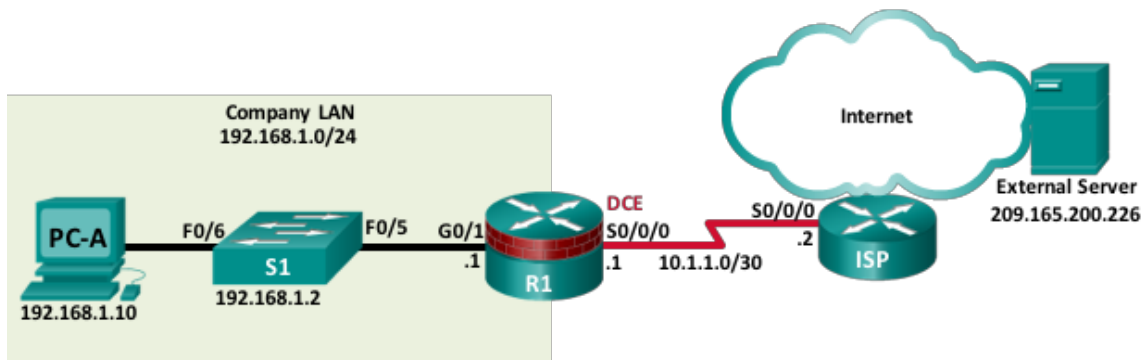


## 实验 - 排除连接故障

### 拓扑



### 地址分配表

设备	接口	IP 地址	子网掩码	默认网关
R1	G0/1	192.168.1.1	255.255.255.0	N/A
	S0/0/0	10.1.1.1	255.255.255.252	N/A
ISP	S0/0/0	10.1.1.2	255.255.255.252	N/A
	Lo0	209.165.200.226	255.255.255.255	N/A
S1	VLAN 1	192.168.1.2	255.255.255.0	192.168.1.1
PC-A	网卡	192.168.1.10	255.255.255.0	192.168.1.1

### 目标

第 1 部分：确定问题

第 2 部分：实施网络更改

第 3 部分：验证完整功能

第 4 部分：记录结果和配置更改

### 背景/场景

在本实验中，您就职的公司遇到了局域网 (LAN) 问题。您需要排除和解决网络问题。在第 1 部分中，您将连接到 LAN 上的设备并使用故障排除工具确定网络问题，建立一套关于潜在原因的理论并测试该理论。在第 2 部分中，您将制定一项行动计划以确定和实施解决方案。在第 3 部分中，您将验证完整功能是否已恢复。第 4 部分为您提供空白，以记录故障排除结果以及您对 LAN 设备进行的配置更改。

**注意：**CCNA 动手实验所用的路由器是采用 Cisco IOS 15.2(4)M3 版（universalk9 映像）的 Cisco 1941 集成多业务路由器 (ISR)。所用的交换机是采用 Cisco IOS 15.0(2) 版（lanbasek9 映像）的 Cisco Catalyst 2960 系列。也可使用其他路由器、交换机以及 Cisco IOS 版本。根据型号以及 Cisco IOS 版本的不同，可用命令和产生的输出可能与实验显示的不一樣。请参考本实验末尾的“路由器接口摘要表”以了解正确的接口标识符。

### 所需资源

- 2 台路由器（采用 Cisco IOS 15.2(4)M3 版通用映像的 Cisco 1941 或同类路由器）
- 1 台交换机（支持 Cisco IOS 15.0(2) lanbasek9 版映像的 Cisco 2960 或同类交换机）
- 1 台 PC（采用 Windows 7 或 8 且支持终端仿真程序，比如 Tera Term）
- 拓扑所示的以太网和串行电缆

### 故障排除配置

必须对拓扑中所示的设备配置以下设置。在开始实验之前，将配置粘贴到指定设备之上。

S1:

```
no ip domain-lookup
hostname S1
ip domain-name ccna-lab.com
username admin01 privilege 15 secret 9
$9$lJgfiLCHj.Xp/q$hA2w.oyQPTMhBGPeR.FZo3NZRJ9T1FdqvgRCFyBYnNs
interface FastEthernet0/1
 shutdown
interface FastEthernet0/2
 shutdown
interface FastEthernet0/3
 shutdown
interface FastEthernet0/4
 shutdown
interface FastEthernet0/5
 duplex full
interface Vlan1
 ip address 192.168.1.2 255.255.255.0
line vty 0 4
 login local
 transport input ssh
line vty 5 15
 login local
 transport input ssh
crypto key generate rsa general-keys modulus 1024
end
```

R1:

```
hostname R1
no ip domain-lookup
ip domain-name ccna-lab.com
username admin01 privilege 15 secret 9
$9$8a4jGjbPPpeeoE$WyPsIiOaYT4ATlJzrR6T9E6vIdESOGF.NYX53arPmtA
interface GigabitEthernet0/0
 shutdown
interface GigabitEthernet0/1
 ip address 192.168.1.1 255.255.255.0
 duplex half
```

```
speed auto
no shutdown
interface Serial0/0/0
ip address 10.1.2.1 255.255.255.252
no shutdown
interface Serial0/0/1
no ip address
shutdown
line vty 0 4
login local
transport input ssh
crypto key generate rsa general-keys modulus 1024
end
```

ISP:

```
hostname ISP
no ip domain-lookup
interface Serial0/0/0
ip address 10.1.1.2 255.255.255.252
no shut
interface Lo0
ip address 209.165.200.226 255.255.255.255
ip route 0.0.0.0 0.0.0.0 10.1.1.1
end
```

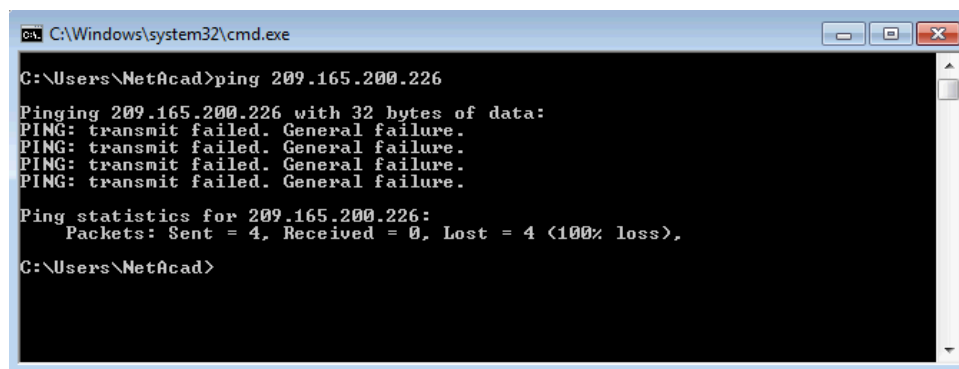
### 第 1 部分：确定问题。

有关网络问题的唯一可用信息是，用户遇到了响应时间变慢的问题，而且他们无法连接到 IP 地址为 209.165.200.226 的 Internet 上的外部设备。要确定这些网络问题的可能起因，您将需要对拓扑中所示的 LAN 设备使用网络命令和工具。

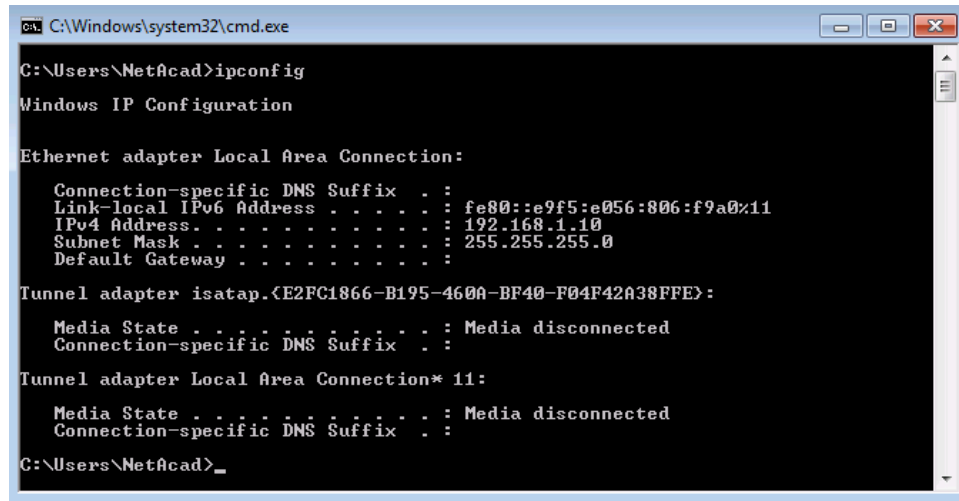
**注意：**需要使用用户名 **admin01** 和密码 **cisco12345** 登录网络设备。

#### 第 1 步：从 PC 进行故障排除。

- 在 PC 的命令提示符下，对外部服务器 IP 地址 **209.165.200.226** 执行 **ping** 操作。



- b. 使用 **ipconfig** 命令确定 PC 上的网络设置。



## 第 2 步：使用 SSH 客户端会话从 S1 进行故障排除。

注意：可使用任何 SSH 客户端软件。本实验的示例中使用了 Tera Term。

- a. 使用其 IP 地址 192.168.1.2 通过 SSH 连接到 S1，并使用用户名 **admin01** 和密码 **cisco12345** 登录交换机。



- b. 在 S1 上发出 **terminal monitor** 命令，以允许将日志消息发送到 SSH 会话中的 VTY 线路。几秒钟后，您的 SSH 窗口将显示以下错误消息。

```
S1# terminal monitor
S1#
*Mar 1 02:08:11.338: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on
FastEthernet0/5 (not half duplex), with R1.ccna-lab.com GigabitEthernet0/1
(half duplex).
S1#
```

- c. 在 S1 上发出 **show interface f0/5** 命令，以查看接口的双工设置。

```
S1# show interface f0/5
FastEthernet0/5 is up, line protocol is up (connected)
```

```
Hardware is Fast Ethernet, address is 0cd9.96e8.8a05 (bia 0cd9.96e8.8a05)
MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
    reliability 255/255, txload 1/255, rxload 1/255
Encapsulation ARPA, loopback not set
Keepalive set (10 sec)
Full-duplex, 100Mb/s, media type is 10/100BaseTX
input flow-control is off, output flow-control is unsupported
ARP type: ARPA, ARP Timeout 04:00:00
Last input 00:00:35, output 00:00:01, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
Queueing strategy: fifo
Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 0 bits/sec, 0 packets/sec
  849 packets input, 104642 bytes, 0 no buffer
    Received 123 broadcasts (122 multicasts)
      0 runs, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    0 watchdog, 122 multicast, 0 pause input
    0 input packets with dribble condition detected
4489 packets output, 361270 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    0 unknown protocol drops
    0 babbles, 0 late collision, 0 deferred
    0 lost carrier, 0 no carrier, 0 pause output
    0 output buffer failures, 0 output buffers swapped out
S1#
```

### 第 3 步：使用 SSH 客户端从 R1 进行故障排除。

- a. 通过 SSH 连接到 R1 的 LAN 接口，并使用用户名 **admin01** 和密码 **cisco12345** 登录。



- b. 在 R1 上发出 **terminal monitor**，以允许将日志消息发送到 R1 的 SSH 会话中的 VTY 线路。几秒钟后，R1 的 SSH 会话中显示双工不匹配消息。

```
R1# terminal monitor
R1#
*Nov 23 16:12:36.623: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on
GigabitEthernet0/1 (not full duplex), with S1.ccna-lab.com FastEthernet0/5 (full
duplex).
R1#
```

- c. 在 R1 上发出 **show interface G0/1** 命令，以显示双工设置。

```
R1# show interfaces g0/1
GigabitEthernet0/1 is up, line protocol is up
  Hardware is CN Gigabit Ethernet, address is d48c.b5ce.a0c1 (bia d48c.b5ce.a0c1)
  Internet address is 192.168.1.1/24
  MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Half Duplex, 100Mbps, media type is RJ45
  output flow-control is unsupported, input flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:15, output 00:00:05, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    641 packets input, 101892 bytes, 0 no buffer
    Received 453 broadcasts (0 IP multicasts)
    0 runts, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    0 watchdog, 361 multicast, 0 pause input
    1043 packets output, 123698 bytes, 0 underruns
    0 output errors, 0 collisions, 1 interface resets
    235 unknown protocol drops
    0 babbles, 0 late collision, 0 deferred
    0 lost carrier, 0 no carrier, 0 pause output
    0 output buffer failures, 0 output buffers swapped out
R1#
```

- d. 在 R1 上发出 **ping 209.165.200.226** 命令，以测试到外部服务器的连接。

```
R1# ping 209.165.200.226
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 209.165.200.226, timeout is 2 seconds:
.....
Success rate is 0 percent (0/5)
R1#
```

- e. 在 R1 上发出 **show ip interface brief** 命令，以验证接口 IP 地址设置。

```
R1# show ip interface brief
Interface                IP-Address      OK? Method Status              Protocol
Embedded-Service-Engine0/0 unassigned      YES unset   administratively down down
GigabitEthernet0/0       unassigned      YES unset   administratively down down
GigabitEthernet0/1       192.168.1.1     YES manual  up                  up
Serial0/0/0              10.1.2.1        YES manual  up                  up
Serial0/0/1              unassigned      YES unset   administratively down down
R1#
```

- f. 在 R1 上发出 **show ip route** 命令，以验证路由器的默认网关设置。

```
R1# 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override
```

Gateway of last resort is not set

```

10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C       10.1.2.0/30 is directly connected, Serial0/0/0
L       10.1.2.1/32 is directly connected, Serial0/0/0
192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C       192.168.1.0/24 is directly connected, GigabitEthernet0/1
L       192.168.1.1/32 is directly connected, GigabitEthernet0/1
R1#
```

列出员工遇到的网络问题的潜在原因。

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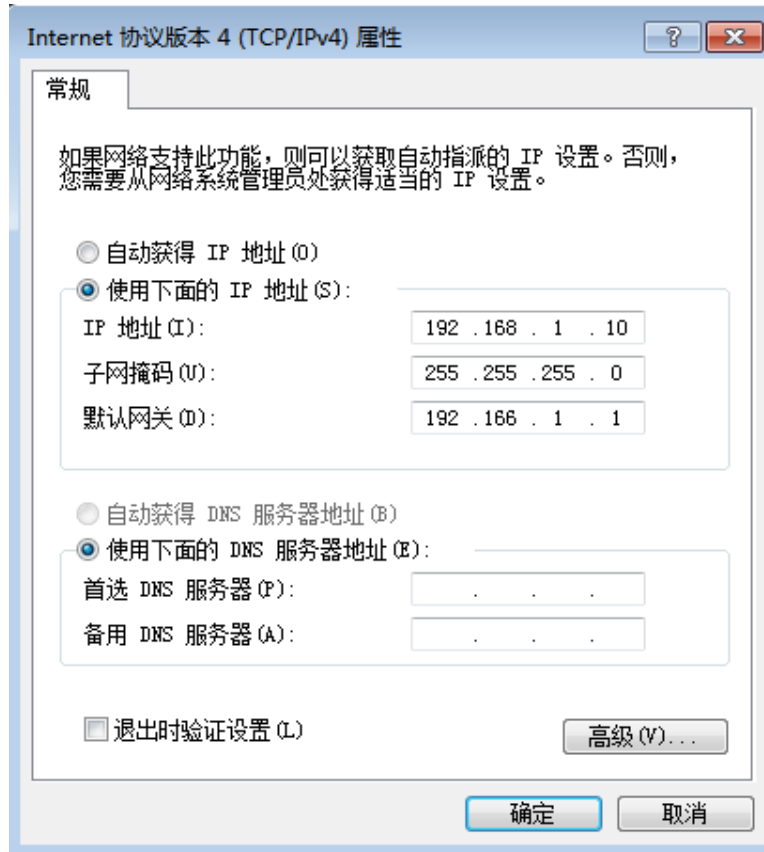


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## 第 2 部分：实施网络更改

您已将您在第 1 部分中发现的问题上报您的主管。她已批准这些更改并要求您进行实施。

## 第 1 步：将 PC 的默认网关设置为 192.168.1.1。



## 第 2 步：将 R1 的接口 G0/1 的双工设置设置为全双工。

```
R1# conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#
*Nov 23 17:23:36.879: %CDP-4-DUPLEX_MISMATCH: duplex mismatch discovered on
GigabitEthernet0/1 (not full duplex), with S1.ccna-lab.com FastEthernet0/5
(full duplex).
R1(config)#
R1(config)# interface g0/1
R1(config-if)# duplex full
R1(config-if)# exit
*Nov 23 17:24:08.039: %LINK-3-UPDOWN: Interface GigabitEthernet0/1, changed state to
down
R1(config)#
*Nov 23 17:24:10.363: %LINK-3-UPDOWN: Interface GigabitEthernet0/1, changed state to
up
*Nov 23 17:24:10.459: %SYS-5-CONFIG_I: Configured from console by console
R1(config)#
```



**第 3 步：重新将 R1 上 S0/0/0 的 IP 地址配置为 10.1.1.1/30。**

```
R1(config)# interface s0/0/0
R1(config-if)# ip address 10.1.1.1 255.255.255.252
R1(config-if)# exit
```

**第 4 步：将 R1 的最后选用网关配置为默认路由 10.1.1.2。**

```
R1(config)# ip route 0.0.0.0 0.0.0.0 10.1.1.2
R1(config)# end
```

## 第 3 部分：验证完整功能

验证完整功能是否已恢复。

**第 1 步：验证所有接口和路由是否设置正确，R1 上的路由是否已恢复。**

- a. 发出 **show ip route** 命令，以验证默认网关是否设置正确。

```
R1# 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       a - application route
       + - replicated route, % - next hop override
```

```
Gateway of last resort is 10.1.1.2 to network 0.0.0.0
```

```
S*    0.0.0.0/0 [1/0] via 10.1.1.2
      10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C      10.1.1.0/30 is directly connected, Serial0/0/0
L      10.1.1.1/32 is directly connected, Serial0/0/0
      192.168.1.0/24 is variably subnetted, 2 subnets, 2 masks
C      192.168.1.0/24 is directly connected, GigabitEthernet0/1
L      192.168.1.1/32 is directly connected, GigabitEthernet0/1
R1#
```

- b. 发出 **show ip interface s0/0/0** 命令，以验证 S0/0/0 上的 IP 地址是否设置正确。

```
R1# show ip interface s0/0/0
Serial0/0/0 is up, line protocol is up
  Internet address is 10.1.1.1/30
  Broadcast address is 255.255.255.255
  Address determined by setup command
  MTU is 1500 bytes
  <省略部分输出>
  IPv4 WCCP Redirect exclude is disabled
R1#
```

- c. 发出 **ping 209.165.200.226** 命令，以验证是否可连接到外部服务器。

```
R1# ping 209.165.200.226
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 209.165.200.226, timeout is 2 seconds:
!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
R1#
```

- d. 发出 **show interface g0/1** 命令，以验证双工设置是否为全双工。

```
R1# show interface g0/1
GigabitEthernet0/1 is up, line protocol is up
  Hardware is CN Gigabit Ethernet, address is d48c.b5ce.a0c1 (bia d48c.b5ce.a0c1)
  Internet address is 192.168.1.1/24
  MTU 1500 bytes, BW 100000 Kbit/sec, DLY 100 usec,
    reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive set (10 sec)
  Full Duplex, 100Mbps, media type is RJ45
  output flow-control is unsupported, input flow-control is unsupported
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:00:04, output 00:00:04, output hang never
  Last clearing of "show interface" counters never
  Input queue: 0/75/0/0 (size/max/drops/flushes); Total output drops: 0
  Queueing strategy: fifo
  Output queue: 0/40 (size/max)
  5 minute input rate 0 bits/sec, 0 packets/sec
  5 minute output rate 0 bits/sec, 0 packets/sec
    559 packets input, 74066 bytes, 0 no buffer
    Received 279 broadcasts (0 IP multicasts)
    0 runs, 0 giants, 0 throttles
    0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
    0 watchdog, 208 multicast, 0 pause input
    742 packets output, 81462 bytes, 0 underruns
    0 output errors, 0 collisions, 2 interface resets
    133 unknown protocol drops
    0 babbles, 0 late collision, 0 deferred
    1 lost carrier, 0 no carrier, 0 pause output
    0 output buffer failures, 0 output buffers swapped out
R1#
```

## 第 2 步：从 LAN PC 验证端到端连接。

- a. 在 PC 的命令提示符下发出 **ipconfig** 命令。

```
C:\Windows\system32\cmd.exe

C:\Users\NetAcad>ipconfig

Windows IP Configuration

Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix  . : 
    Link-local IPv6 Address . . . . . : fe80::e9f5:e056:806:f9a0%11
    IPv4 Address. . . . . : 192.168.1.10
    Subnet Mask . . . . . : 255.255.255.0
    Default Gateway . . . . . : 192.168.1.1

Tunnel adapter isatap.{E2FC1866-B195-460A-BF40-F04F42A38FFE}:

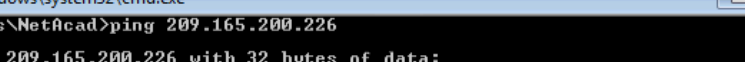
    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 

Tunnel adapter Local Area Connection* 11:

    Media State . . . . . : Media disconnected
    Connection-specific DNS Suffix  . : 

C:\Users\NetAcad>
```

- b. 在 PC 的 CMD 窗口发出 **ping 209.165.200.226** 命令



The screenshot shows a Windows Command Prompt window with the title bar "C:\Windows\system32\cmd.exe". The command prompt shows the user has entered "C:\Users\NetAcad>ping 209.165.200.226". The output of the command is as follows:

```

C:\Users\NetAcad>ping 209.165.200.226

Pinging 209.165.200.226 with 32 bytes of data:
Reply from 209.165.200.226: bytes=32 time=1ms TTL=254
Reply from 209.165.200.226: bytes=32 time=1ms TTL=254
Reply from 209.165.200.226: bytes=32 time=1ms TTL=254
Reply from 209.165.200.226: bytes=32 time=1ms TTL=254

Ping statistics for 209.165.200.226:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\Users\NetAcad>
C:\Users\NetAcad>

```

## 第 4 部分：记录结果和配置更改

在提供的以下空白处记录故障排除中发现的问题，以及为解决问题进行的配置更改。

[illegible]

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思考

本实验要求您在做出任何更改之前排除所有设备的故障。是否有应用故障排除方法的其他方式？

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路由器接口摘要表

路由器接口摘要				
路由器型号	以太网接口 1	以太网接口 2	串行接口 1	串行接口 2
1800	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
1900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2801	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/1/0 (S0/1/0)	Serial 0/1/1 (S0/1/1)
2811	Fast Ethernet 0/0 (F0/0)	Fast Ethernet 0/1 (F0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
2900	Gigabit Ethernet 0/0 (G0/0)	Gigabit Ethernet 0/1 (G0/1)	Serial 0/0/0 (S0/0/0)	Serial 0/0/1 (S0/0/1)
<b>注意：</b> 若要了解如何配置路由器，请查看接口来确定路由器类型以及路由器拥有的接口数量。我们无法为每类路由器列出所有的配置组合。下表列出了设备中以太网和串行接口组合的标识符。此表中未包含任何其他类型的接口，但实际的路由器可能会含有其他接口。例如 ISDN BRI 接口。括号中的字符串是官方缩写，可在 Cisco IOS 命令中用来代表接口。				