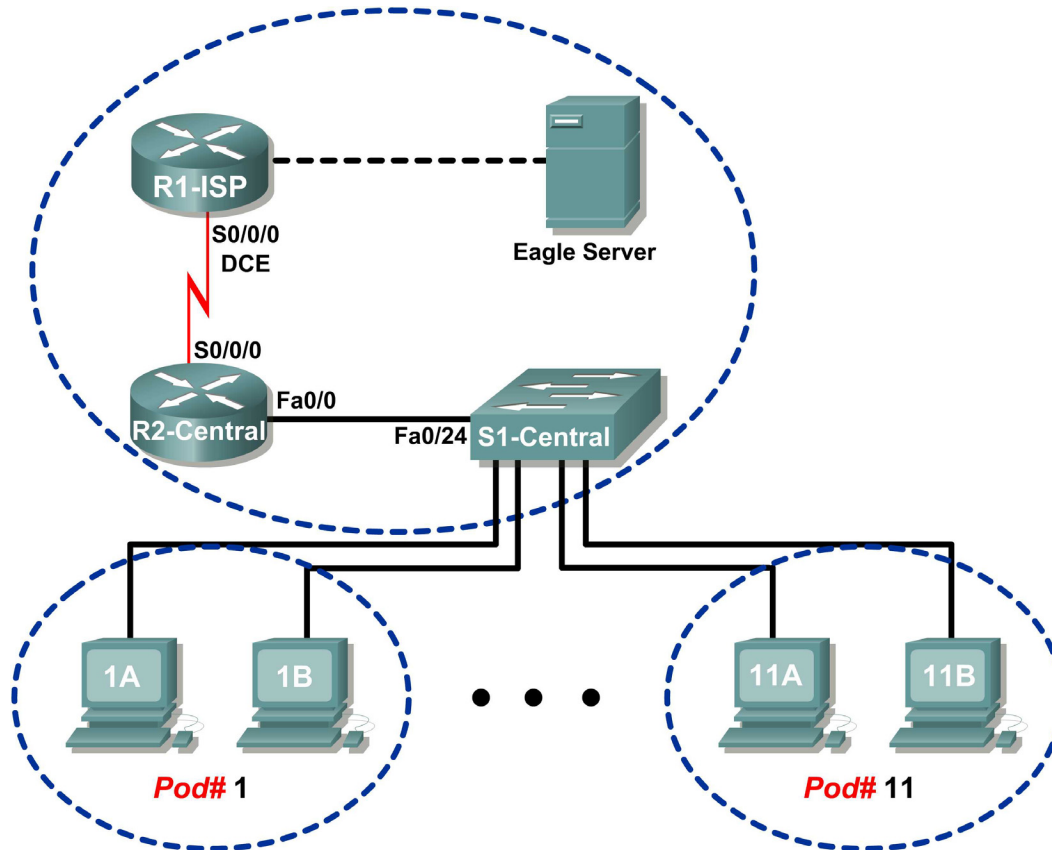


Lab 5.5.1: Examining a Device's Gateway

Topology Diagram



Addressing Table

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1-ISP	S0/0/0	10.10.10.6	255.255.255.252	N/A
	Fa0/0	192.168.254.253	255.255.255.0	N/A
R2-Central	S0/0/0	10.10.10.5	255.255.255.252	N/A
	Fa0/0	172.16.255.254	255.255.0.0	N/A
Eagle Server	N/A	192.168.254.254	255.255.255.0	192.168.254.253
	N/A	172.31.24.254	255.255.255.0	N/A
hostPod#A	N/A	172.16.Pod#.1	255.255.0.0	172.16.255.254
hostPod#B	N/A	172.16.Pod#.2	255.255.0.0	172.16.255.254
S1-Central	N/A	172.16.254.1	255.255.0.0	172.16.255.254

Learning Objectives

Upon completion of this lab, you will be able to:

- Understand and explain the purpose of a gateway address.
- Understand how network information is configured on a Windows computer.
- Troubleshoot a hidden gateway address problem.

Background

An IP address is composed of a network portion and a host portion. A computer that communicates with another device must first know how to reach the device. For devices on the same local area network (LAN), the host portion of the IP address is used as the identifier. The network portion of the destination device is the same as the network portion of the host device.

However, devices on different networks have different source and destination network numbers. The network portion of the IP address is used to identify when a packet must be sent to a gateway address, which is assigned to a network device that forwards packets between distant networks.

A router is assigned the gateway address for all the devices on the LAN. One purpose of a router is to serve as an entry point for packets coming into the network and exit point for packets leaving the network.

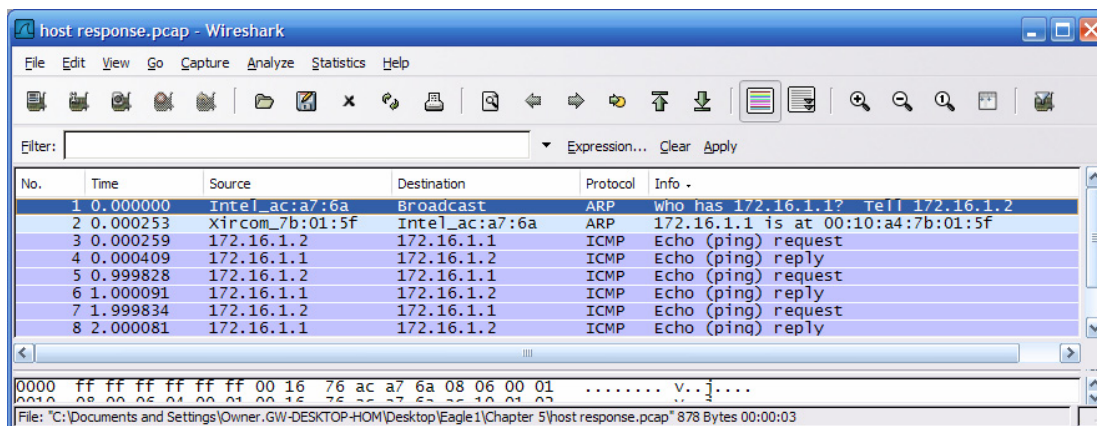
Gateway addresses are very important to users. Cisco estimates that 80 percent of network traffic will be destined to devices on other networks, and only 20 percent of network traffic will go to local devices. This is called the 80/20 rule. Therefore, if a gateway cannot be reached by the LAN devices, users will not be able to perform their job.

Scenario

Pod host computers must communicate with Eagle Server, but Eagle Server is located on a different network. If the pod host computer gateway address is not configured properly, connectivity with Eagle Server will fail.

Using several common utilities, network configuration on a pod host computer will be verified.

Task 1: Understand and Explain the Purpose of a Gateway Address.



command. Any device that has the same network address—in this example, 172.16.0.0—is on the same LAN.

Referring to Figure 1, what is the MAC address of the network device on IP address 172.16.1.1?

There are several Windows commands that will display a network gateway address. One popular command is `netstat -r`. In the following transcript, the `netstat -r` command is used to view the gateway addresses for this computer. The top highlight shows what gateway address is used to forward all network packets destined outside of the LAN. The "quad-zero" Network Destination and Netmask values, 0.0.0.0 and 0.0.0.0, refer to *any* network not specifically known. For any non-local network, this computer will use 172.16.255.254 as the default gateway. The second yellow highlight displays the information in human-readable form. More specific networks are reached through other gateway addresses. A local interface, called the loopback interface, is automatically assigned to the 127.0.0.0 network. This interface is used to identify the local host to local network services. Refer to the gray highlighted entry. Finally, any device on network 172.16.0.0 is accessed through gateway 172.16.1.2, the IP address for this Ethernet interface. This entry is highlighted in green.

```
C:\>netstat -r

Route Table
=====
Interface List
0x1 ..... MS TCP Loopback interface
0x20005 ...00 16 76 ac a7 6a Intel(R) 82562V 10/100 Network Connection
=====

Active Routes:
Network Destination    Netmask          Gateway          Interface        Metric
0.0.0.0                0.0.0.0          172.16.255.254   172.16.1.2        1
127.0.0.0              255.0.0.0        127.0.0.1        127.0.0.1        1
172.16.0.0             255.255.0.0      172.16.1.2       172.16.1.2       20
172.16.1.2             255.255.255.255   127.0.0.1        127.0.0.1       20
172.16.255.255         255.255.255.255   172.16.1.2       172.16.1.2       20
255.255.255.255        255.255.255.255   172.16.1.2       172.16.1.2        1
Default Gateway:       172.16.255.254
=====

Persistent Routes:
None
C:\>
```

Step 1: Open a terminal window on a pod host computer.

What is the default gateway address?

Step 2: Use the `ping` command to verify connectivity with IP address 127.0.0.1.

Was the ping successful? _____

Step 3: Use the ping command to ping different IP addresses on the 127.0.0.0 network, 127.10.1.1, and 127.255.255.255.

Were responses successful? If not, why?

A default gateway address permits a network device to communicate with other devices on different networks. In essence, it is the door to other networks. All traffic destined to different networks must go through the network device that has the default gateway address.

The image shows a Wireshark packet capture window titled 'eagle-server response.pcap - Wireshark'. The packet list table contains the following data:

No.	Time	Source	Destination	Protocol	Info
1	0.000000	Intel_ac:a7:6a	Broadcast	ARP	who has 172.16.255.254? Tell 172.16.1.2
2	0.000653	Cisco_cf:66:40	Intel_ac:a7:6a	ARP	172.16.255.254 is at 00:0c:85:cf:66:40
3	0.000659	172.16.1.2	192.168.254.254	ICMP	Echo (ping) request
4	0.001808	192.168.254.254	172.16.1.2	ICMP	Echo (ping) reply
5	1.000568	172.16.1.2	192.168.254.254	ICMP	Echo (ping) request
6	1.001013	192.168.254.254	172.16.1.2	ICMP	Echo (ping) reply
7	2.000567	172.16.1.2	192.168.254.254	ICMP	Echo (ping) request
8	2.001014	192.168.254.254	172.16.1.2	ICMP	Echo (ping) reply
9	3.000577	172.16.1.2	192.168.254.254	ICMP	Echo (ping) request
10	3.001009	192.168.254.254	172.16.1.2	ICMP	Echo (ping) reply

Figure 2. Communication Between Devices on Different Networks

As shown in Figure 2, communication between devices on different networks is different than on a LAN. Pod host computer #2, IP address 172.16.1.2, initiates a ping to IP address 192.168.254.254. Because network 172.16.0.0 is different from 192.168.254.0, the pod host computer requests the MAC address of the default gateway device. This gateway device, a router, responds with its MAC address. The computer composes the Layer 2 header with the destination MAC address of the router and places frames on the wire to the gateway device.

Referring to Figure 2, what is the MAC address of the gateway device?

Referring to Figure 2, what is the MAC address of the network device with IP address 192.168.254.254?

Task 2: Understand how Network Information is Configured on a Windows Computer.

Many times connectivity issues are attributed to wrong network settings. In troubleshooting connectivity issues, several tools are available to quickly determine the network configuration for any Windows computer.

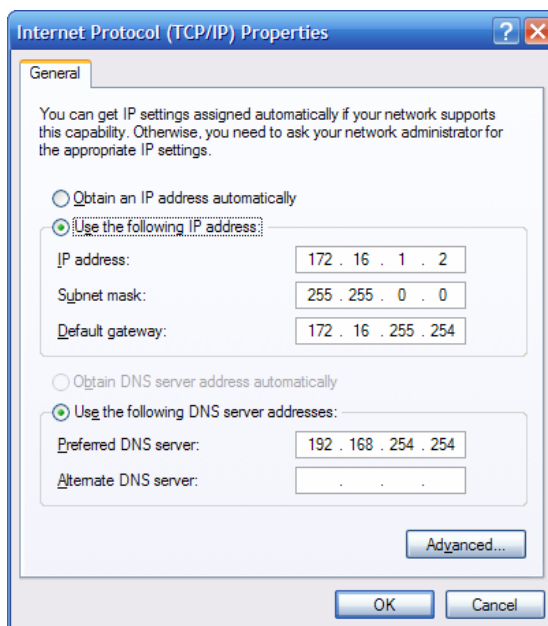


Figure 3. Network Interface with Static IP Address

Step 1: Examine network properties settings.

One method that may be useful in determining the network interface IP properties is to examine the pod host computer's Network Properties settings. To access this window:

1. Click **Start > Control Panel > Network Connections**.
2. Right-click **Local Area Connection**, and choose **Properties**.
3. On the **General** tab, scroll down the list of items in the pane, select **Internet Protocol (TCP/IP)**, and click the **Properties** button. A window similar to the one in Figure 3 will be displayed.

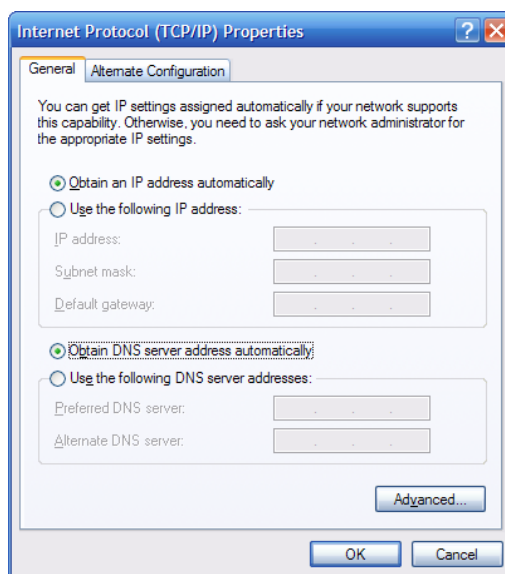


Figure 4. Network Interface with Dynamic IP Address

However, a dynamic IP address may be configured, as shown in Figure 4. In this case, the Network Properties settings window is not very useful for determining IP address information.

A more consistently reliable method for determining network settings on a Windows computer is to use the `ipconfig` command:

```
C:\>ipconfig
Windows IP Configuration
Ethernet adapter Local Area Connection:

    Connection-specific DNS Suffix . : 
    ① IP Address. . . . . : 172.16.1.2
    ② Subnet Mask . . . . . : 255.255.0.0
    ③ Default Gateway . . . . . : 172.16.255.254
```

- ① IP address for this pod host computer
- ② Subnet mask
- ③ Default gateway address

There are several options available with the `ipconfig` command, accessible with the command `ipconfig /?`. To show the most information about the network connections, use the command `ipconfig /all`.

```
C:\>ipconfig /all
Windows IP Configuration
    Host Name . . . . . : GW-desktop-hom
    Primary Dns Suffix . . . . . : 
    Node Type . . . . . : Unknown
    IP Routing Enabled. . . . . : No
    WINS Proxy Enabled. . . . . : No
Ethernet adapter Local Area Connection:
    Connection-specific DNS Suffix . : 
    Description . . . . . : Intel(R) 82562V 10/100
Network Connection
    Physical Address. . . . . : 00-16-76-AC-A7-6A
    Dhcp Enabled. . . . . : No
    IP Address. . . . . : 172.16.1.2
    Subnet Mask . . . . . : 255.255.0.0
    Default Gateway . . . . . : 172.16.255.254
    ① DNS Servers . . . . . : 192.168.254.254
C:\>
```

- ① Domain name server IP address

Step 2: Using the command `ipconfig /all`, fill in the following table with information from your pod host computer:

Description	Address
IP Address	
Subnet Mask	
Default Gateway	
DNS Server	

Task 3: Troubleshoot a Hidden Gateway Address Problem.

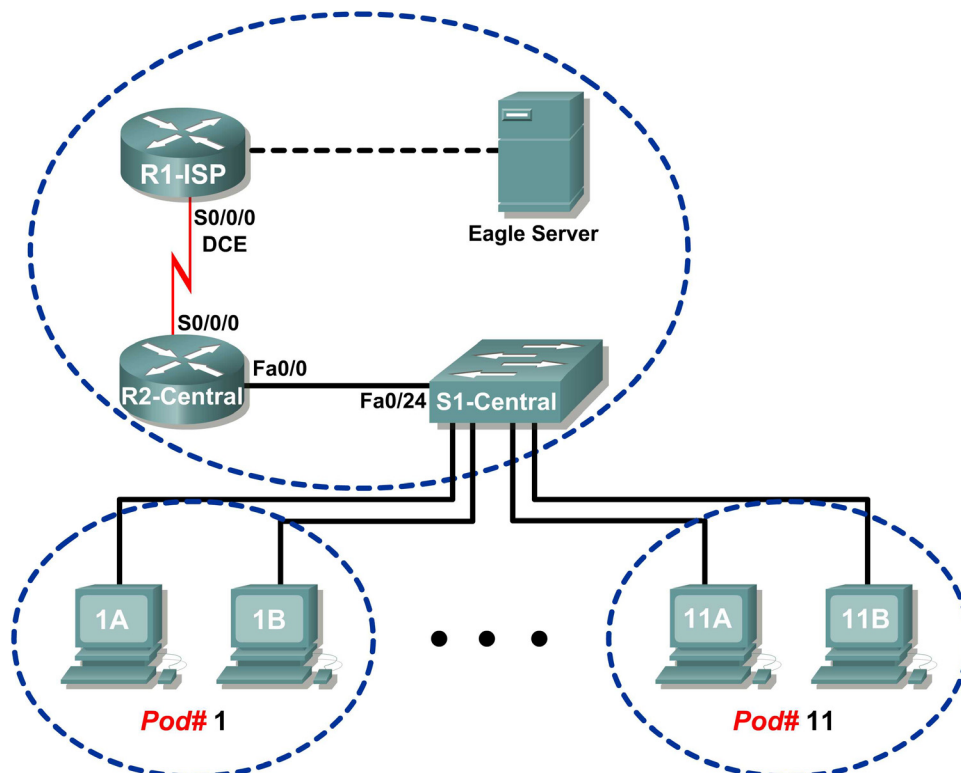


Figure 5. Topology Diagram

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1-ISP	S0/0/0	10.10.10.4	255.255.255.252	N/A
	Fa0/0	192.168.254.253	255.255.255.0	N/A
R2-Central	S0/0/0	10.10.10.3	255.255.255.252	N/A
	Fa0/0	172.16.255.254	255.255.0.0	N/A
Eagle Server	N/A	192.168.254.254	255.255.255.0	192.168.254.253
	N/A	172.31.24.254	255.255.255.0	N/A
hostPod#A	N/A	172.16.Pod#.1	255.255.0.0	172.16.255.254
hostPod#B	N/A	172.16.Pod#.2	255.255.0.0	172.16.255.254
S1-Central	N/A	172.16.254.1	255.255.0.0	172.16.255.254

Table 1. Logical Address Assignments

When troubleshooting network issues, a thorough understanding of the network can often assist in identifying the real problem. Refer to the network topology in Figure 5 and the logical IP address assignments in Table 1.

As the 3rd shift help desk Cisco engineer, you are asked for assistance from the help desk technician. The technician received a trouble ticket from a user on computer host-1A, complaining that computer host-11B, `host-11B.example.com`, does not respond to pings. The technician verified the cables and network settings on both computers, but nothing unusual was found. You check with the corporate network engineer, who reports that R2-Central has been temporarily brought down for a hardware upgrade.

Nodding your head in understanding, you ask the technician to ping the IP address for host-11B, `172.16.11.2` from host-1A. The pings are successful. Then, you ask the technician to ping the gateway IP address, `172.16.254.254`, and the pings fail.

What is wrong?

You instruct the help desk technician to tell the user to use the IP address for host-11B temporarily, and the user is able to establish connectivity with the computer. Within the hour the gateway router is back on line, and normal network operation resumes.

Task 4: Reflection

A gateway address is critical to network connectivity, and in some instances LAN devices require a default gateway to communicate with other devices on the LAN.

Using Windows command line utilities such as `netstat -r` and `ipconfig /all` will report gateway settings on host computers.

Task 5: Challenge

Use Wireshark to capture a ping between two pod host computers. It may be necessary to restart the host computer to flush the DNS cache. First, use the hostname of the destination pod computer for DNS to reply with the destination IP address. Observe the communication sequence between network devices, especially the gateway. Next, capture a ping between network devices using only IP addresses. The gateway address should not be needed.

Task 6: Clean Up.

Unless directed otherwise by the instructor, turn off power to the host computers. Remove anything that was brought into the lab, and leave the room ready for the next class.