#### **Addressing Table**

Device	Interface	IP Address	Subnet Mask	Default Gateway
R1	G0/0	192.168.10.1	255.255.255.0	N/A
	G0/1	192.168.11.1	255.255.255.0	N/A
	S0/0/0 (DCE)	209.165.200.225	255.255.255.252	N/A
R2	G0/0	10.1.1.1	255.255.255.0	N/A
	G0/1	10.1.2.1	255.255.255.0	N/A
	SO/O/O	209.165.200.226	255.255.255.252	N/A
PC1	NIC	192.168.10.10	255.255.255.0	192.168.10.1
PC2	NIC	192.168.11.10	255.255.255.0	192.168.11.1
PC3	NIC	10.1.1.10	255.255.255.0	10.1.1.1
PC4	NIC	10.1.2.10	255.255.255.0	10.1.2.1

### **Objectives**

Part 1: Display Router Information

Part 2: Configure Router Interfaces

Part 3: Verify the Configuration

#### **Background**

In this activity, you will use various show commands to display the current state of the router. You will then use the Addressing Table to configure router Ethernet interfaces. Finally, you will use commands to verify and test your configurations.

**Note:** The routers in this activity are partially configured. Some of the configurations are not covered in this course but they are provided to assist you in using verification commands.

# **Part 1: Display Router Information**

## Step 1: Display interface information on R1.

**Note:** Click a device and then click the **CLI** tab to access the command line directly. The console password is **cisco**. The privileged EXEC password is **class**.



a. Which command displays the statistics for all interfaces configured on a router?

### show interface

```
R1# show interface
GigabitEthernet0/0 is administratively down, line protocol is
down (disabled)
Hardware is CN Gigabit Ethernet, address is 000d.bd6c.7d01
(bia 000d.bd6c.7d01)
MTU 1500 bytes, BW 1000000 Kbit, DLY 10 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 RJ45
output flow-control is unsupported, input flow-control is
unsupported
ARP type: ARPA, ARP Timeout 04:00:00,
Last input 00:00:08, output 00:00:5, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); 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, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0
abort
0 watchdog, 1017 multicast, 0 pause input
```

b. Which command displays the information about the Serial 0/0/0 interface only?

#### show interface serial 0/0/0

```
Rlishow interface serial 0/0/0
Serial0/0/0 is up, line protocol is up (connected)
Hardware is HD64570
Internet address is 209.165.200.225/30
MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,
reliability 255/255, txload 1/255, rxload 1/255
Encapsulation HDLC, loopback not set, keepalive set (10
sec)
Last input never, output never, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Queueing strategy: weighted fair
Output queue: 0/1000/64/0 (size/max total/threshold/drops)
Conversations 0/0/256 (active/max active/max total)
Reserved Conversations 0/0 (allocated/max allocated)
Available Bandwidth 1158 kilobits/sec
5 minute input rate 146 bits/sec, 0 packets/sec
5 minute output rate 54 bits/sec, 0 packets/sec
2004 packets input, 125452 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0
abort
639 packets output, 43476 bytes, 0 underruns
0 output buffer failures, 0 output buffers swapped out
---Mora--
```

- c. Enter the command to display the statistics for the Serial 0/0/0 interface on R1 and answer the following questions:
  - 1) What is the IP address configured on R1?

209.165.200.225/30

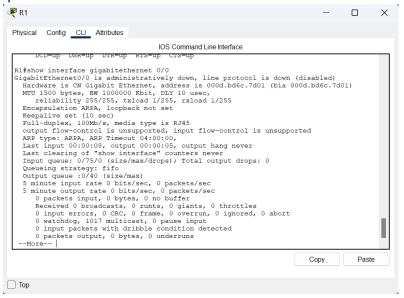
Internet address is 209.165.200.225/30

2) What is the bandwidth on the Serial 0/0/0 interface?

1544 Kbit

MTU 1500 bytes, BW 1544 Kbit, DLY 20000 usec,

d. Enter the command to display the statistics for the GigabitEthernet 0/0 interface and answer the following questions:



1) What is the IP address on R1?

There is no set IP address for interface gigabit ethernet 0/0.

2) What is the MAC address of the GigabitEthernet 0/0 interface?

000d.bd6c.7d01

Hardware is CN Gigabit Ethernet, address is 000d.bd6c.7d01 (bia 000d.bd6c.7d01)

3) What is the bandwidth (BW) of the GigabitEthernet 0/0 interface? 1,000,000 Kbit

MTU 1500 bytes, BW 1000000 Kbit, DLY 10 usec,

## Step 2: Display a summary list of the interfaces on R1.

a. Which command displays a brief summary of the current interfaces, interface status, and the IP addresses assigned to them?

### show ip interface brief

```
R1# show ip interface brief
                      IP-Address
Interface
                                       OK? Method Status
GigabitEthernet0/0
                                       YES unset administratively down down
                       unassigned
GigabitEthernet0/1
                       unassigned
                                       YES unset
                                                  administratively down down
Serial0/0/0
                       209.165.200.225 YES manual up
                      unassigned
Serial0/0/1
                                       YES unset administratively down down
FastEthernet0/1/0
                                       YES unset administratively down down
                      unassigned
FastEthernet0/1/1
                                                 administratively down down
                                       YES unset
                      unassigned
FastEthernet0/1/2
                      unassigned
                                      YES unset administratively down down
FastEthernet0/1/3
                                      YES unset administratively down down
                      unassigned
Vlan1
                      unassigned YES unset administratively down down
R2#show ip interface brief
                       IP-Address
Interface
                                       OK? Method Status
                                                                          Protocol
                                    YES unset administratively down down
GigabitEthernet0/0
                       unassigned
GigabitEthernet0/1
                       unassigned
                                       YES unset
                                                   administratively down down
                      209.165.200.226 YES manual up
Serial0/0/0
                       unassigned YES unset administratively down down unassigned YES unset administratively down down
Serial0/0/1
Vlan1
R2#
```

- b. Enter the command on each router and answer the following questions:
  - 1) How many serial interfaces are there on **R1** and **R2**?

#### 2 for R1.

Serial0/0/0 Serial0/0/1	209.165.200.225 unassigned		up administratively	down	up down
2 for R2 as well.					
Serial0/0/0 Serial0/0/1	209.165.200.226		up administratively		up

2) How many Ethernet interfaces are there on R1 and R2?

#### 6 for R1.

GigabitEthernet0/0	unassigned	YES unset		
2 for R2.				
FastEthernet0/1/3	unassigned	YES unset	administratively	down down
FastEthernet0/1/2	unassigned	YES unset	administratively	
FastEthernet0/1/1	unassigned	YES unset	administratively	
FastEthernet0/1/0	unassigned	YES unset	administratively	
GigabitEthernet0/1	unassigned	YES unset	administratively	down down
GigabitEthernet0/0	unassigned	YES unset		

3) Are all the Ethernet interfaces on **R1** the same? If no, explain the difference(s).

No, R1 has gigabit ethernet and fast ethernet interfaces. The main difference between the two is speed. Fast ethernet supports 1 to 100 Mbps, while gigabit ethernet supports up to 1 Gbps.

### Step 3: Display the routing table on R1.

c. What command displays the contents of the routing table?

#### show ip route

```
Ri#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, E - EGP

i - IS-IS, Ii - 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

Gateway of last resort is not set

209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks

C 209.165.200.225/32 is directly connected, Serial/070

L 209.165.200.25/32 is directly connected, Serial/070
```

- d. Enter the command on **R1** and answer the following questions:
  - 1) How many connected routes are there (uses the **C** code)?

There's 1 route that uses the C code.

```
C 209.165.200.224/30 is directly connected, Serial0/0/0
```

2) Which route is listed?

```
209.165.200.224/30
```

```
C 209.165.200.224/30 is directly connected, Serial0/0/0
```

3) How does a router handle a packet destined for a network that is not listed in the routing table?

The router will drop the packets. A router will only handle the packet only if its entry is listed in the routing table.

## **Part 2: Configure Router Interfaces**

### **Step 1: Configure the GigabitEthernet 0/0 interface on R1.**

a. Enter the following commands to address and activate the GigabitEthernet 0/0 interface on R1:

```
R1(config)# interface gigabitethernet 0/0
R1(config-if)# ip address 192.168.10.1 255.255.25.0
R1(config-if)# no shutdown
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
```

```
R1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface gigabitethernet 0/0
R1(config-if)#ip address 192.168.10.1 255.255.255.0
R1(config-if)#no shutdown
R1(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state to up
```

b. It is good practice to configure a description for each interface to help document the network. Configure an interface description that indicates the device to which it is connected.

### R1(config-if)# description LAN connection to S1

```
R1(config-if) #description LAN connection to S1
```

c. **R1** should now be able to ping PC1.

```
R1(config-if)# end
%SYS-5-CONFIG_I: Configured from console by console
R1# ping 192.168.10.10

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.10, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/2/8 ms
```

```
R1(config-if) #end
R1#
%SYS-5-CONFIG_I: Configured from console by console
R1#ping 192.168.10.10

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.10.10, timeout is 2 seconds:
.!!!!
Success rate is 80 percent (4/5), round-trip min/avg/max = 0/0/0 ms
```

## Step 2: Configure the remaining Gigabit Ethernet Interfaces on R1 and R2.

- a. Use the information in the Addressing Table to finish the interface configurations for R1 and R2. For each interface, do the following:
  - 1) Enter the IP address and activate the interface.

```
R1#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
R1(config)#interface gigabitethernet 0/1
R1(config-if) #ip address 192.168.11.1 255.255.255.0
R1(config-if) #no shutdown
R1(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state to up
R2#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
R2(config) #interface gigabitethernet 0/0
R2(config-if) #ip address 10.1.1.1 255.255.255.0
R2(config-if) #no shutdown
R2(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/0, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/0, changed state
to up
R2(config-if)#exit
R2(config) #interface gigabitethernet 0/1
R2(config-if)#ip address 10.1.2.1 255.255.255.0
R2(config-if) #no shutdown
R2(config-if)#
%LINK-5-CHANGED: Interface GigabitEthernet0/1, changed state to up
%LINEPROTO-5-UPDOWN: Line protocol on Interface GigabitEthernet0/1, changed state
to up
```

2) Configure an appropriate description.

```
R1(config-if) #description LAN connecting to S2
R2(config-if) #description LAN connecting to S3
R2(config-if) #description LAN connecting to S4
```

b. Verify interface configurations.

#### R2

```
R2#show interfaces gigabitethernet 0/0
GigabitEthernet0/0 is up, line protocol is up (connected)
Hardware is CN Gigabit Ethernet, address is 0002.16cb.1d01 (bia 0002.16cb.1d01)
Description: LAN connecting to S3
Internet address is 10.1.1.1/24
MTU 1500 bytes, BW 10000000 Kbit, DLY 10 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 RJ45
    output flow-control is unsupported, input flow-control is unsupported
ARP type: ARPA, ARP Timeout 04:00:00,
Last input 00:00:08, output 00:00:05, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); Total output drops: 0
Oueueing strategy: fifo
Output queue: 0/40 (size/max)
5 minute input rate 0 bits/sec, 0 packets/sec
5 minute output rate 121 bits/sec, 0 packets/sec
5 minute output rate 121 bits/sec, 0 packets/sec
0 packets input, 0 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
0 watchdog, 1017 multicast, 0 pause input
0 input packets with dribble condition detected
79 packets output, 4840 bytes, 0 underruns
0 output errors, 0 collisions, 2 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out
```

```
R2#show interfaces gigabitethernet 0/1
GigabitEthernet0/1 is up, line protocol is up (connected)
Hardware is CN Gigabit Ethernet, address is 0002.16cb.1d02 (bia 0002.16cb.1d02)
Description: LAN connecting to S4
Internet address is 10.1.2.1/24
MTU 1500 bytes, BW 1000000 Kbit, DLY 10 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 RJ45
output flow-control is unsupported, input flow-control is unsupported
ARP type: ARPA, ARP Timeout 04:00:00,
Last input 00:00:08, output 00:00:05, output hang never
Last clearing of "show interface" counters never
Input queue: 0/75/0 (size/max/drops); 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 148 bits/sec, 0 packets/sec
5 minute output rate 148 bits/sec, 0 packets/sec
0 packets input, 0 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants, 0 throttles
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 ignored, 0 abort
0 watchdog, 1017 multicast, 0 pause input
0 input packets with dribble condition detected
109 packets output, 6676 bytes, 0 underruns
0 output errors, 0 collisions, 2 interface resets
0 unknown protocol drops
0 babbles, 0 late collision, 0 deferred
0 lost carrier, 0 no carrier
0 output buffer failures, 0 output buffers swapped out
```

# Step 3: Back up the configurations to NVRAM.

Save the configuration files on both routers to NVRAM.

```
R1#copy running-config startup-config Destination filename [startup-config]? Building configuration...
[OK]
```

R2#copy running-config startup-config Destination filename [startup-config]? Building configuration... [OK]

#### What command did you use?

copy running-config to startup-config

# **Part 3: Verify the Configuration**

### Step 1: Use verification commands to check your interface configurations.

a. Use the **show ip interface brief** command on both **R1** and **R2** to quickly verify that the interfaces are configured with the correct IP address and are active.

```
R1#show ip interface brief
Interface IP-Address OK? Method Status Protocol
GigabitEthernet0/0 192.168.10.1 YES manual up up
GigabitEthernet0/1 192.168.11.1 YES manual up up
Serial0/0/0 209.165.200.225 YES manual up up
Serial0/0/1 unassigned YES unset administratively down down
FastEthernet0/1/0 unassigned YES unset administratively down down
FastEthernet0/1/1 unassigned YES unset administratively down down
FastEthernet0/1/2 unassigned YES unset administratively down down
FastEthernet0/1/3 unassigned YES unset administratively down down
FastEthernet0/1/3 unassigned YES unset administratively down down
Vlan1 vnassigned YES unset administratively down down
VES unset administratively down down
VES unset administratively down down
```

```
R2#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
R2#show ip interface brief
Interface IP-Address OK? Method Status Protocol
GigabitEthernet0/0 10.1.1.1 YES manual up up
GigabitEthernet0/1 10.1.2.1 YES manual up up
Serial0/0/0 209.165.200.226 YES manual up up
Serial0/0/1 unassigned YES unset administratively down down
Vlan1 unassigned YES unset administratively down down
```

How many interfaces on R1 and R2 are configured with IP addresses and in the "up" and "up" state?

3 for R1, and 3 for R2 as well.

What part of the interface configuration is NOT displayed in the command output?

The subnet masks.

What commands can you use to verify this part of the configuration?

If you I want to see the IP addresses with their subnet masks, I can use the **show interface** and **show running-config** commands.

b. Use the **show ip route** command on both **R1** and **R2** to view the current routing tables and answer the following questions:

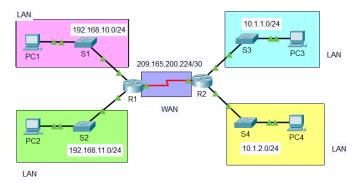
```
R1#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, 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
Gateway of last resort is not set
     10.0.0.0/24 is subnetted, 2 subnets
        10.1.1.0/24 [110/65] via 209.165.200.226, 00:18:24, Serial0/0/0
        10.1.2.0/24 [110/65] via 209.165.200.226, 00:16:30, Serial0/0/0
0
     192.168.10.0/24 is variably subnetted, 2 subnets, 2 masks
       192.168.10.0/24 is directly connected, GigabitEthernet0/0
L
        192.168.10.1/32 is directly connected, GigabitEthernet0/0
     192.168.11.0/24 is variably subnetted, 2 subnets, 2 masks
С
       192.168.11.0/24 is directly connected, GigabitEthernet0/1
        192.168.11.1/32 is directly connected, GigabitEthernet0/1
     209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
        209.165.200.224/30 is directly connected, Serial0/0/0
С
        209.165.200.225/32 is directly connected, Serial0/0/0
```

```
R2#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, E - EGP i - IS-IS, 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
Gateway of last resort is not set
     10.0.0.0/8 is variably subnetted, 4 subnets, 2 masks
C
        10.1.1.0/24 is directly connected, GigabitEthernet0/0
        10.1.1.1/32 is directly connected, GigabitEthernet0/0
        10.1.2.0/24 is directly connected, GigabitEthernet0/1
C
        10.1.2.1/32 is directly connected, GigabitEthernet0/1
    192.168.10.0/24 [110/65] via 209.165.200.225, 00:27:18, Serial0/0/0
     192.168.11.0/24 [110/65] via 209.165.200.225, 00:21:49, Serial0/0/0
0
     209.165.200.0/24 is variably subnetted, 2 subnets, 2 masks
С
        209.165.200.224/30 is directly connected, Serial0/0/0
        209.165.200.226/32 is directly connected, Serial0/0/0
```

- 1) How many connected routes (uses the **C** code) do you see on each router? 3 for R1, and 3 for R2 as well.
- 2) How many OSPF routes (uses the **O** code) do you see on each router? 2 for R1, and 2 for R2 as well.

3) If the router knows all the routes in the network, then the number of connected routes and dynamically learned routes (OSPF) should equal the total number of LANs and WANs. How many LANs and WANs are in the topology?

4 LANS, 1 WAN.



4) Does this number match the number of C and O routes shown in the routing table?

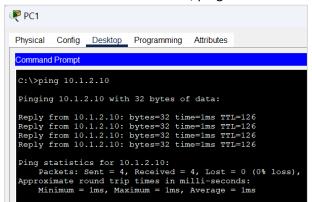
Note: If your answer is "no", then you are missing a required configuration. Review the steps in Part 2.

Each route has 3 connected routes and 2 OSPF routes, totaling to 5, which corresponds to the number of networks in our topology.

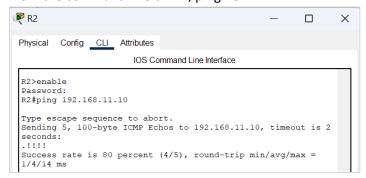
### Step 2: Test end-to-end connectivity across the network.

You should now be able to ping from any PC to any other PC on the network. In addition, you should be able to ping the active interfaces on the routers. For example, the following tests should be successful:

From the command line on PC1, ping PC4.



• From the command line on R2, ping PC2.



**Note:** For simplicity in this activity, the switches are not configured. You will not be able to ping them.