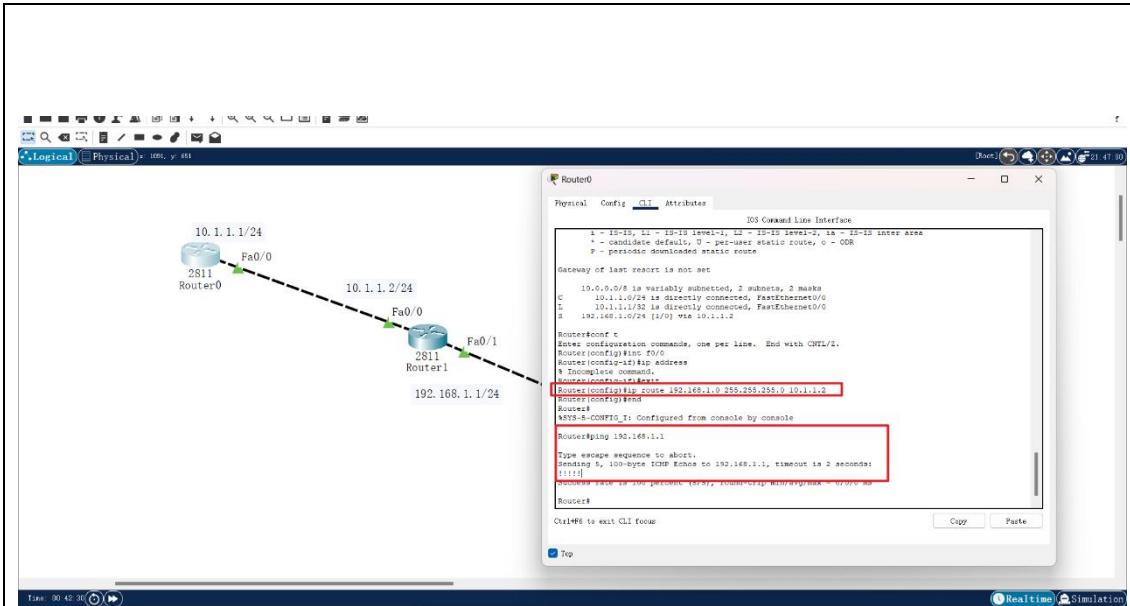
设置之前：



- 与 Router1 (10.1.1.2): 成功, 因为是直连网段, 路由表自动生成直连条目。

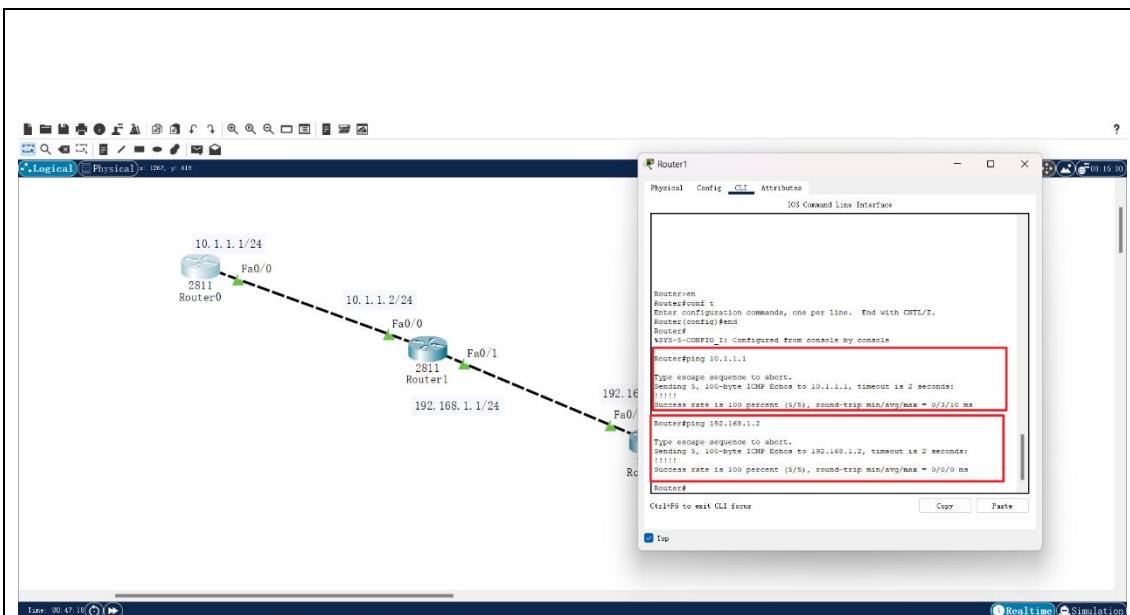
- 与 Router2 (192.168.1.2): 失败, 因为 Router0 路由表无 192.168.1.0/24 网段的转发路径。

设置之后:



- 与 Router1: 仍成功, 直连网段不受路由配置影响。
- 与 Router2: 成功, 因为静态路由为 192.168.1.0/24 网段添加了转发路径。

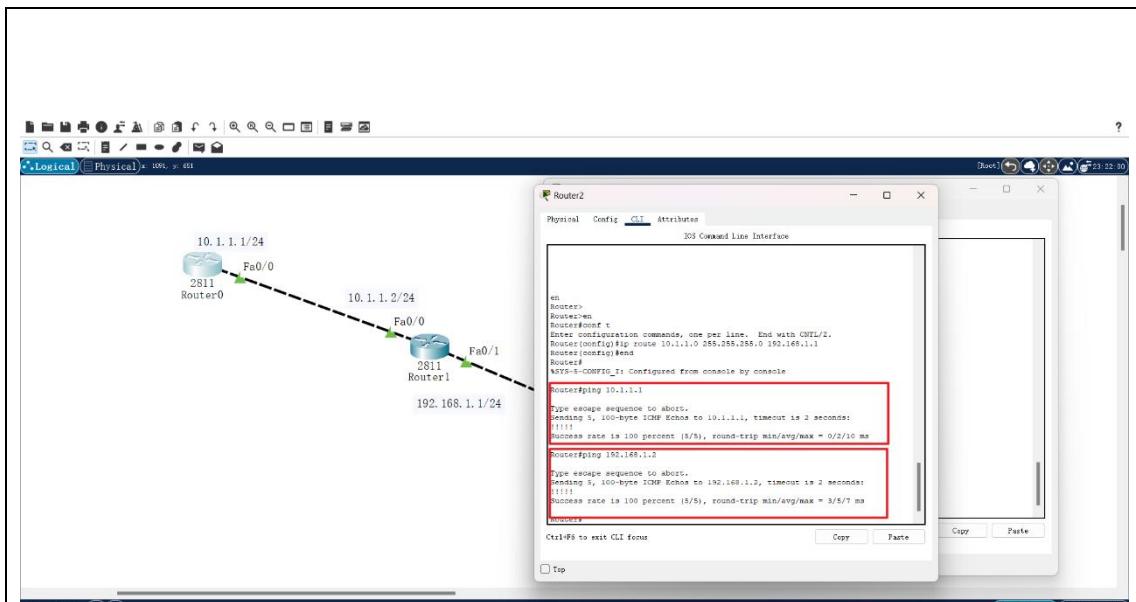
2、用 Router1 分别和其他的两台路由器进行测试, 看一下网络是否联通, 并思考为什么会出现这种情况。



- 与 Router0 (10.1.1.1): 成功; 与 Router2 (192.168.1.2): 成功。
- 原因: Router1 同时直连两个网段 (10.1.1.0/24 和 192.168.1.0/24), 路由表自动生成直连条目, 无需手动配置静态路由即可互通。

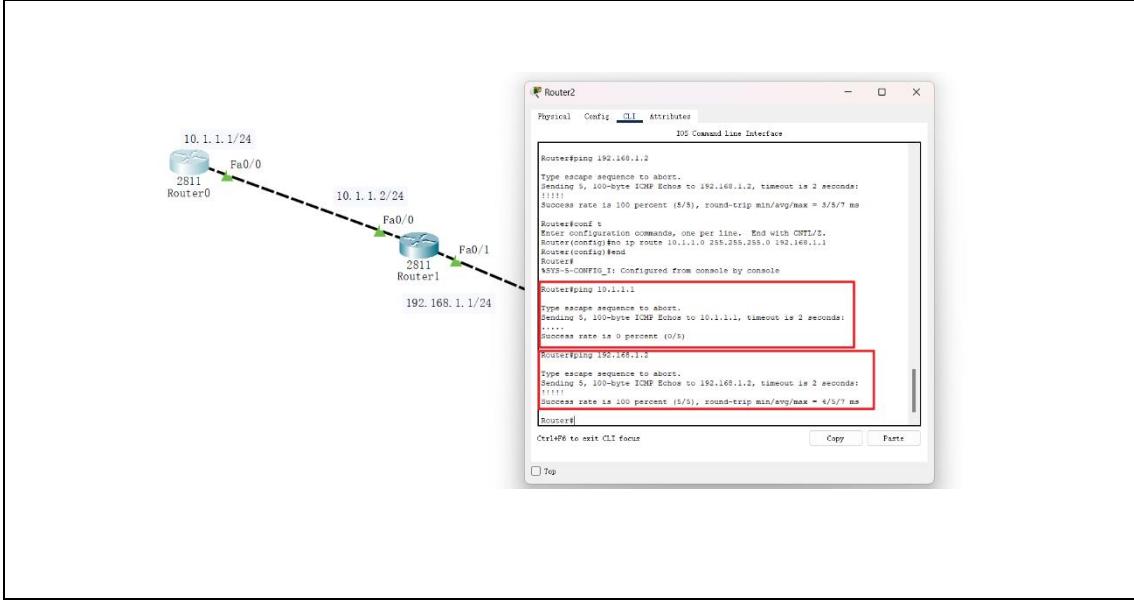
3、用 Router2 分别和其他的两台路由器进行测试, 看一下网络是否联通, 并思考为什么会出现这种情况。

设置前:



- 与 Router1 (192.168.1.1): 成功, 因为是直连网段。
- 与 Router0 (10.1.1.1): 失败, 因为 Router2 路由表无 10.1.1.0/24 网段的转发路径。

设置后:



- 与 Router1: 仍成功，直连网段不受影响。
- 与 Router0: 成功，因为静态路由为 10.1.1.0/24 网段添加了转发路径。

实验八 plus

Router1 配置



```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#no ip domain-lookup
Router(config)#interface FastEthernet0/0
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)#
Router(config-if)#exit
Router(config)#interface FastEthernet0/1
Router(config-if)#ip address 172.1.1.1 255.255.255.0
Router(config-if)#no shutdown
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)#
Router(config-if)#
%SYS-5-CONFIG_I: Configured from console by console
Router#show ip interface brief
Interface          IP-Address      OK? Method Status        Protocol
FastEthernet0/0    192.168.1.1    YES manual up           down
FastEthernet0/1    172.1.1.1     YES manual up           up
Vlan1              unassigned     YES unset administratively down down
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

Router#
Ctrl+F6 to exit CLI focus
```

Top

□ 接口状态:

show ip interface brief 显示 F0/1 (连 PC1/2, IP172.1.1.1) 始终 up/up, F0/0 (连 Router2, IP192.168.1.1) 在配置 Router2 对应接口后从 down 变为 up/up, 接口均正常启用。

□ 路由表:

包含直连网段 (172.1.1.0/24、192.168.1.0/24) 和静态路由 (指向 172.2.2.0/24 的下一跳 192.168.1.2), 路由可达性满足。

Router2 配置

The screenshot shows the Router2 CLI interface. The title bar says "Router2". The menu bar has "Physical", "Config", "CLI" (which is selected), and "Attributes". The main window title is "IOS Command Line Interface". The command-line area contains the following configuration and output:

```
Router(config-if)#ip address 192.168.1.2 255.255.255.0
Router(config-if)#no shutdown

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)#exit
Router(config)#
Router(config)#interface FastEthernet0/0
Router(config-if)#ip address 172.2.2.1 255.255.255.0
Router(config-if)#no shutdown

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)#exit
Router(config)#ip route 172.1.1.0 255.255.255.0 192.168.1.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip interface brief
Interface          IP-Address      OK? Method Status       Protocol
FastEthernet0/0    172.2.2.1      YES manual up        up
FastEthernet0/1    192.168.1.2    YES manual up        up
Vlan1             unassigned     YES unset administratively down down

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

  172.1.0.0/24 is subnetted, 1 subnets
S   172.1.1.0/24 [1/0] via 192.168.1.1
C   172.2.0.0/16 is variably subnetted, 2 subnets, 2 masks
L     172.2.2.0/24 is directly connected, FastEthernet0/0
      172.2.2.1/32 is directly connected, FastEthernet0/0
C   192.168.1.0/24 is directly connected, FastEthernet0/1
L     192.168.1.2/32 is directly connected, FastEthernet0/1

Router#
```

At the bottom, there are "Copy" and "Paste" buttons. Below the window, there is a "Top" button.

□ 接口状态:

show ip interface brief 显示 F0/0 (连 PC3/4, IP172.2.2.1)、F0/1 (连 Router1, IP192.168.1.2) 均为 up/up，接口正常启用。

□ 路由表:

包含直连网段 (172.2.2.0/24、192.168.1.0/24) 和静态路由 (指向 172.1.1.0/24 的下一跳 192.168.1.1)，路由可达性满足。

路由器之间连通性测试

Router1:

Router1

Physical Config CLI Attributes

IOS Command Line Interface

```
Router(config-if)#ip address 172.1.1.1 255.255.255.0
Router(config-if)#no shutdown

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)#exit
Router(config)#ip route 172.2.2.0 255.255.255.0 192.168.1.2
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip interface brief
Interface          IP-Address      OK? Method Status      Protocol
FastEthernet0/0    192.168.1.1    YES manual up        down
FastEthernet0/1    172.1.1.1     YES manual up        up
Vlan1              unassigned     YES unset administratively down down
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

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

Router#show ip interface brief
Interface          IP-Address      OK? Method Status      Protocol
FastEthernet0/0    192.168.1.1    YES manual up        up
FastEthernet0/1    172.1.1.1     YES manual up        up
Vlan1              unassigned     YES unset administratively down down
Router#ping
Router#ping 192.168.1.2

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms

Router#
```

Ctrl+F6 to exit CLI focus

Top

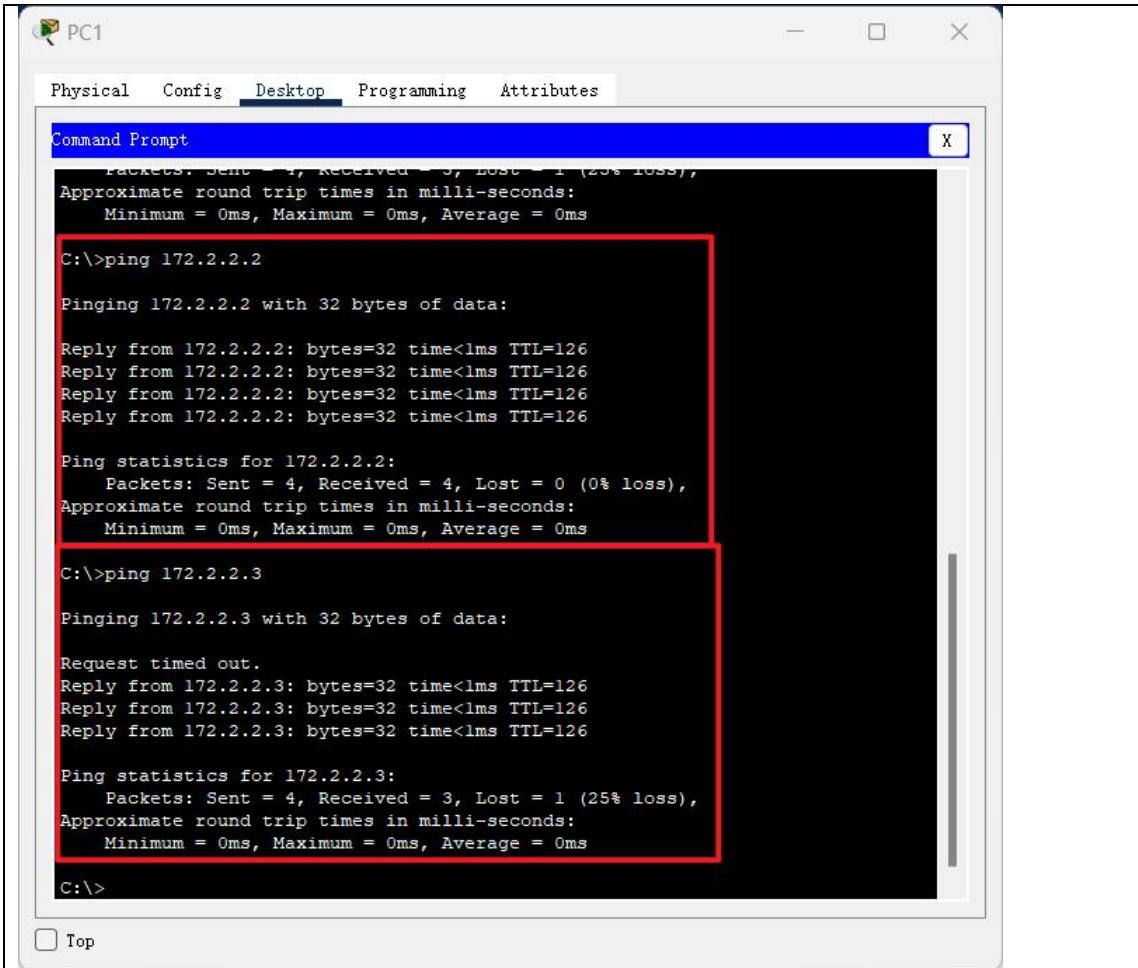
从 Router1 执行 ping 192.168.1.2 , ping 结果返回!!!!!(4/5 成功), 说明 Router1 和 Router2 之间的通信正常 (丢 1 包属于测试中的正常波动)。

```
Router>en
Router#ping 192.168.1.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 0/2/11 ms
```

从 Router2 执行 ping 192.168.1.1 (Router1 的 F0/0 接口 IP)，返回!!!! (5/5 成功)，丢包率 0%，说明两台路由器之间的物理连接、接口配置、路由可达性均无问题

PC 跨网段连通性测试



The screenshot shows a Windows Command Prompt window titled "PC1". The window has tabs at the top: Physical, Config, Desktop, Programming, and Attributes. The "Desktop" tab is selected. Below the tabs is a title bar for "Command Prompt" with an "X" button. The main area of the window displays command-line output:

```
Packets: Sent = 4, Received = 3, Lost = 1 (25% 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:

Reply from 172.2.2.2: bytes=32 time<1ms TTL=126

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

C:\>ping 172.2.2.3

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 = 0ms, Average = 0ms

C:\>
```

At the bottom left of the window, there is a checkbox labeled "Top".

PC1 ping PC3 (172.2.2.2): 4 包全通 (0% 丢包), TTL=126, 说明跨 Router1、Router2 的网段通信完全正常。

PC1 ping PC4 (172.2.2.3): 丢 1 包 (25% 丢包), 但后续 3 包成功, 属于测试中的临时网络波动 (非配置问题), 核心连通性已达标。

整体来看, PC 跨网段通信的配置目标已实现

The screenshot shows a Windows-style window titled "PC3" with a menu bar containing "Physical", "Config", "Desktop" (which is underlined), "Programming", and "Attributes". Below the menu is a toolbar with a "Command Prompt" button. The main area is a terminal window titled "Command Prompt" showing the output of a ping test.

```
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<1ms 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 = 0ms, Maximum = 0ms, Average = 0ms

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
Reply from 172.1.1.3: bytes=32 time=3ms TTL=126

Ping statistics for 172.1.1.3:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 3ms, Average = 1ms

C:\>
```

Top

PC3 ping PC1 (172.1.1.2): 4 包全通 (0 丢包), TTL=126, 证明跨 Router2、Router1 的网段通信完全稳定。

PC3 ping PC2 (172.1.1.3): 首包超时后 3 包成功 (25% 丢包), 属于临时网络波动 (非配置错误), 核心连通性达标。