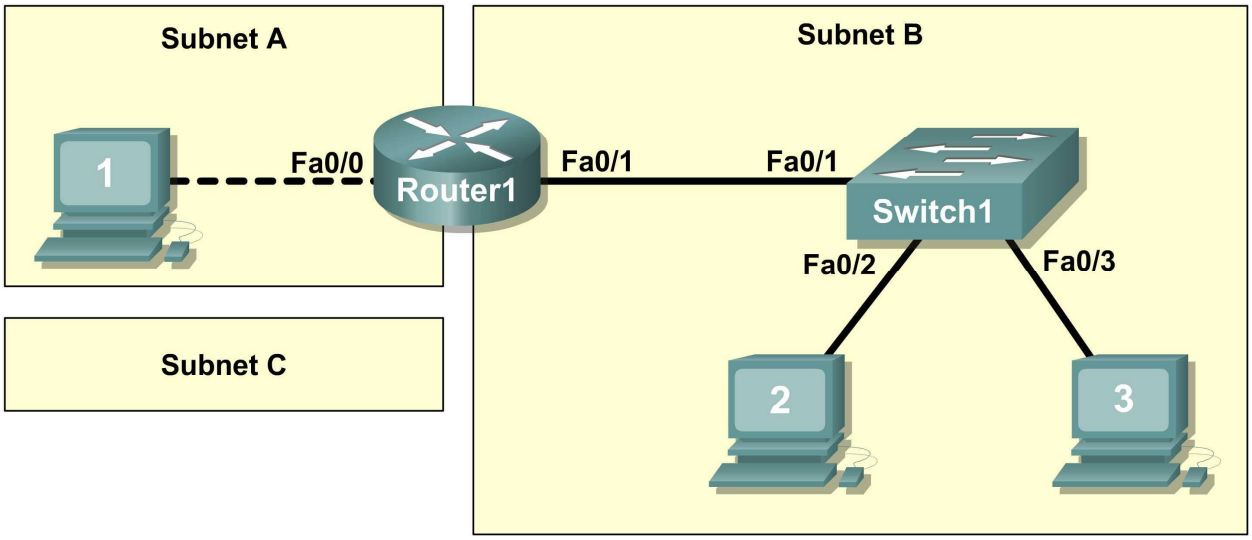
Lab 11.5.5: Network Documentation with Utility Commands (Instructor Version)

Topology Diagram



Learning Objectives

- Design the logical lab topology.
- Configure the physical lab topology.
- Design and configure the logical LAN topology.
- Verify LAN connectivity.
- Document the network.

Background

Hardware	Qty	Description
Cisco Router	1	Part of CCNA Lab bundle.
Cisco Switch	1	Part of CCNA Lab bundle.
*Computer (host)	3	Lab computer.
CAT-5 or better straight-through UTP cables	3	Connects Router1, Host1, and Host2 to switch1.
CAT-5 crossover UTP cable	1	Connects host 1 to Router1
Console (rollover) cable	1	Connects Host1 to Router1 console

Table 1. Equipment and hardware for Eagle 1 lab.

Gather the necessary equipment and cables. To configure the lab, make sure the equipment listed in Table 1 is available.

Note to instructor: If you do not have a router that has two FastEthernet interfaces, consider configuring a loopback interface as an alternative to the FastEthernet 0/1. Another alternative would be to use two routers connected through a serial connection and use the FastEthernet interfaces from each router.

In this lab router and host output will be copied from the devices and into Notepad for use in network documentation. Appendix1 contains tables that can be used to copy output into, or create your own tables.

Scenario

Network documentation is a very important tool for the organization. A well-documented network enables network engineers to save significant time in troubleshooting and planning future growth.

In this lab students will create a small network that requires connecting network devices and configuring Host computers for basic network connectivity. Subnet A and Subnet B are subnets that are currently needed. Subnet C is an anticipated subnet, not yet connected to the network. The 0th subnet will be used.

Note to instructor: To reinforce student cable identification, have several different types of cables available for the students. Mix crossover, straight-through, and rollover cables. Students should be able to identify the proper cable type based on a visual inspection.

Task 1: Configure the logical lab topology.

Given an IP address of `209.165.200.224 / 27 (address / mask)`, design an IP addressing scheme that satisfies the following requirements:

Subnet	Number of Hosts
Subnet A	2
Subnet B	Between 2 - 6
Subnet C	Between 10 – 12

Step 1: Design Subnet C address block.

Begin the logical network design by satisfying the requirement for Subnet C, the largest IP address block. Using binary numbers to create your subnet chart, pick the next available address block that will support Subnet C.

Fill in the following table with IP address information for Subnet C:

Network Address	Mask	First Host address	Last Host address	Broadcast
209.165.200.224	255.255.255.240	209.165.200.225	209.165.200.238	209.165.200.239

What is the bit mask? __11111111.1111111.11111111.11110000___

Step 2: Design Subnet B address block.

Satisfy the requirement of Subnet B, the next largest block of IP addresses. Using binary numbers to create your subnet chart, pick the first address block that will support Subnet B.

Fill in the following table with IP address information for Subnet B:

Network Address	Mask	First Host address	Last Host address	Broadcast
209.165.200.240	255.255.255.248	209.165.200.240	209.165.200.246	209.165.200.247

What is the bit mask? __11111111.1111111.11111111.111111000___

Step 3: Design Subnet A address block.

Satisfy the requirement of Subnet A, the smallest IP address block. Using binary numbers to create your subnet chart, pick the next available address block that will support Subnet A.

Fill in the following table with IP address information for Subnet A:

Network Address	Mask	First Host address	Last Host address	Broadcast
209.165.200.248	255.255.255.252	209.165.200.249	209.165.200.250	209.165.200.251

What is the bit mask? ___11111111.1111111.11111111.11111100____

Task 2: Configure the Physical Lab Topology.

Step 1: Physically connect lab devices.

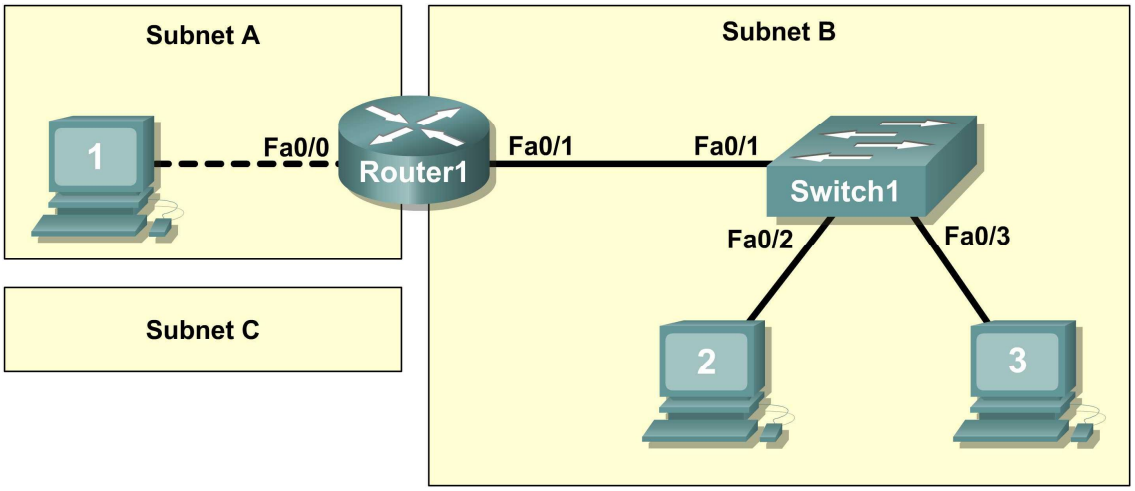


Figure 1. Cabling the network.

Cable the network devices as shown in Figure 1. Pay special attention to the crossover cable required between Host1 and Router1.

If not already enabled, turn power on to all devices.

Step 2: Visually inspect network connections.

After cabling the network devices, take a moment to verify the connections. Attention to detail now will minimize the time required to troubleshoot network connectivity issues later.

Task 3: Configure the Logical Topology.

Step 1: Document logical network settings.

Host computers will use the first two IP addresses in the subnetwork. The network router will use the LAST network host address. Write down the IP address information for each device:

Device	Subnet	IP address	Mask	Gateway
Router1-Fa0/0	209.165.200.248	209.165.200.250	255.255.255.252	N/A
Host1	209.165.200.248	209.165.200.249	255.255.255.252	209.165.200.250
Router1-Fa0/1	209.165.200.240	209.165.200.246	255.255.255.248	N/A
Host2	209.165.200.240	209.165.200.241	255.255.255.248	209.165.200.246
Host3	209.165.200.240	209.165.200.242	255.255.255.248	209.165.200.246
Switch1	N/A	N/A	N/A	N/A

Step 2: Configure host computers.

On each computer in turn, select start | Control Panel | Network Connections. Identify the Local Area Connection device icon. Use the mouse pointer to highlight the icon, right-click, and select properties. Highlight Internet Protocol (TCP/IP), and select Properties.

Verify that the Host1 Layer 3 IP address is on a different subnetwork than Host2 and Host3. Configure each host computer using the IP address information recorded in Step 1.

Verify proper configuration of each host computer with the **`ipconfig /all`** command. Record your information in Appendix1, Network Documentation:

Step 3: Configure Router1.

From the Widows taskbar, start the HyperTerminal program by clicking on Start | Programs | Accessories | Communications | HyperTerminal. Configure HyperTerminal for access to Router1. Configuration tasks for Router1 include the following:

Task
Specify Router name- `Router1`
Specify an encrypted privileged exec password- `cisco`
Specify a console access password- `class`
Specify a telnet access password- `class`
Configure the MOTD banner.
Configure Router1 interface Fa0/0- set the description set the Layer 3 address issue **`no shutdown`**
Configure Router1 interface Fa0/1- set the description set the Layer 3 address issue **`no shutdown`**

Save the configuration in NVRAM.

Display the contents of RAM: **`show running-configuration`**

Copy the output of the configuration into the Router1 configuration table, Appendix 1.

Copy the output of the **`show interface fa0/0`** and **`show interface fa0/1`** commands into the Router1 Interface configuration tables, Appendix 1.

Copy the output of the **`show ip interface brief`** command into the Router1 IP Address configuration table, Appendix1.

Step 4: Configure Switch1.

Move the console cable from Router1 to Switch1. Press Enter until a response is received. Configuration tasks for Switch1 include the following:

Task
Specify Switch name- `Switch1`
Specify an encrypted privileged exec password- `cisco`
Specify a console access password- `class`
Specify a telnet access password- `class`
Configure the MOTD banner.
Configure Switch1 interface Fa0/1- set the description
Configure Switch1 interface Fa0/2- set the description
Configure Switch1 interface Fa0/3- set the description

Display the contents of RAM: **`show runnig-configuration`**

Copy the output of the configuration into the Switch1 configuration table, Appendix 1.

Copy the output of the **`show mac address-table`** command into the Switch1 MAC address table, Appendix 1.

Task 4: Verify Network Connectivity.

Step 1: Use the `ping` command to verify network connectivity.

Network connectivity can be verified with the **`ping`** command. It is very important that connectivity exists throughout the network. Corrective action must be taken if there is a failure.

**NOTE: If pings to host computers fail, temporarily disable the computer firewall and retest. To disable a Windows firewall, select Start | Control Panel | Windows Firewall, select OFF, and OK.

Use the following table to methodically verify connectivity with each network device. Take corrective action to establish connectivity if a test fails:

From	To	IP Address	Ping results
Host1	LocalHost (127.0.0.1)	127.0.0.1	Should be success.
Host1	NIC IP address	209.165.200.249	Should be success.
Host1	Gateway (Router1, Fa0/0)	209.165.200.250	Should be success.
Host1	Router1, Fa0/1	209.165.200.246	Should be success.
Host1	Host2	209.165.200.241	Should be success.
Host1	Host3	209.165.200.242	Should be success.
Host2	LocalHost (127.0.0.1)	127.0.0.1	Should be success.
Host2	NIC IP address	209.165.200.241	Should be success.
Host2	Host3	209.165.200.242	Should be success.
Host2	Gateway (Router1, Fa0/1)	209.165.200.246	Should be success.
Host2	Router1, Fa0/0	209.165.200.250	Should be success.
Host2	Host1	209.165.200.249	Should be success.
Host3	LocalHost (127.0.0.1)	127.0.0.1	Should be success.
Host3	NIC IP address	209.165.200.242	Should be success.
Host3	Host2	209.165.200.241	Should be success.
Host3	Gateway (Router1, Fa0/1)	209.165.200.246	Should be success.
Host3	Router1, Fa0/0	209.165.200.250	Should be success.
Host3	Host1	209.165.200.249	Should be success.

Step 2: Use the `tracert` command to verify local connectivity.

In addition to connectivity testing, the tracert command may also be used as a crude throughput tester for network baselining. That is, with minimal traffic, tracert results can be compared against periods of high traffic. Results can be used to justify equipment upgrades or new purchases.

From Host1, issue the tracert command to Router1, Host2, and Host3. Record the results in the Host1 Tracert output, Appendix A.

From Host2, issue the tracert command to Host3, Router1, and Host1. Record the results in the Host2 Tracert output, Appendix A.

From Host3, issue the tracert command to Host2, Router1, and Host1. Record the results in the Host3 Tracert output, Appendix A.

Task 5: Document the Network.

With all the work performed so far, it would seem that there is nothing left to do. The network was physically and logically configured, verified, and command output copied into tables.

The last step in network documentation is to organize your output. As you organize, think what might be needed six months or a year from now. For example:

When was the network created?
When was the network documented?
Were there any significant challenges that were overcome?
Who performed the configuration (talent like this needs to be tracked)?
Who performed the documentation (talent like this needs to be tracked)?

These questions should be answered in the documentation, perhaps in a cover letter.

Be sure to include the following information:
A copy of the physical topology.
A copy of the logical topology.

Prepare your documentation in a professional format, and submit it to your instructor.

Task 6: Reflection

Review any physical or logical configuration problems encountered during this lab. Insure a thorough understanding of the procedures used to verify network connectivity.

Task 7: Challenge

Ask your instructor or another student to introduce one or two problems in your network when you aren't looking or are out of the lab room. Problems can be either physical (cables moved on the switch) or logical (wrong IP address or gateway).

Use your network documentation to troubleshoot and remedy the problems:

1. Perform a good visual inspection. Look for green link lights on Switch1.

2. Use your network documentation to compare what should be to what is:
   _____
   _____
   _____
   _____
   _____

3. Write down your proposed solution(s):
   _____
   _____
   _____
   _____
   _____

4. Test your solution. If the solution fixed the problem, document the solution. If the solution did not fix the problem, continue troubleshooting.
   _____
   _____
   _____
   _____
   _____

Task 6: Cleanup

Unless directed otherwise by the instructor, restore host computer network connectivity, then turn off power to the host computers.

Before turning off power to the router and switch, remove the NVRAM configuration file from each device with the privileged exec command **`erase startup-config`**.

Carefully remove cables and return them neatly to their storage. Reconnect cables that were disconnected for this lab.

Remove anything that was brought into the lab, and leave the room ready for the next class.

Appendix 1- Network Documentation

Host tables created from Task 3, Step 2:

Host1 Network Configuration	
Host Name	Answers will vary.
IP Routing Enabled	Answers will vary.
Ethernet adapter	Answers will vary.
Description	Answers will vary.
Physical Address	Answers will vary.
IP Address	209.165.200.249
Subnet Mask	255.255.255.252
Default Gateway	209.165.200.250

Host2 Network Configuration	
Host Name	Answers will vary.
IP Routing Enabled	Answers will vary.
Ethernet adapter	Answers will vary.
Description	Answers will vary.
Physical Address	Answers will vary.
IP Address	209.165.200.241
Subnet Mask	255.255.255.248
Default Gateway	209.165.200.246

Host3 Network Configuration	
Host Name	Answers will vary.
IP Routing Enabled	Answers will vary.
Ethernet adapter	Answers will vary.
Description	Answers will vary.
Physical Address	Answers will vary.
IP Address	209.165.200.242
Subnet Mask	255.255.255.248
Default Gateway	209.165.200.246

Router1 configuration from Task 3, Step 3:

Router1 Configuration

```
Current configuration : 1138 bytes
!
version 12.4
service timestamps debug datetime msec
service timestamps log datetime msec
no service password-encryption
!
hostname Router1
!
boot-start-marker
boot-end-marker
!
enable secret 5 $1$sqIx$iKGfkjNa6IlaBVnPnGrVR0
!
no aaa new-model
ip cef
!
interface FastEthernet0/0
 description connection to Host1
 ip address 209.165.200.250 255.255.255.252
 duplex auto
 speed auto
!
interface FastEthernet0/1
 description connection to Switch1
 ip address 209.165.200.240 255.255.255.248
 duplex auto
 speed auto
!
interface Serial0/1/0
 no ip address
 shutdown
 no fair-queue
!
interface Serial0/1/1
 no ip address
 shutdown
 clock rate 2000000
!
interface Vlan1
 no ip address
!
ip http server
no ip http secure-server
!
control-plane
!
banner motd ^C
**** ABC network device ****

**** Authorized access only ****
```



```
**** Logging is enabled *****
^C
!
line con 0
 password class
 login
line aux 0
line vty 0 4
 password class
 login
!
scheduler allocate 20000 1000
end
```

Router1 Interface Fa0/0 configuration from Task 2, Step 3:

```
Router1# show interface fa0/0
Router1#sh int fa0/0
FastEthernet0/0 is up, line protocol is up
  Hardware is Gt96k FE, address is 001b.530c.cdee (bia 001b.530c.cdee)
  Description: connection to Host1
  Internet address is 172.25.100.6/29
  MTU 1500 bytes, BW 100000 Kbit, 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, 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input 00:01:27, output 00:00:02, 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
     54 packets input, 8915 bytes
     Received 44 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog
     0 input packets with dribble condition detected
     277 packets output, 88733 bytes, 0 underruns
     0 output errors, 0 collisions, 4 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
Router1#
```


Router1 Interface fa0/1 configuration from Task 3, Step 3:

```
Router1# show interface fa0/1
FastEthernet0/1 is up, line protocol is up
  Hardware is Gt96k FE, address is 001b.530c.cdef (bia 001b.530c.cdef)
  Description: connection to Switch1
  Internet address is 172.25.100.14/29
  MTU 1500 bytes, BW 100000 Kbit, DLY 100 usec,
     reliability 255/255, txload 1/255, rxload 1/255
  Encapsulation ARPA, loopback not set
  Keepalive not set
  Auto-duplex, Auto Speed, 100BaseTX/FX
  ARP type: ARPA, ARP Timeout 04:00:00
  Last input never, output never, 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
     0 packets input, 0 bytes
     Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
     0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored
     0 watchdog
     0 input packets with dribble condition detected
     91 packets output, 14481 bytes, 0 underruns
     0 output errors, 0 collisions, 1 interface resets
     0 babbles, 0 late collision, 0 deferred
     0 lost carrier, 0 no carrier
     0 output buffer failures, 0 output buffers swapped out
Router1#
```

Router1 IP Address configuration from Task 3, Step 3:

```
Router1#sh ip int brief
Interface          IP-Address      OK? Method Status                Protocol
FastEthernet0/0    209.165.200.250 YES manual up                    up
FastEthernet0/1    209.165.200.246 YES manual up                    up
Serial0/1/0        unassigned      YES unset  administratively down down
Serial0/1/1        unassigned      YES unset  administratively down down
Router1#
```


Switch1 Configuration from Task 3, Step 4:

```
Building configuration...

Current configuration : 1862 bytesad 1/255
!
version 12.1

no service padARPA, loopback
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Switch1
!
enable secret 5 $1$X9tO$93NSNcI66s8ESanQ/o3A60
!
interface FastEthernet0/1
 description connection to Router1
 no ip address
!
interface FastEthernet0/2
 description connection to Host2
 no ip address
!
interface FastEthernet0/3
 description connection to Host3
 no ip address
!
interface FastEthernet0/4
 no ip address
!
interface FastEthernet0/5
 no ip address
!
interface FastEthernet0/6
 no ip address
!
interface FastEthernet0/7
 no ip address
!
interface FastEthernet0/8
 no ip address
!
interface FastEthernet0/9
 no ip address
!
interface FastEthernet0/10
 no ip address
!
interface FastEthernet0/11
  no ip address
!
interface FastEthernet0/12
 no ip address
```



```
!
interface FastEthernet0/13
 no ip address
!
interface FastEthernet0/14
 no ip address
!
interface FastEthernet0/15
 no ip address
!
interface FastEthernet0/16
 no ip address
!
interface FastEthernet0/17
 no ip address

!
interface FastEthernet0/18
 no ip address
!
Interface FastEthernet0/19
 no ip address
!
Interface FastEthernet0/20
 no ip address
!
Interface FastEthernet0/21
 no ip address
!
interface FastEthernet0/22
 no ip address
!
interface FastEthernet0/23
  no ip address
!
interface FastEthernet0/24
 no ip address
!
 interface GigabitEthernet0/1
 no ip address
!s
interface GigabitEthernet0/2
no ip address
!
ip http server
!
banner motd ^C
**** ABC network device ****

**** Authorized access only ****

**** Logging is enabled *****
^C
!
```



```
line con 0
 password class
 login
line vty 0 4
 password class
 login
line vty 5 15
 password class
 login
!
end

Switch1#
```

Switch1 MAC address-table from Task 3, Step 4:

```
          Mac Address Table
-------------------------------------------
Vlan    Mac Address       Type        Ports
----    -----------       --------    -----
 All    000f.f79f.6cc0    STATIC      CPU
 All    0100.0ccc.cccc    STATIC      CPU
 All    0100.0ccc.cccd    STATIC      CPU
 All    0100.0cdd.dddd    STATIC      CPU
   1    0016.76ac.a76a    DYNAMIC     Fa0/3
   1    0018.8bb4.3c3a    DYNAMIC     Fa0/2
   1    001b.530c.cdef    DYNAMIC     Fa0/1
Total Mac Addresses for this criterion: 7
Switch1#
```

Traceroute results from Host1 Task 4, Step 2:

```
C:\> tracert 209.165.200.250
Tracing route to 209.165.200.250 over a maximum of 30 hops
  1    <1 ms    <1 ms    <1 ms  209.165.200.250
Trace complete.

C:\> tracert 209.165.200.241
Tracing route to 209.165.200.241 over a maximum of 30 hops
  1    <1 ms    <1 ms    <1 ms  209.165.200.250
  2     1 ms    <1 ms    <1 ms  209.165.200.241
Trace complete.

C:\> tracert 209.165.200.242
Tracing route to 209.165.200.242 over a maximum of 30 hops
  1    <1 ms    <1 ms    <1 ms  209.165.200.250
  2     1 ms    <1 ms    <1 ms  209.165.200.241
Trace complete.
C:\>
```


Traceroute results from Host2 Task 4, Step 2:

```
C:\> tracert 209.165.200.242
Tracing route to 209.165.200.242 over a maximum of 30 hops
  1    <1 ms    <1 ms    <1 ms  209.165.200.242
Trace complete.

C:\> tracert 209.165.200.246
Tracing route to 209.165.200.246 over a maximum of 30 hops
  1    <1 ms    <1 ms    <1 ms  209.165.200.246
Trace complete.

C:\> tracert 209.165.200.249
Tracing route to 209.165.200.249 over a maximum of 30 hops
  1     1 ms    <1 ms    <1 ms  209.165.200.246
  2    <1 ms    <1 ms    <1 ms  209.165.200.249
Trace complete.
C:\>
```

Traceroute results from Host3 Task 4, Step 2:

```
C:\> tracert 209.165.200.241
Tracing route to 209.165.200.241 over a maximum of 30 hops
  1    <1 ms    <1 ms    <1 ms  209.165.200.241
Trace complete.

C:\> tracert 209.165.200.246
Tracing route to 209.165.200.246 over a maximum of 30 hops
  1    <1 ms    <1 ms    <1 ms  209.165.200.246
Trace complete.

C:\> tracert 209.165.200.249
Tracing route to 209.165.200.249 over a maximum of 30 hops
  1     1 ms    <1 ms    <1 ms  209.165.200.246
  2    <1 ms    <1 ms    <1 ms  209.165.200.249
Trace complete.
C:\>
```

