7

TRANSMISSION CONTROL PROTOCOL/ INTERNET PROTOCOL (TCP/IP)

PROJECTS

Project 7.1	Understanding Key Concepts
Overview	Due in no small part to the explosive growth of the Internet, TCP/IP has taken over as the de facto network standard over the last several years. As a result, if you're talking about networks, you're talking TCP/IP. Being able to identify TCP/IP terms and the proper context of their use is important. For many network administrators, TCP/IP is the only network protocol with which they will ever deal. During this project, you match TCP/IP terms to the definitions and descriptions of how they are used.
Outcomes	After completing this project, you will know how to: ▲ identify key terms and concepts related to TCP/IP
What you'll need	To complete this project, you will need: ▲ the following worksheet
Completion time	20 minutes
Precautions	None

The worksheet includes a list of TCP/IP terms on the left and descriptions on the right. Match each term with the description that it most closely matches. You will *not* use all descriptions. Each description can be used only once.

___	TTL	A. TCP/IP protocol that supports automated IP address and TCP/IP property configuration
___	IPv4	B. Network subnetted to define the boundary for the network and host bits
___	IPv6	C. Canonical name, an alternate name record with the same address as a host A record
___	Classful network	D. DNS record identifying a DNS server
___	Class A	E. TCP/IP utility used to test host-to-host communication
___	Class D	F. Linux/UNIX TCP/IP utility used to retrieve information from, test, and manage name servers
___	NS record	G. Communication test where a computer sends an echo request to itself

___   CNAME record

H. Time to live IP header field whose value is used to limit the lifespan of a datagram based on the number of routers (hops) it crosses

___   Dig

I. Linux/UNIX TCP/IP utility that can be used to view and manage IP address and configuration information

___   IPconfig

J. Linux/UNIX TCP/IP utility used to track a packet from one host to another, including any routers along the way

___   Ping

K. Emerging IP address standard based on 128-bit addresses

___   Traceroute

L. Windows/MS-DOS TCP/IP utility that can be used to view and manage IP address and configuration information

___   WINS

M. Network address classification defining, by default, up to 127 networks with up to 16,777,214 hosts each

___   Loopback

N. The current IP addressing standard based on 32-bit addresses

O. Service used for automated NetBIOS name to IP address resolution on a Windows network

P. Network addresses set aside for multicast applications

Project 7.2	Configuring TCP/IP Properties
Overview	All TCP/IP hosts must have a unique IP address. This unique address can be assigned as a **static address**, one explicitly specified through the TCP/IP configuration properties, or as a **dynamic address**, where the host leases an address from a DHCP server.
	Dynamic addressing is typically used for the majority of the hosts in a TC/IP network, but you need to understand how to configure both dynamic and static addresses. A number of potential security concerns exist when dealing with DHCP servers, especially in a Windows Active Directory network. Because of this security risk, you will not be setting up and testing DHCP.
	During this project, you will have an opportunity to review not only address properties, but advanced configuration properties as well.
Outcomes	After completing this project, you will know how to:
	▲ configure a host for dynamic address assignment
	▲ configure static IP address parameters
	▲ configure multihomed addresses
What you'll need	To complete this project, you will need:
	▲ a computer running Windows 7 Professional or Windows 7 Enterprise
	▲ the worksheet below
Completion time	30 minutes
Precautions	This project assumes that you are working on a network that consists of a computer running Windows7 Professional or Windows 7 Enterprise and one computer running Windows Server 2008. Your instructor may provide different instructions if you are working in a different network configuration.
	If you are doing this project on an existing network, you must review the project steps with your network administrator. Your network administrator may need to make changes or additions to the project instructions.
	The project steps assume that you are connected to a wired network. If you are connected to a wireless network and you have trouble locating the network connection properties, ask your instructor for assistance.

■ Part A: Record Current IP Parameters

Complete the following steps in all parts of this project on the computer running Windows 7 Professional or Windows 7 Enterprise. You should be logged on as an Administrator.

1. Open the **Control Panel/Network** and **Internet/View Network Status and Tasks**.
2. Open **Change Adapter Settings** in the upper left hand window.
3. Double-click **Local Area Connection** (or double-click **Wireless Connection** if you have a wireless adapter).

4. Click **Properties** to open the **Local Area Connection Properties** dialog box, as shown in Figure 7-1. Because of the increased security built into Windows 7 Professional and Windows 7 Enterprise, you will be prompted for the administrator password.
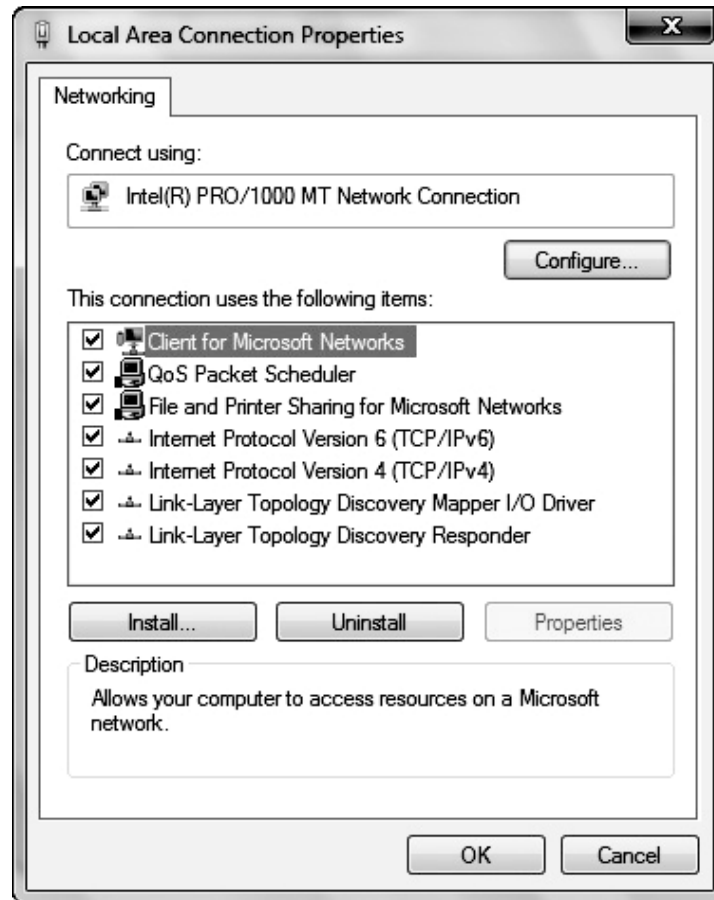

Figure 7-1: **Local Area Connection Properties dialog box**

5. Select **Internet Protocol (TCP/IP) Version 4** and click **Properties** to display the **Internet Protocol (TCP/IP) Properties** dialog box, similar to that shown in Figure 7-2.
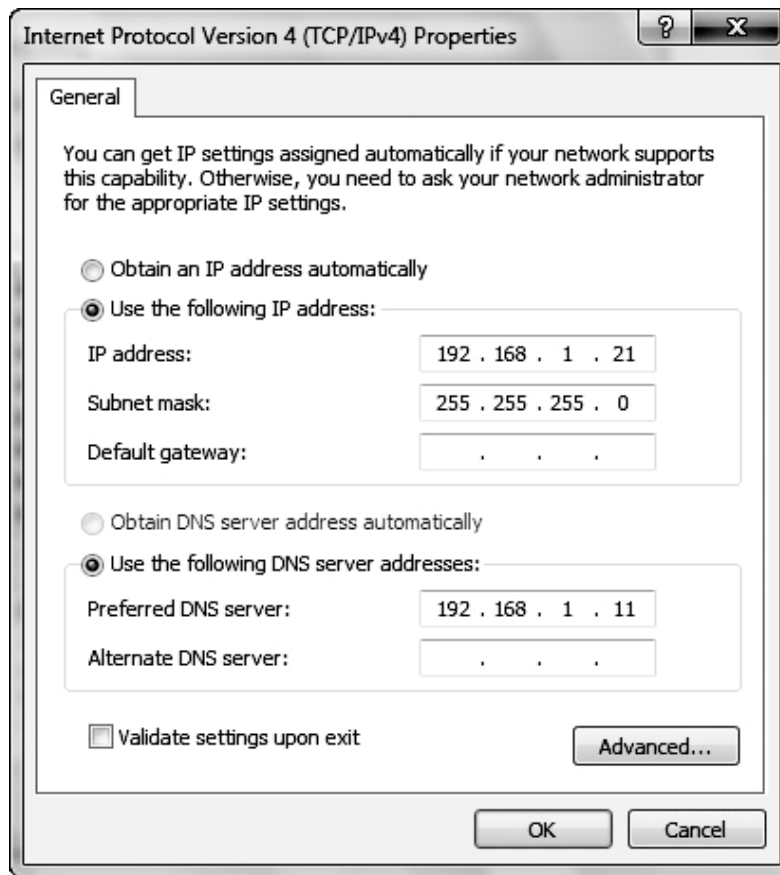
Figure 7-2: **General tab in the Internet Protocol (TCP/IP) Properties dialog box**

6. Record your current configuration settings below:

   IP address: _____

   Subnet mask: _____

   Default gateway: _____

   Preferred DNS server: _____

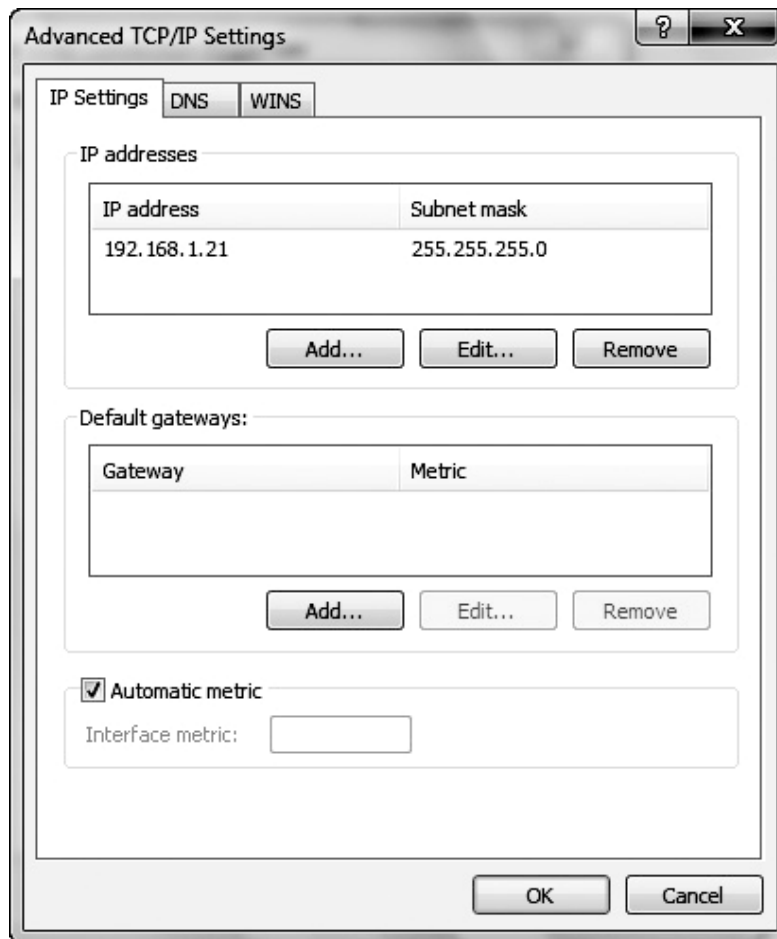7. Click **Advanced** to display the **Advanced TCP/IP Settings** dialog box, similar to that shown in Figure 7-3.

Figure 7-3: **Advanced TCP/IP Settings dialog box**

8. When would you need to configure a default gateway?

    _____

    _____

9. Select the *DNS* tab. Review the DNS settings. DNS configuration settings will be covered in detail in a later project.

10. Select the *WINS* tab. Other than broadcast, what NetBIOS name resolution methods are supported by this computer?

    _____

11. Is NetBIOS currently enabled?

    _____

12. Close the Advanced TCP/IP Settings dialog box. The Internet Protocol (TCP/IP) Properties dialog box should still be displayed. Do not close it.

■ Part B: Record Current IP Parameters

This project assumes you do not have a DCHP server available. You are modifying the settings for practice only.

1. Choose **Obtain an IP address automatically**.
2. How does this change the configuration settings?

   _____

3. Choose **Obtain DNS Server address automatically**.
4. How will the computer know what IP address to use?

   _____

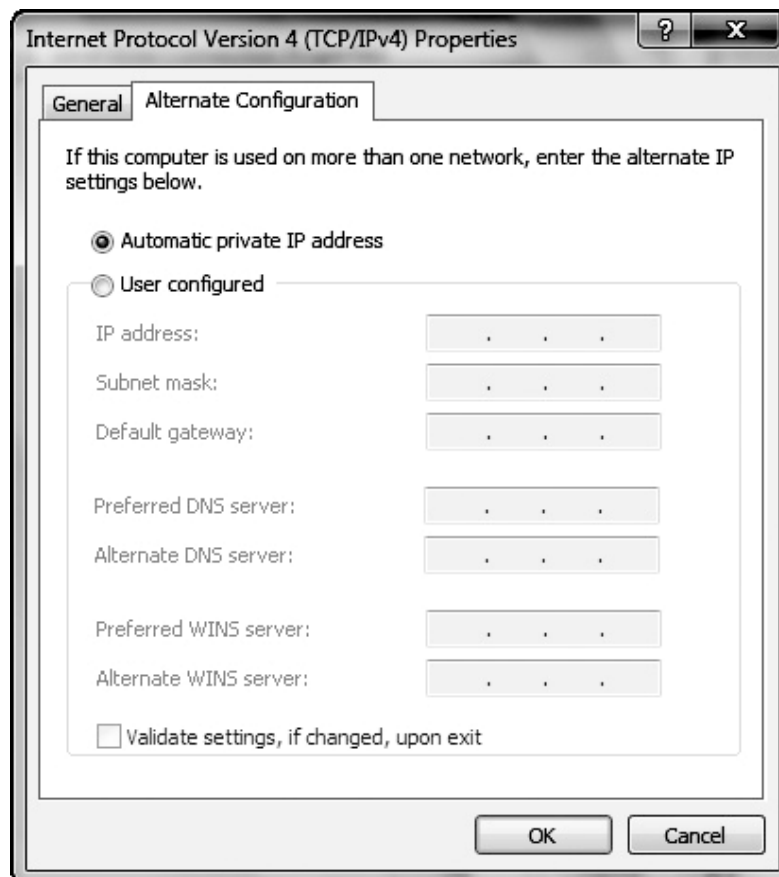5. Select the *Alternate Configuration* tab, as shown in Figure 7-4.

Figure 7-4: **Default Alternate Configuration properties**

6. When is this configuration used?

_____

7. What difference would it make if you configure explicit address information?

_____

8. Select the *General* tab and click **Advanced**.
9. Review each of the properties settings. How have the IP settings changed?

_____

10. How have the other tabs in the Advanced TCP/IP Settings dialog box changed?

_____

11. Click **Cancel** to close the Advanced TCP/IP Settings dialog box. Do not exit the Internet Protocol (TCP/IP) Properties dialog box.

■ Part C: Configure a Multihomed Address

A **multihomed address** is a host with multiple IP addresses assigned.
1. What happens when you select Use the following IP address?

_____

_____

2. Restore the original settings you recorded in Part A of this project. How do you restore this information?

_____

3. Click **Advanced**.
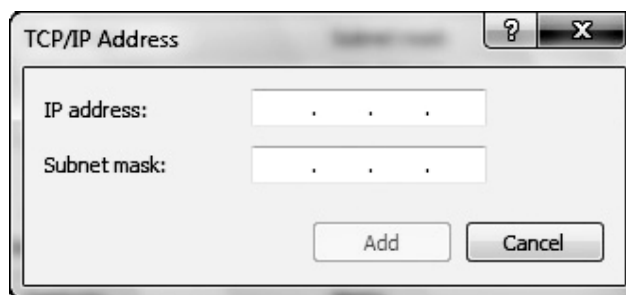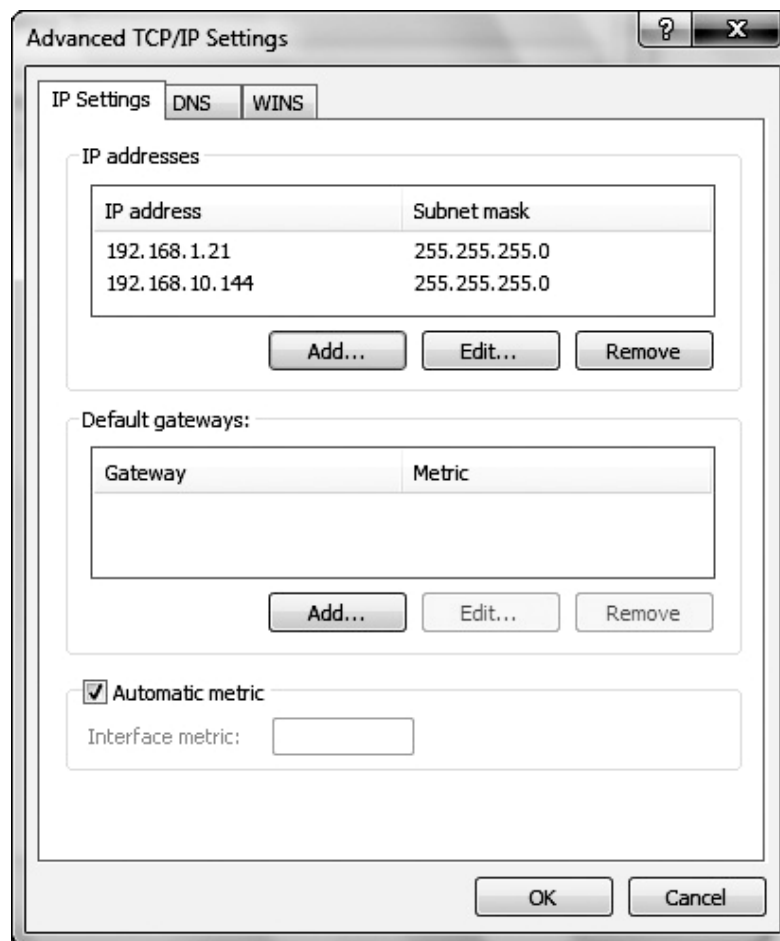4. Click **Add** to open the TCP/IP Address dialog box, as shown in Figure 7-5.

Figure 7-5: **TCP/IP Address dialog box**

5. Enter **192.168.10.144**, or other address provided by your instructor, in the IP address box, and press the *Tab* key on the keyboard. What happens?

   _____

6. Click **Add**. Your IP address properties should look like the example shown in Figure 7-6.

Figure 7-6: Multihomed addresses

7. Click **OK**. How have the general properties changed?

   _____

8. Click **OK** to save the TCP/IP property changes.
9. Click **Close** to close the Local Area Connection Properties dialog box. Click **Close** to close the Network Connections window.
10. Open **Start/All Programs/Accessories**, select **Command Prompt** as shown in Figure 7-7 for Alt 1.
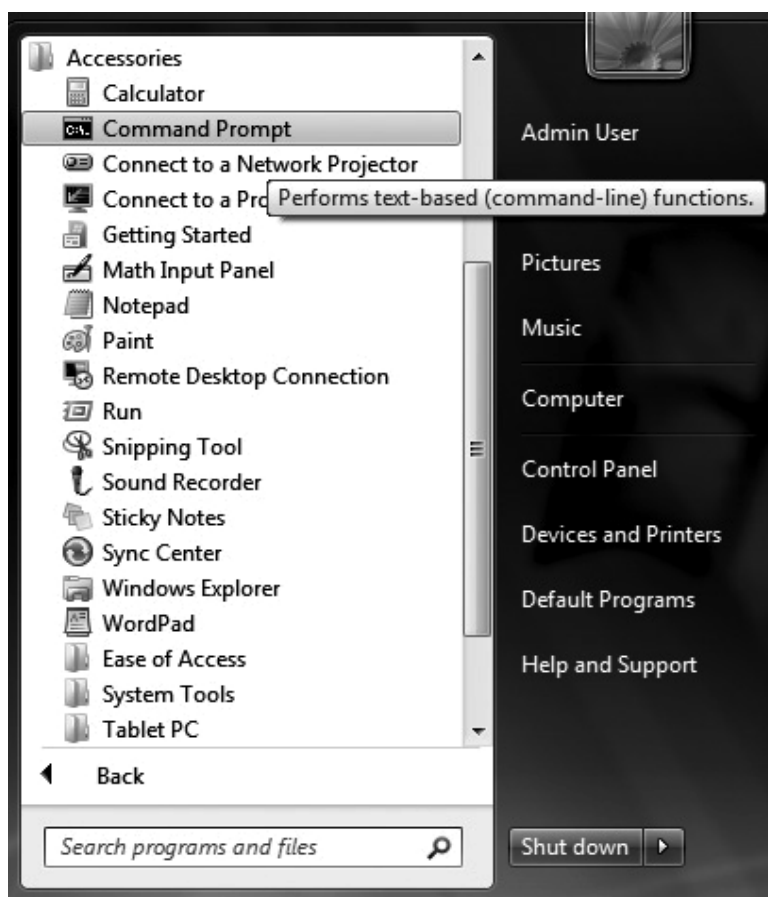
Figure 7-7: Opening Command Prompt Alt 1

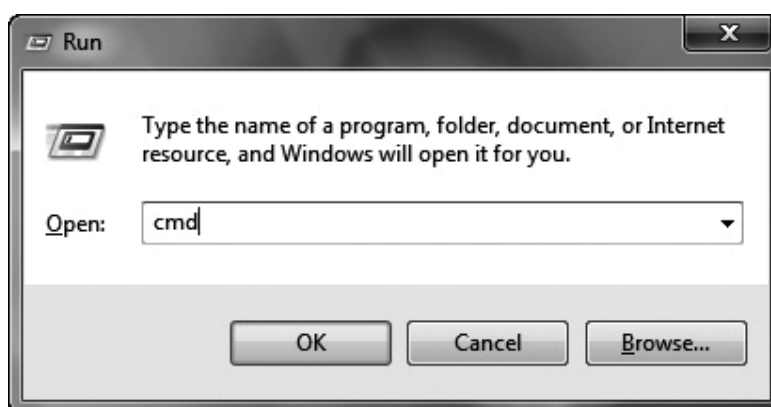Or press the **Flag + R** keys, type **cmd** and press Enter, as shown in Figure 7-8 in Alt 2.

Figure 7-8: Opening Command Prompt Alt 2

11. Enter **ipconfig** in the command prompt.

12. What IP address or addresses are returned?

_____

13. Exit the **Command Prompt**.
14. Complete Steps 1 through 9 on your Windows Server 2008 with the IPv4 address of 192.168.10.154, or other address provided by your instructor.

Project 7.3	Comparing Name Resolution Options
Overview	**Name resolution**, associating computer names with IP addresses, is a critical function in a TCP/IP network. Name resolution lets you locate hosts by name.
	Two types of name systems are used, DNS names and NetBIOS names. **DNS names** are the types of names used across the Internet. A DNS name consists of the host's unique name with the domain name as a suffix, like student00.busicorp.com.
	The other type of name system used is **NetBIOS names**, which are simple text names used with NetBIOS applications and the NetBEUI network protocol, like STUDENT00.
	Name resolution is managed through name servers and text files. DNS names are resolved using DNS servers and the HOSTS file. NetBIOS names, in a Windows network, are resolved using WINS servers and the LMHOSTS file. LMHOSTS can also be used with other network types. For local name resolution, hosts on the same subnetwork, NetBIOS names can also be resolved through broadcasts.
	In this project, you will answer questions related to name resolution scenarios.
Outcomes	After completing this project, you will know how to:
	▲ identify DNS resolution options and parameters
	▲ identify WINS resolution options and parameters
What you'll need	To complete this project, you will need:
	▲ the following worksheet
Completion time	30 minutes
Precautions	None

■ Part A: DNS Name Resolution

Part A is based on the network shown in Figure 7-9. The DNS server named dns1.busicorp.com is the authoritative name server for the domain. The server dns2.busicorp.com is updated periodically with information from dns1.busicrop.com. Hosts can use either name server to resolve host names. You want to keep traffic related to name resolution to a minimum. The computer linux.busicorp.com is configured as a router.

Note: In a real-world configuration, you would probably give your DNS servers less obvious names to help prevent them from being compromised.
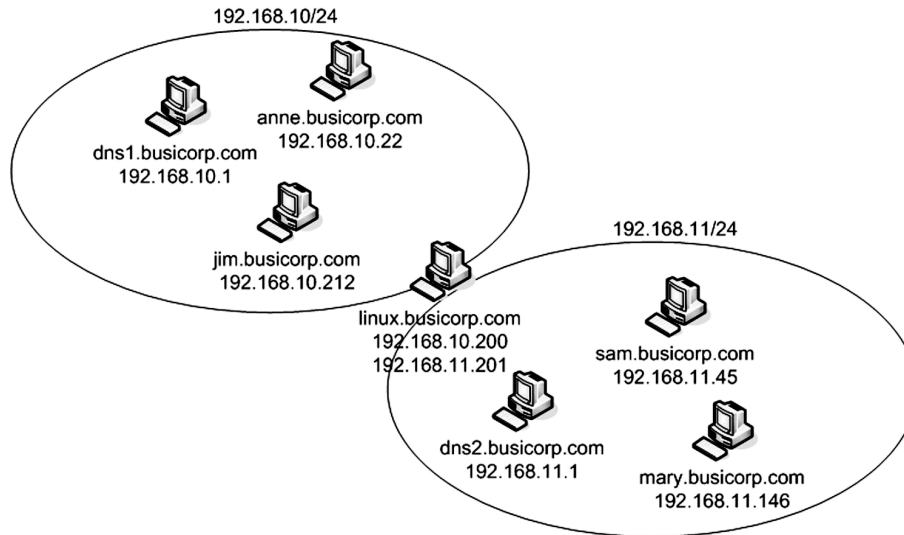
Figure 7-9: **DNS resolution sample**

1. How would you configure the primary and alternate DNS servers for sam.busicorp.com and jim.busicorp.com and why?

   a. sam.busicorp.com

   Primary DNS server: _____

   Alternate DNS server: _____

   b. jim.busicorp.com

   Primary DNS server: _____

   Alternate DNS server: _____

   Reason:

   _____

   _____

2. To which DNS server would you make updates?

   _____

3. Why?

   _____

4. Why shouldn't you make updates to the other DNS server?

   _____

   _____

   _____

5. What special configuration requirements are there for linux.busicorp.com to support name resolution?

   _____

6. If the following is run from sam.busicorp.com, it succeeds:

   ```
   ping 192.168.11.146
   ```

   If the following is run, it succeeds:

   ```
   ping anne.busicorp.com:
   ```

   If the following is run, it fails:

   ```
   ping mary.busicorp.com
   ```

   If you run the same commands from jim.busicorp.com, you get the same symptoms. What is most likely wrong, and how did you determine this?

   _____

   _____

   _____

   _____

   _____

7. This is a separate scenario. Do not consider the errors reported in Question 4.

   The only computer experiencing problems is anne.busicorp.com. When you run the following, it succeeds:

   ```
   ping jim.busicorp.com
   ```

   If you run the following, it fails:

   ```
   ping mary.busicorp.com
   ```

   If you run the following, it fails:

   ```
   ping sam.busicorp.com
   ```

   If you run the same commands from any other computer, they all succeed. What is most likely wrong, and how did you determine this?

   _____

   _____

   _____

   _____

   _____

■ Part B: Mixed Name Resolution

Part B is based on the network shown in Figure 7-10. The network is a Windows Active Directory domain with the domain controllers identified in the figure. The domain controllers are configured as DNS servers. The computer named sppt.busicorp.com will be configured as a WINS proxy server, which means that it forwards NetBIOS name resolution requests to the WINS server and returns the result to the local subnetwork. The computer linux.busicorp.com is configured as a router.
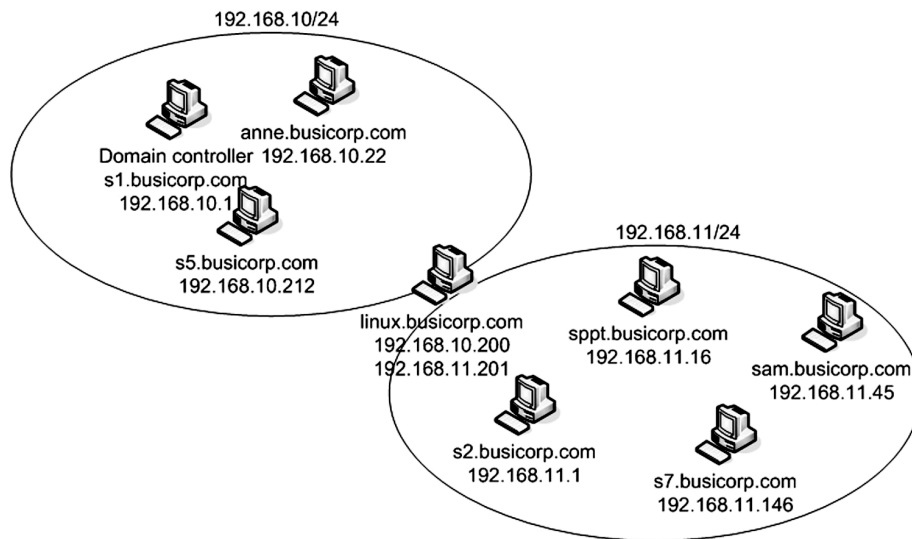

Figure 7-10: Mixed name resolution

1. What would justify configuring NetBIOS name resolution?

    _____

    _____

    _____

2. If configuring a WINS server, which server should you use (s5.busicorp.com or s7.busicorp.com)?

    _____

3. Why?

    _____

    _____

4. How can you avoid having computers running Windows 7 Professional or Windows 7 Enterprise to use the WINS proxy server?

    _____

    _____

5. How would you do this?

   _____

   _____

6. Assuming you do not want to configure a WINS server, how could you support NetBIOS name resolution for computers on the local network?

   _____

   _____

7. How could you support NetBIOS name resolution for computers on the remote network?

   _____

   _____

Project 7.4	Comparing Name Resolution Methods
Overview	The specific requirements for configuring name resolution depend on whether you need to support DNS names or both NetBIOS names and DNS names. They also vary depending on how you are managing name resolution.
	A **DNS server** is the preferred method on most networks. However, in some situations you need to use HOSTS file name resolution. Thus, you need to understand how to set up and how to use both resolution methods.
	This project takes a closer look at DNS configuration options and tests using a HOSTS files for name resolution.
Outcomes	After completing this project, you will know how to:
	▲ view DNS server properties
	▲ configure DNS client properties
	▲ modify and use a HOSTS file
What you'll need	To complete this project, you will need:
	▲ a computer running Windows 7 Professional or Windows 7 Enterprise
	▲ a computer running Windows Server 2008
	▲ the following worksheet
Completion time	30 minutes
Precautions	This project assumes that you are working on a network that consists of a computer running Windows Server2008 configured as a domain controller and a computer running Windows 7 Professional or Windows 7 Enterprise configured as a domain member. Your instructor may provide different instructions if you are working in a different network configuration.
	If you are doing this project on an existing network, you must review the project steps with your network administrator. Your network administrator may need to make changes or additions to the project instructions.

■ Part A: DNS Server Properties

Complete this part of the project on the computer running Windows Server 2008. You must be logged on as an Administrator.

1. Why was it necessary to configure this computer as a DNS server when promoting the server to domain controller?

    _____

    _____

2. Open the *Start* menu, point to **Administrative Tools**, and then select **DNS**.

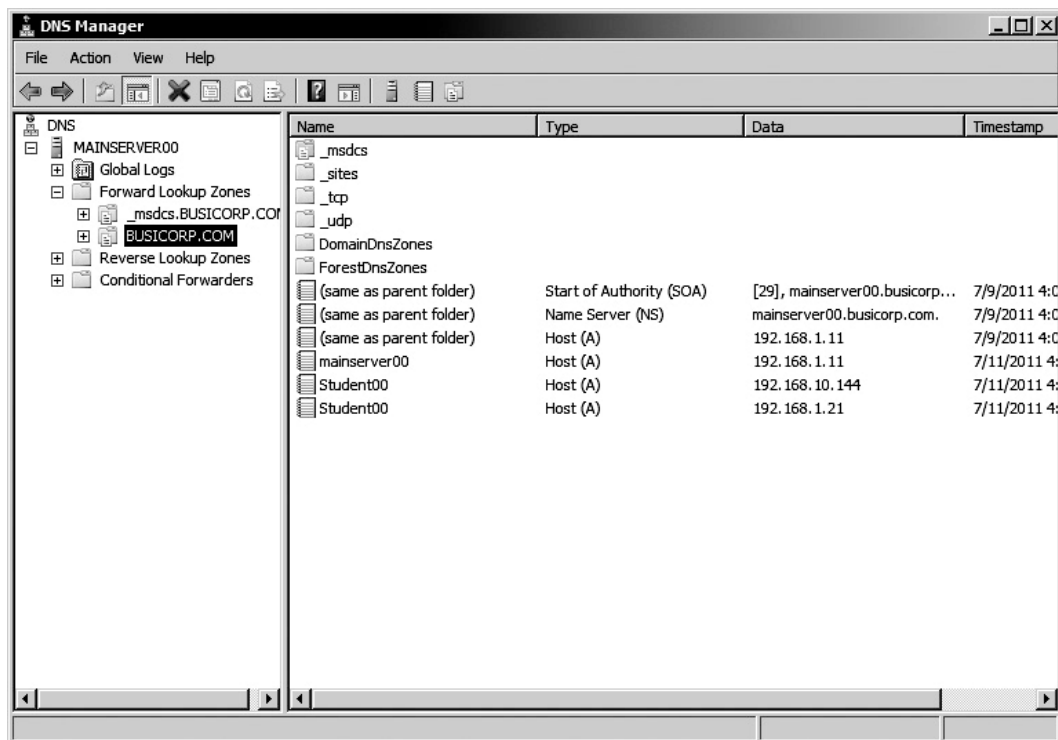3. Expand your server and Forward Lookup Zones, and then select BUSICORP.COM, as shown in Figure 7-11.

Figure 7-11: **BUSICORP.COM zone**

4. What computers are listed?

    _____

    _____

5. Look closely at Figure 7-11. How do the domain controller's TCP/IP configuration properties differ from your computer, assuming your domain controller is configured as specified in earlier projects?

    _____

6. How can you tell this?

   _____

7. From the information in the DNS table, how can you tell that the domain controller is a DNS server?

   _____

8. Is it required in any network configuration that each domain controller also be configured as a DNS server?

   _____

9. Now go back to the Administrative Tools and select **Event Viewer**. Expand the *Application and Service Logs* and choose **DNS Server**. You should see one or more errors listed, as in Figure 7-12.
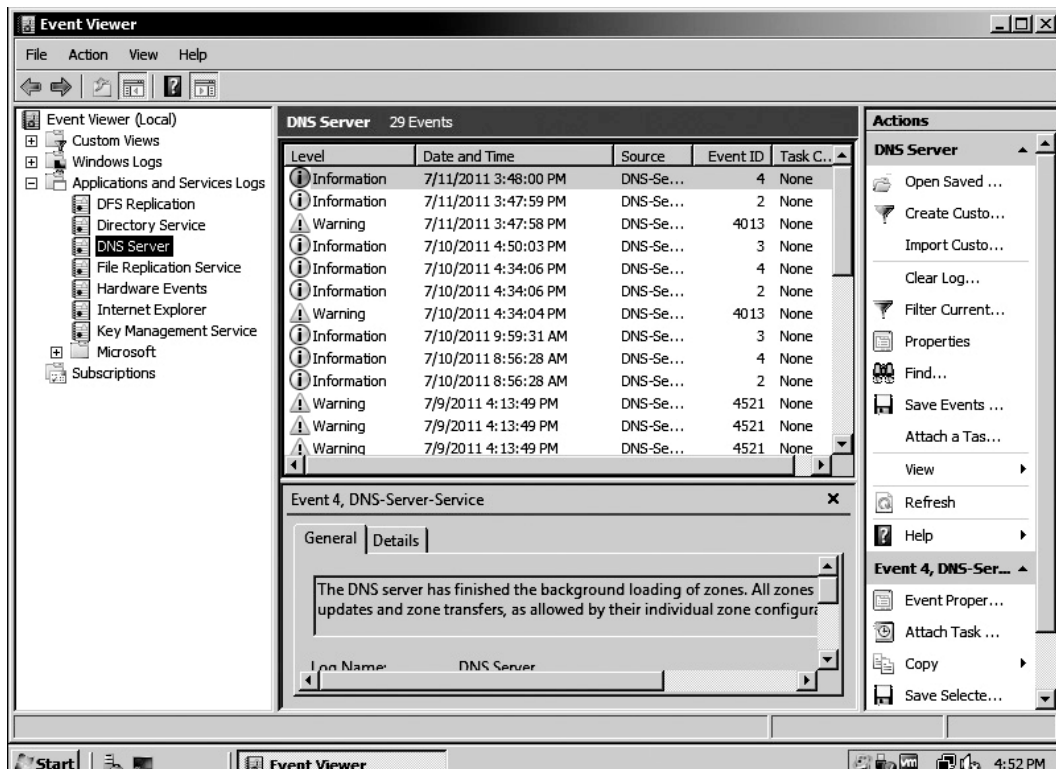
Figure 7-12: **DNS server event log entries**

10. Double-click the most recent error to view error details. They should be similar to the example shown in Figure 7-12. Why did this error occur?

   _____

   _____

   _____

11. Close all open windows.

■ **Part B: View Name Resolution Configuration**

You will complete this portion of the project on the computer running Windows 7 Professional or Windows 7 Enterprise.

1. Open the Internet Protocol (TCP/IP) Properties dialog box for your computer. Refer to the steps in Project 7.2 if necessary.
2. What computer is configured as the DNS server?

    _____

3. Click **Advanced**.
4. Select the *DNS* tab.
5. Which configuration option enables this computer to register itself with the DNS server?

    _____

6. What term refers to this DNS feature?

    _____

7. Click **Cancel**. Do not close the Internet Protocol (TCP/IP) Properties dialog box.

■ **Part C: Test Name Resolution Options**

You will complete this portion of the project on the computer running Windows 7 Professional or Windows 7 Enterprise.

1. Open a command prompt and execute the following: ping domain_controller. (Replace domain_controller with your domain controller's fully qualified name.)
2. How did your computer get the remote computer's address?

    _____

3. In the Internet Protocol (TCP/IP) Properties dialog box, delete the DNS server address so that no DNS server is defined, as shown in Figure 7-13.
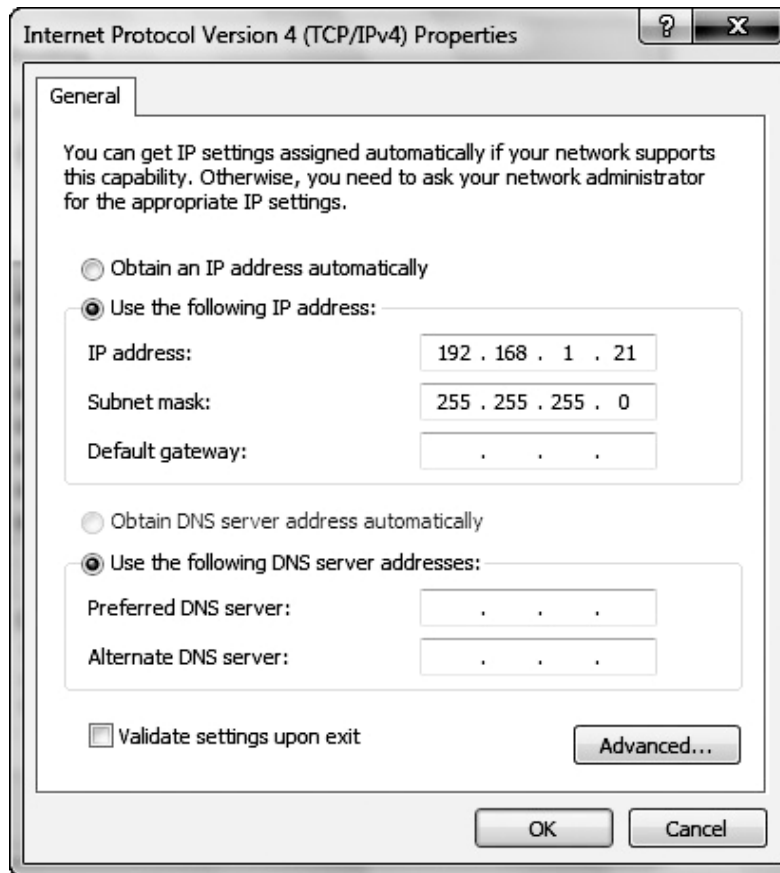
Figure 7-13: **No DNS Server defined**

4. Click *OK* and then close the Local Area Connection Properties dialog box to apply the changes.

5. In the command prompt, execute the following to remove any cached name resolution information: ipconfig /flushdns.

6. Repeat Step 1 to ping your domain controller. What happens? (***Remember:*** Both Windows 7 Professional, Windows 7 Enterprise, and Server 2008 enable IPv6 by default, which means that the OS is communicating on both protocols, and thus deleting the DNS address will yield different results that a machine using only IPv4.)
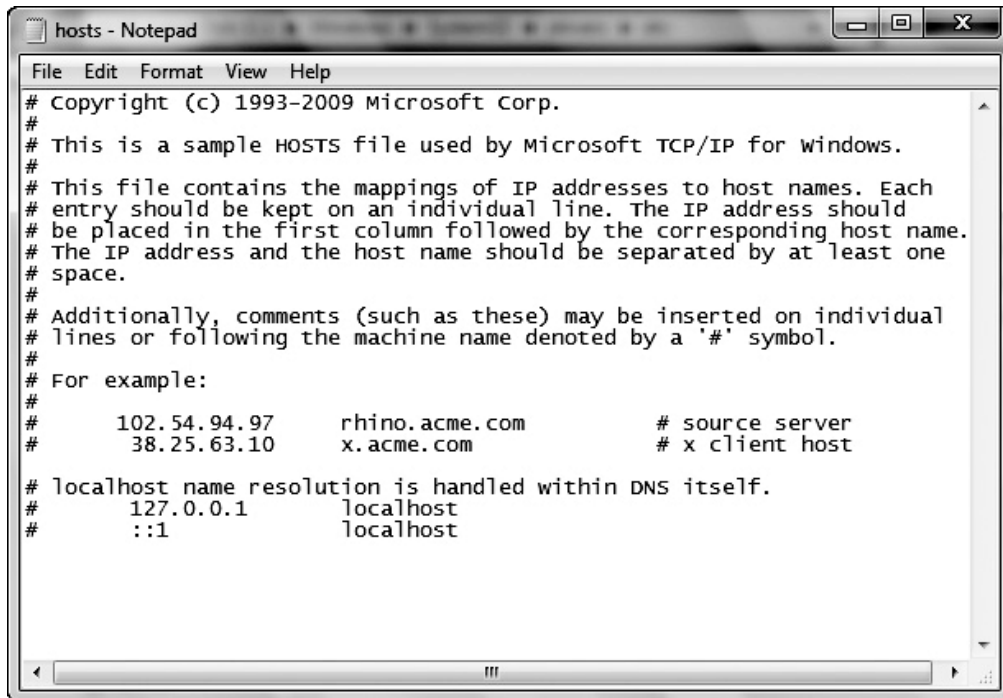
_____

7. Why?

_____

8. Open *My Computer* and navigate to the following location: c:\WINDOWS\system32\drivers\etc.

   Note: This assumes that Windows 7 Professional or Windows 7 Enterprise was installed to the default location. If not, use the path to the installation destination.
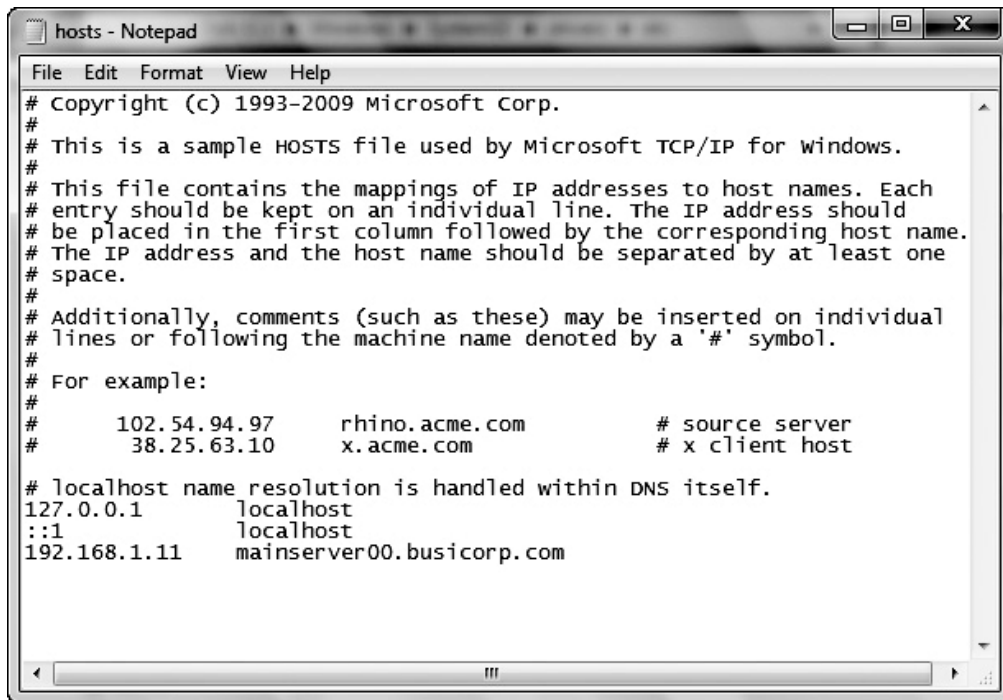
9. Double-click **hosts**. When prompted for the program you want to use, select **Notepad** and click *OK*.

10. The file should look like the sample shown in Figure 7-14.


```
hosts - Notepad
File  Edit  Format  View  Help
# Copyright (c) 1993-2009 Microsoft Corp.
#
# This is a sample HOSTS file used by Microsoft TCP/IP for Windows.
#
# This file contains the mappings of IP addresses to host names. Each
# entry should be kept on an individual line. The IP address should
# be placed in the first column followed by the corresponding host name.
# The IP address and the host name should be separated by at least one
# space.
#
# Additionally, comments (such as these) may be inserted on individual
# lines or following the machine name denoted by a '#' symbol.
#
# For example:
#
#      102.54.94.97      rhino.acme.com          # source server
#       38.25.63.10      x.acme.com              # x client host

# localhost name resolution is handled within DNS itself.
#       127.0.0.1        localhost
#        ::1             localhost
```

Figure 7-14: **Default HOSTS file**

11. Edit the file to add your domain controller. A sample is shown in Figure 7-15.

Figure 7-15: **Edited HOSTS file**

12. Select **File**, click **Save** to save your changes, and then exit Notepad (Administrative permissions are needed to save this file).

13. In the command prompt, ping your domain controller. What happens?

    _____

14. Why?

    _____

15. Open your computer's Internet Protocol (TCP/IP) Properties dialog box and restore the DNS server properties to their original settings.

16. Close all open windows.

Project 7.5	Designing Subnetworks
Overview	**Subnetworking** is the process of dividing a network address into smaller networks. The more the subnetworks you create, the fewer hosts per subnetwork are supported. The subnet mask determines which bits are used for the network address and which are used for the host address.
	To understand the available host addresses, you have to consider the binary host address values. Two values cannot be used as host addresses. The host bits cannot be set to all zeros, because this is the network address. The host bits also cannot be set to all ones, because this is the broadcast address. Packets sent to the broadcast address are processed by all hosts on the subnetwork. Routers do not pass broadcast packets.
	In the project, you will be presented with subnet scenarios and graphic representations of network configurations. You will be asked questions about each scenario.
Outcomes	After completing this project, you will know how to:
	▲ design subnetworks to meet network configuration requirements
	▲ determine the available addresses for a network
What you'll need	To complete this project, you will need:
	▲ the following worksheet
Completion time	45 minutes
Precautions	None.
	You can use the Windows calculator in scientific mode to convert between binary and decimal values.

■ Part A: Scenario #1

All of the questions in this scenario refer to Figure 7-16. Each subnet must support at least 50 host computers. There are no plans in the near future to expand the network. You have the class C address 201.14.2 available for subnetting.
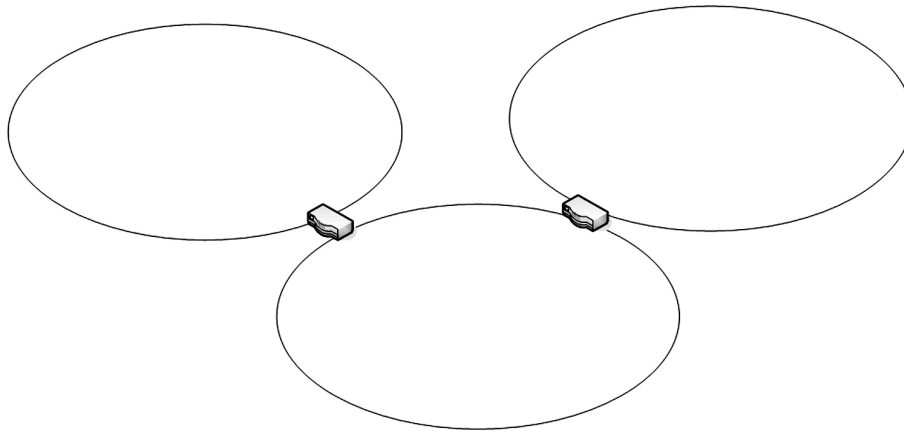
Figure 7-16: **Scenario #1**

1. What subnet mask should you use?

    _____

2. Why?

    _____

3. At minimum, how many IP addresses must be configured for each router?

    _____

4. Why?

    _____

5. For each possible network, what are the network address and broadcast address?
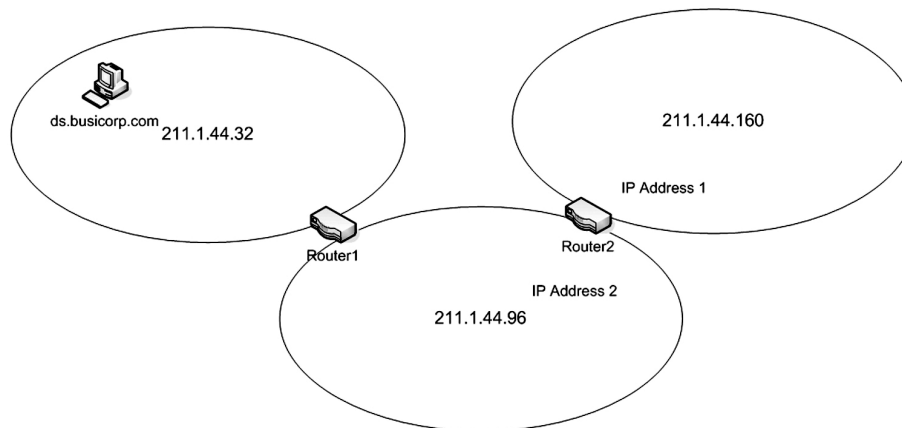
    _____

    _____

    _____

    _____

■Part B: Scenario #2

All of the questions in this scenario refer to Figure 7-17. The number inside each subnet is the network address. These addresses were derived by subnetting the class C address 211.1.44. Each network must support at least 16 hosts.

Figure 7-17: **Scenario #2**

1. What subnet mask would you use with this configuration?

   _____

2. How many additional network addresses are available that are not used?

   _____

3. How many hosts can each subnet support?

   _____

4. You want to address Router2 with the first valid host address in each connected network. What addresses should you use?

   _____

   _____

5. You want to configure ds.busicorp.com with the numerically highest available host address. What should you use?

   _____

6. The network does not use WINS servers. NetBIOS support is needed only on network number 211.1.44.96. If a host is attempting to resolve a NetBIOS address, to what IP address would it address the request?

   _____

7. Why?

    _____

    _____

8. For each of the following addresses, identify it as being on network number 211.1.44.32, 211.1.44.96, 211.1.44.160, or invalid (not supported on any subnetwork).

    211.1.44.190   _____

    211.1.44.187   _____

    211.1.44.40   _____

    211.1.44.65   _____

    211.1.44.94   _____

    211.1.44.170   _____

    211.1.44.131   _____