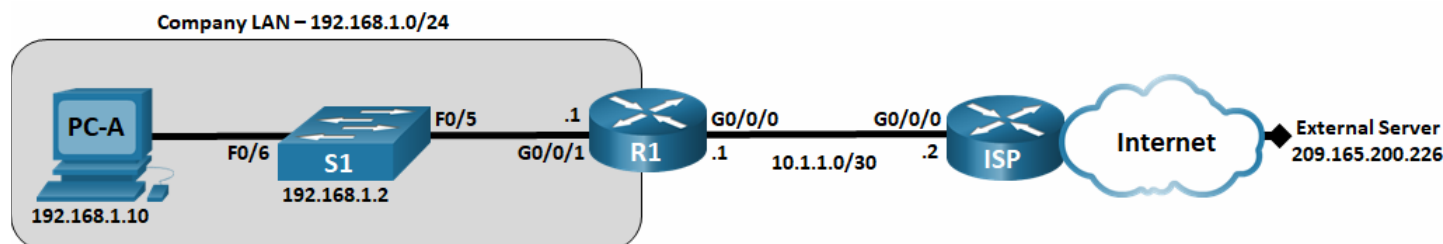


## Lab - Troubleshoot Connectivity Issues (Instructor Version)

**Instructor Note:** Red font color or gray highlights indicate text that appears in the instructor copy only.

### Topology



### Addressing Table

| Device | Interface | IP Address      | Subnet Mask     | Default Gateway |
|--------|-----------|-----------------|-----------------|-----------------|
| R1     | G0/0/0/1  | 192.168.1.1     | 255.255.255.0   | N/A             |
|        | G0/0/0    | 10.1.1.1        | 255.255.255.252 | N/A             |
| ISP    | G0/0/0    | 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   | NIC       | 192.168.1.10    | 255.255.255.0   | 192.168.1.1     |

### Objectives

**Part 1: Identify the Problem**

**Part 2: Implement Network Changes**

**Part 3: Verify Full Functionality**

**Part 4: Document Findings and Configuration Changes**

### Background / Scenario

In this lab, the company that you work for is experiencing problems with their Local Area Network (LAN). You have been asked to troubleshoot and resolve the network issues. In Part 1, you will connect to devices on the LAN and use troubleshooting tools to identify the network issues, establish a theory of probable cause, and test that theory. In Part 2, you will establish a plan of action to resolve and implement a solution. In Part 3, you will verify full functionality has been restored. Part 4 provides space for you to document your troubleshooting findings along with the configuration changes that you made to the LAN devices.

**Note:** The routers used with CCNA hands-on labs are Cisco 4221 with Cisco IOS XE Release 16.9.4 (universalk9 image). The switches used in the labs are Cisco Catalyst 2960s with Cisco IOS Release 15.2(2) (lanbasek9 image). Other routers, switches, and Cisco IOS versions can be used. Depending on the model and Cisco IOS version, the commands available and the output produced might vary from what is shown in the labs. Refer to the Router Interface Summary Table at the end of the lab for the correct interface identifiers.

### Required Resources

- 2 Routers (Cisco 4221 with Cisco IOS XE Release 16.9.4 universal image or comparable)
- 1 Switch (Cisco 2960 with Cisco IOS Release 15.2(2) lanbasek9 image or comparable)
- 1 PC (Windows with a terminal emulation program, such as Tera Term)
- Console cables to configure the Cisco IOS devices via the console ports
- Ethernet cables as shown in the topology\

### Troubleshooting Configuration

The following settings must be configured on the devices shown in the topology. Paste the configurations onto the specified devices prior to starting the lab.

#### Lab Preconfiguration

The following settings must be configured on the devices shown in the topology. These settings contain the errors that are being injected into the lab. Paste the configurations onto the specified devices prior to starting the lab.

PC:

IP Address: **192.168.1.10**

Subnet Mask: **255.255.255.0**

Default Gateway: **(leave blank)**

**Instructor:** You may choose to configure the PC settings; if you do not, student will know that the missing default gateway setting is a problem.

**S1:**

```
no ip domain-lookup
hostname S1
ip domain-name ccna-lab.com
username admin01 privilege 15 secret cisco12345
interface FastEthernet0/1
  shutdown
interface FastEthernet0/2
  shutdown
interface FastEthernet0/3
  shutdown
interface FastEthernet0/4
  shutdown
interface FastEthernet0/5
  speed 10
  duplex half
! duplex full
interface Vlan1
  ip address 192.168.1.2 255.255.255.0
  ip default-gateway 192.168.1.0
!ip default-gateway 192.168.1.1
banner motd $ Authorized Users Only! $
```

```
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 cisco12345
interface GigabitEthernet0/0/1
  ip address 192.168.1.1 255.255.255.0
  no negotiation auto
  speed 100
! speed 100
! negotiation auto
  no shutdown
interface GigabitEthernet0/0/0
  ip address 10.1.1.1 255.255.255.252
  no shutdown
banner motd $ Authorized Users Only! $
line vty 0 4
  login local
!ip route 0.0.0.0 0.0.0.0 10.1.1.2
  transport input ssh
crypto key generate rsa general-keys modulus 1024
end
```

### ISP:

```
hostname ISP
no ip domain lookup
interface GigabitEthernet0/0/0
  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
```

## Part 1: Identify the Problem.

The only available information about the network problem is that the users are experiencing slow response times and that they are not able to reach an external device on the internet at IP address 209.165.200.226.

To determine probable cause(s) for these network issues, you will need to utilize network commands and tools on the LAN equipment shown in the topology.

**Note:** The user name **admin01** with a password of **cisco12345** will be required to log into the network equipment.

### Step 1: Troubleshoot the network.

Use the tools available to you to troubleshoot the network, keeping in mind that the requirement is to restore connectivity to the external server and the eliminate slow response times.

**Note:** While using SSH to connect to network devices, issue the **terminal monitor** privileged exec command to enable log output to the SSH console.

### Step 2: Document the probable causes.

List the probable causes for the network problems that employees are experiencing.

1. The Default Gateway is not set on the PC.
2. S1 Interface F0/5 is set to half duplex and speed set to 10.
3. S1 default-gateway set to 192.168.1.0
3. R1 G0/0/1 speed set to 100 and auto negotiation is disabled.
4. The Gateway of last resort is not set on R1.

## Part 2: Implement Network Changes

You have communicated the problems that you discovered in Part 1 to your supervisor. She has approved these changes and has requested that you implement them.

## Part 3: Verify Full Functionality

Verify that full functionality has been restored. PC-A, S1, and R1 should be able to reach the external server, and ping replies from PC-A to the external server should exhibit no significant variation in response times.

## Part 4: Document Findings and Configuration Changes

Use the space provided below to document the issues found during your troubleshooting and the configurations changes made to resolve those issues.

**Documentation will vary but should include the date when troubleshooting was conducted, devices that were tested, commands used along with the output generated by those commands, issues found, and configuration changes made to resolve those issues.**

### Reflection Question

This lab had you troubleshoot all devices before making any changes. Is there another way to apply the troubleshooting methodology?

**Answers may vary. Another way the troubleshooting methodology could be applied would be to complete all 6 steps on a device before moving on to another device. e.g. After you determined that the default gateway was not set on the PC, you would add the default gateway setting and verify functionality. If network issues still exist, you would then move on to the next device, S1 in this**

example. When the troubleshooting process had been completed on S1 and issues still exist, you would then move on to R1. This process would continue until full network functionality was achieved.

### Router Interface Summary Table

| Router Model | Ethernet Interface #1           | Ethernet Interface #2           | Serial Interface #1   | Serial Interface #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) |
| 4221         | Gigabit Ethernet 0/0/0 (G0/0/0) | Gigabit Ethernet 0/0/1 (G0/0/1) | Serial 0/1/0 (S0/1/0) | Serial 0/1/1 (S0/1/1) |
| 4300         | Gigabit Ethernet 0/0/0 (G0/0/0) | Gigabit Ethernet 0/0/1 (G0/0/1) | Serial 0/1/0 (S0/1/0) | Serial 0/1/1 (S0/1/1) |

**Note:** To find out how the router is configured, look at the interfaces to identify the type of router and how many interfaces the router has. There is no way to effectively list all the combinations of configurations for each router class. This table includes identifiers for the possible combinations of Ethernet and Serial interfaces in the device. The table does not include any other type of interface, even though a specific router may contain one. An example of this might be an ISDN BRI interface. The string in parenthesis is the legal abbreviation that can be used in Cisco IOS commands to represent the interface.

### Device Configs - Final

#### Router R1

```
R1# show run
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
!
hostname R1
!
boot-start-marker
boot-end-marker
!
no aaa new-model
!
no ip domain lookup
```

## Lab - Troubleshoot Connectivity Issues

---

```
ip domain name ccna-lab.com
!
login on-success log
!
subscriber templating
!
multilink bundle-name authenticated
!
no license smart enable
diagnostic bootup level minimal
!
spanning-tree extend system-id
!
username admin01 privilege 15 secret 5 $1$/Iz6$7tWVeWuJQPAk5G2fySf10/
!
redundancy
mode none
!
interface GigabitEthernet0/0/0
ip address 10.1.1.1 255.255.255.252
negotiation auto
!
interface GigabitEthernet0/0/1
ip address 192.168.1.1 255.255.255.0
negotiation auto
!
ip forward-protocol nd
no ip http server
ip http secure-server
ip route 0.0.0.0 0.0.0.0 10.1.1.2
!
control-plane
!
banner motd $ Authorized Users Only! $
!
line con 0
logging synchronous
transport input none
stopbits 1
line aux 0
stopbits 1
line vty 0 4
login local
transport input ssh
!
end
```

### Switch S1

```
S1# show run
```

## Lab - Troubleshoot Connectivity Issues

---

```
Building configuration...
Current configuration : 1585 bytes
!
version 15.2
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname S1
!
boot-start-marker
boot-end-marker
!
username admin01 privilege 15 secret 5 $1$y6iJ$uy3VBz1/JYXksFH99dKGa1
no aaa new-model
system mtu routing 1500
!
no ip domain-lookup
ip domain-name ccna-lab.com
spanning-tree mode pvst
spanning-tree extend system-id
vlan internal allocation policy ascending
!
interface FastEthernet0/1
 shutdown
!
interface FastEthernet0/2
 shutdown
!
interface FastEthernet0/3
 shutdown
!
interface FastEthernet0/4
 shutdown
!
interface FastEthernet0/5
 duplex full
!
interface FastEthernet0/6
!
interface FastEthernet0/7
!
interface FastEthernet0/8
!
interface FastEthernet0/9
!
interface FastEthernet0/10
!
interface FastEthernet0/11
!
```

```
interface FastEthernet0/12
!
interface FastEthernet0/13
!
interface FastEthernet0/14
!
interface FastEthernet0/15
!
interface FastEthernet0/16
!
interface FastEthernet0/17
!
interface FastEthernet0/18
!
interface FastEthernet0/19
!
interface FastEthernet0/20
!
interface FastEthernet0/21
!
interface FastEthernet0/22
!
interface FastEthernet0/23
!
interface FastEthernet0/24
!
interface GigabitEthernet0/1
!
interface GigabitEthernet0/2
!
interface Vlan1
 ip address 192.168.1.2 255.255.255.0
 shutdown
!
ip default-gateway 192.168.1.1
ip http server
ip http secure-server
!
banner motd $ Authorized Users Only! $
!
line con 0
 logging synchronous
line vty 0 4
 login local
 transport input ssh
line vty 5 15
 login local
 transport input ssh
!
end
```



### Router ISP

```
ISP# show run
version 16.9
service timestamps debug datetime msec
service timestamps log datetime msec
platform qfp utilization monitor load 80
no platform punt-keepalive disable-kernel-core
!
hostname ISP
!
boot-start-marker
boot-end-marker
no aaa new-model
!
no ip domain lookup
login on-success log
!
subscriber templating
!
multilink bundle-name authenticated
!
spanning-tree extend system-id
!
redundancy
mode none
!
interface Loopback0
 ip address 209.165.200.226 255.255.255.255
!
interface GigabitEthernet0/0/0
 ip address 10.1.1.2 255.255.255.252
 negotiation auto
!
ip forward-protocol nd
no ip http server
ip http secure-server
ip route 0.0.0.0 0.0.0.0 10.1.1.1
!
control-plane
!
line con 0
 logging synchronous
 transport input none
 stopbits 1
line aux 0
 stopbits 1
line vty 0 4
 login local
end
```