

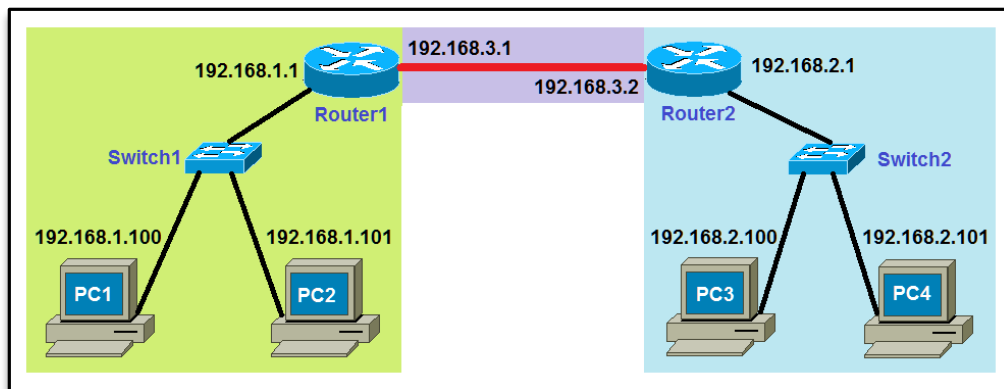
Packet Tracer Mini-Lab 05: Supplement

Configuring 2 LANs with 2 Routers using CLI in Packet Tracer

CAVEAT: THE LABS IN CC2-180 MAY NOT WORK ENTIRELY AS PLANNED. WE WILL BE UTILIZING BOTH A SERVER 2012 R2 HOST PC AND VIRTUAL MACHINES (VMs) ON THE HOST PC, IN WHICH CASE THERE MAY BE UNFORESEEN ISSUES. AS SUCH WE WILL LIKELY GET SOME UNEXPECTED 'REAL WORLD' TROUBLESHOOTING PRACTICE AND MAY EVEN HAVE TO "WING IT"

Mini-Lab 05 Objective

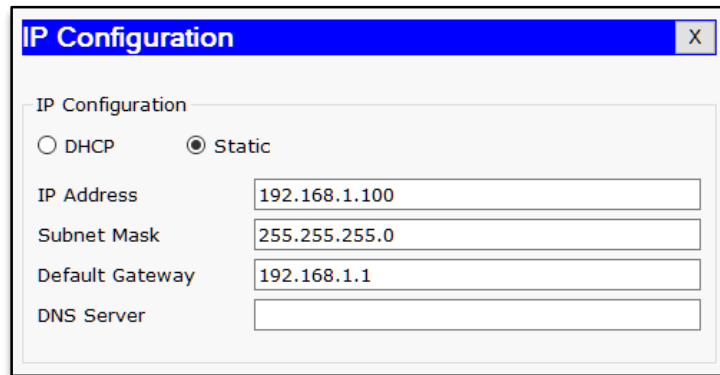
The lab provides further practice in a simulated environment using **Cisco's Packet Tracer** application.



1. Create **two** small **networks** using **4 PC** hosts, **2 switches**, **2 Routers** connected with **6 copper straight-through** cables and **1 serial** cable. **NOTE:** You will need to add a **WIC-2T** add-in (2-port asynchronous / synchronous serial network module) to each of the routers to use the serial cable. When you choose the serial cable, for this example I have put the DTE end on the right and the DCE end (the end with the little clock icon) on the left. More on DTE and DCE a bit later in this mini-lab.
2. Click on **PC1** and select the **Desktop** tab.



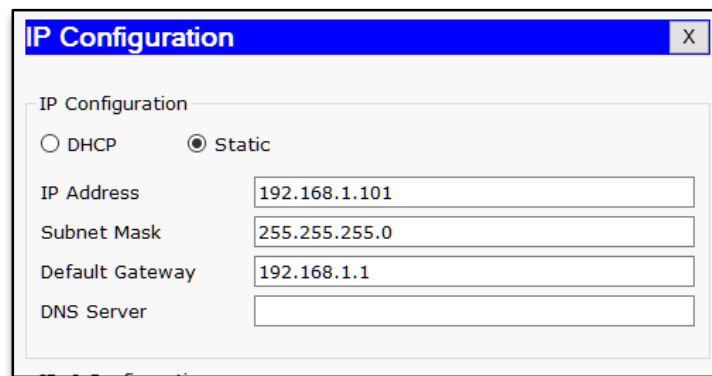
3. Select **IP Configuration**, and enter the following **address information**:



The screenshot shows the 'IP Configuration' dialog box with the 'Static' radio button selected. The fields are filled with the following values:

Field	Value
IP Address	192.168.1.100
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS Server	

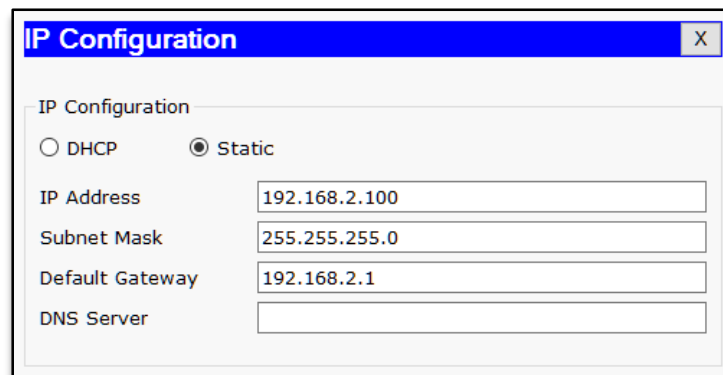
4. Click on **PC2** and select the **Desktop** tab.
5. Select **IP Configuration**, and enter the following **address information**:



The screenshot shows the 'IP Configuration' dialog box with the 'Static' radio button selected. The fields are filled with the following values:

Field	Value
IP Address	192.168.1.101
Subnet Mask	255.255.255.0
Default Gateway	192.168.1.1
DNS Server	

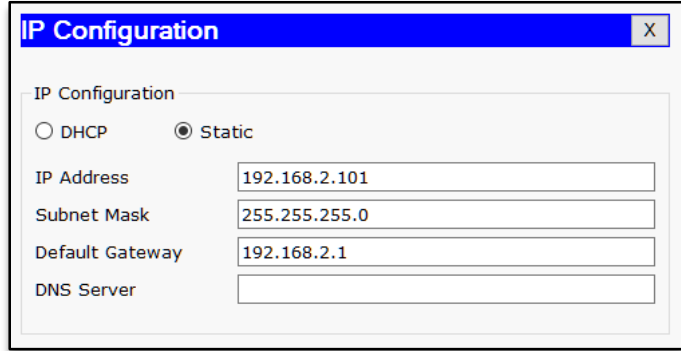
6. Click on **PC3** and select the **Desktop** tab.
7. Select **IP Configuration**, and enter the following **address information**:



The screenshot shows the 'IP Configuration' dialog box with the 'Static' radio button selected. The fields are filled with the following values:

Field	Value
IP Address	192.168.2.100
Subnet Mask	255.255.255.0
Default Gateway	192.168.2.1
DNS Server	

8. Click on **PC4** and select the **Desktop** tab.
9. Select **IP Configuration**, and enter the following **address information**:



10. Roll the mouse cursor over **PC 1** to confirm the **address configuration** on the **popup box**.

```

Port          Link  IP Address      IPv6 Address      MAC Address
FastEthernet0 Up    192.168.1.100/24 <not set>         0060.7064.D252

Gateway: 192.168.1.1
DNS Server: <not set>
Line Number: <not set>

Physical Location: Intercity, Home City, Corporate Office, Main Wiring Closet

```

11. Roll the mouse cursor over **PC 2** to confirm the **address configuration** on the **popup box**.

```

Port          Link  IP Address      IPv6 Address      MAC Address
FastEthernet0 Up    192.168.1.101/24 <not set>         0030.F225.20ED

Gateway: 192.168.1.1
DNS Server: <not set>
Line Number: <not set>

Physical Location: Intercity, Home City, Corporate Office, Main Wiring Closet

```

12. Roll the mouse cursor over **PC 3** to confirm the **address configuration** on the **popup box**.

```

Port          Link  IP Address      IPv6 Address      MAC Address
FastEthernet0 Up    192.168.2.100/24 <not set>         0030.F265.8A82

Gateway: 192.168.2.1
DNS Server: <not set>
Line Number: <not set>

Physical Location: Intercity, Home City, Corporate Office, Main Wiring Closet

```

13. Roll the mouse cursor over **PC 4** to confirm the **address configuration** on the **popup box**.

```

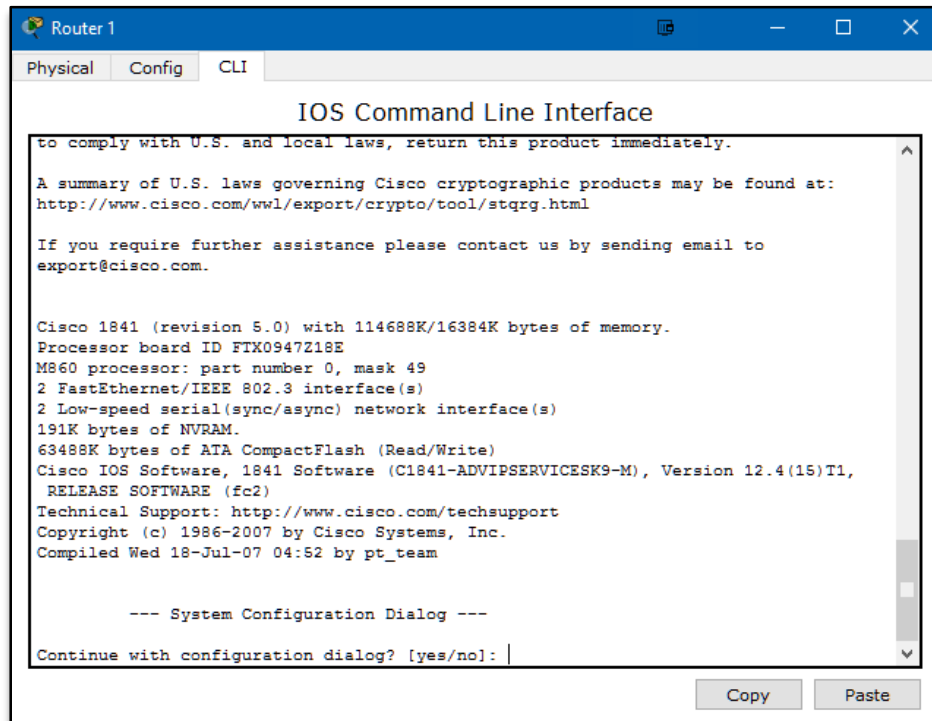
Port          Link  IP Address      IPv6 Address      MAC Address
FastEthernet0 Up    192.168.2.101/24 <not set>         00E0.A3A9.864B

Gateway: 192.168.2.1
DNS Server: <not set>
Line Number: <not set>

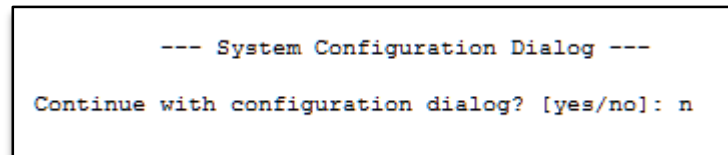
Physical Location: Intercity, Home City, Corporate Office, Wiring Closet

```

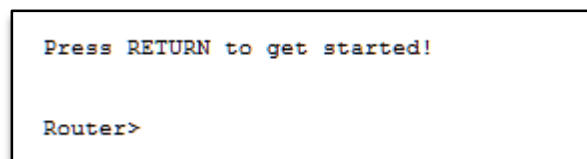
14. Click on **Router 1**, and select the **CLI** tab.



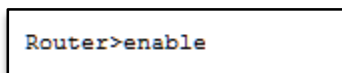
15. At the **Continue with configuration dialog?** type **n** (or **no**), then hit the **Enter** key.



16. Press **Enter** again to get started.



17. At the **Router>** prompt, type **enable** (or just **en**, for short) then hit the **Enter** key



18. The **Router>** prompt changes to **privileged exec mode**, showing **Router#**

```
Router>enable
Router#
```

19. Next, type **configure terminal** (or **config t**, for short), then hit the **Enter** key.

```
Router>enable
Router#configure t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#
```

20. The **Router#** prompt changes to **global configuration mode**, showing **Router(config)#**

21. You'll need to configure both the router interfaces to communicate with the two networks, so start by typing **interface fastEthernet 0/0** then hit the **Enter** key

FYI – when starting a keyword like 'fastEthernet', if you hit the Tab key it will auto-fill the rest of the word for you ('fast' → 'fastEthernet'). You could've also entered **int f 0/0** for short.

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fast
Router(config)#interface fastEthernet 0/0
Router(config-if)#
```

22. The **Router(config)#** prompt changes to **interface configuration mode**, showing **Router(config-if)#**

23. Now you need to give the **fastEthernet 0/0** interface an **IP address**, so type all on the same line **ip address 192.168.1.1 255.255.255.0**, then hit the **Enter** key

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fast
Router(config)#interface fastEthernet 0/0
Router(config-if)#ip address 192.168.1.1 255.255.255.0
```

24. Back at the **Router(config-if)#** prompt, type **no shutdown** (or **no shut** for short) to keep the interface **up** and running

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fast
Router(config)#interface fastEthernet 0/0
Router(config-if)#ip address 192.168.1.1 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
```

25. The **fastEthernet 0/0** (or **fa0/0** for short) **interface** has now be set up.
26. Now you need to configure the **serial** interface, so hit Enter to get back to the prompt, then at the prompt type **int s 0/1/0**, then hit the **Enter** key

```
Router(config-if)#int s 0/1/0
Router(config-if)#
```

27. Now you need to give the **serial 0/1/0** interface an **IP address**, so type all on the same line **ip address 192.168.3.1 255.255.255.0**, then hit the **Enter** key

```
Router(config-if)#int s 0/1/0
Router(config-if)#ip address 192.168.3.1 255.255.255.0
Router(config-if)#
```

28. We might also change the clock rate at this time on the DCE side of things. At the prompt, type **clock rate 64000**, then hit the **Enter** key.

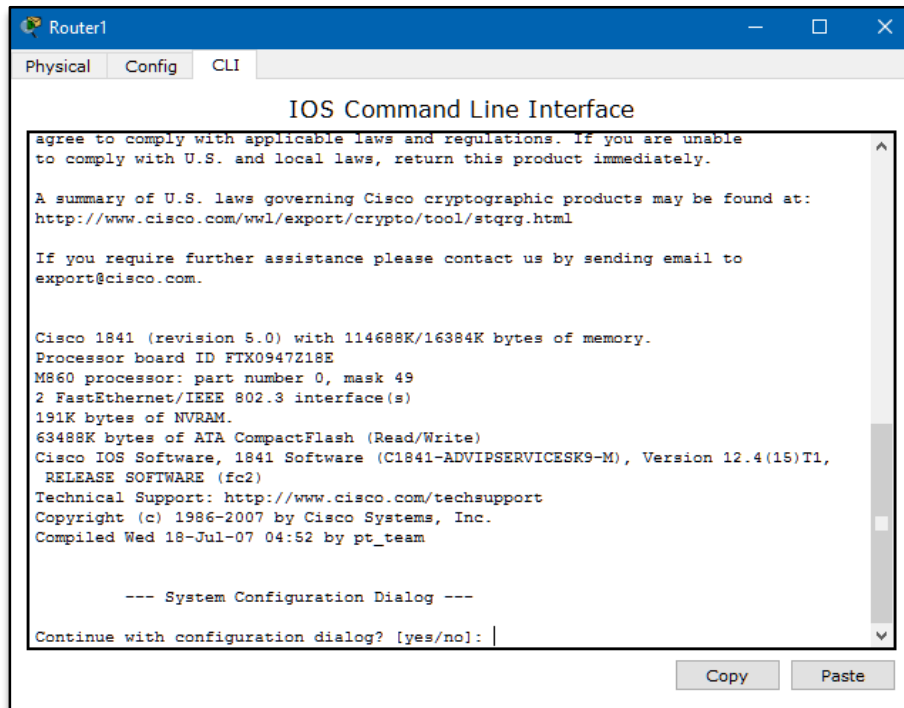
```
Router(config-if)#clock rate 64000
Router(config-if)#
```

29. Back at the **Router (config-if)#** prompt, type **no shutdown** (or **no shut** for short) to keep the interface **up** and running (*NOTE: the 'down' state will be changed to 'up' once Router 2 is configured. This just means Router 1 has no one to talk to at the moment*)

```
Router(config-if)#int s 0/1/0
Router(config-if)#ip address 192.168.3.1 255.255.255.0
Router(config-if)#
Router(config-if)#no shut

%LINK-5-CHANGED: Interface Serial0/1/0, changed state to down
Router(config-if)#
```

30. The **serial 0/1/0** (or **s0/1/0** for short) **interface** on **Router 1** has now be set up.
31. On Router 2 we need to do the same thing to configure the interfaces. Click on **Router 2**, and select the **CLI** tab.



32. At the **Continue with configuration dialog?** type **n** (or **no**), then hit the **Enter** key.

```
--- System Configuration Dialog ---

Continue with configuration dialog? [yes/no]: n
```

33. Press **Enter** again to get started.

```
Press RETURN to get started!  
  
Router>
```

34. At the **Router>** prompt, type **enable**, then hit the **Enter** key.

```
Router>enable
```

35. The **Router>** prompt changes to **privileged exec mode**, showing **Router#**

```
Router>enable  
Router#
```

36. Next, type **configure terminal** (or **config t**, for short), then hit the **Enter** key.

```
Router>enable  
Router#configure t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#
```

37. The **Router#** prompt changes to **global configuration mode**, showing **Router (config)#**

38. You'll need to configure both the router interfaces to communicate with the two networks, so start by typing **interface fastEthernet 0/0**, then hit the **Enter** key
FYI – when starting a keyword like 'fastEthernet', if you hit the Tab key it will auto-fill the rest of the word for you ('fast' → 'fastEthernet')

```
Router#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#interface fast  
Router(config)#interface fastEthernet 0/0  
Router(config-if)#
```

39. The **Router (config)#** prompt changes to **interface configuration mode**, showing **Router (config-if)#**

40. Now you need to give the **fastEthernet 0/0** interface an **IP address**, so type all on the same line **ip address 192.168.2.1 255.255.255.0**, then hit the **Enter** key

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int f 0/0
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#
```

41. Back at the **Router(config-if)#** prompt, type **no shutdown** (or **no shut** for short) to keep the interface **up** and running.

```
Router>en
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#int f 0/0
Router(config-if)#ip address 192.168.2.1 255.255.255.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface FastEthernet0/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface FastEthernet0/0, changed state to up
```

42. The **fastEthernet 0/0** (or **fa0/0** for short) **interface** has now be set up.

43. Now you need to configure the **serial** interface, so hit Enter to get back to the prompt, then at the prompt type **int s 0/1/0**, then hit the **Enter** key

```
Router(config-if)#int s 0/1/0
Router(config-if)#
```

44. Now you need to give the **serial 0/1/0** interface an **IP address**, so type all on the same line **ip address 192.168.3.2 255.255.255.0**, then hit the **Enter** key

```
Router(config-if)#int s 0/1/0
Router(config-if)#ip ad
Router(config-if)#ip address 192.168.3.2 255.255.255.0
```

45. Back at the **Router (config-if)#** prompt, type **no shutdown** (or **no shut** for short) to keep the interface **up** and running

```
Router(config-if)#ip address 192.168.3.2 255.255.255.0
Router(config-if)#no shut

Router(config-if)#
%LINK-5-CHANGED: Interface Serial0/1/0, changed state to up

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial0/1/0, changed state to up
```

46. The **serial 0/1/0** (or **s0/1/0** for short) **interface** on **Router 2** has now be set up.



A NOTE ABOUT DTE AND DCE: DTE stands for *Data Terminal Equipment* and DCE stands for *Data Communication Equipment*. DCE provides clock rate, and DTE receives the clock rate being an 'end' or 'terminating' device. In Packet Tracer, when you select a serial cable, you notice the two red 'lightning bolt' icons are either DCE or DTE. The DCE side of the cable has a little clock associated with the icon and the DTE side of the cable does not. Whichever way you connect the cable to your routers, the DCE side always gets any clock rate changes but the DTE side does not. This will become more obvious when setting up the routers manually using CLI. Just remember that the 'C' in DCE might also mean 'clock' and the 'T' in DTE might also mean 'terminate' (as to 'end'). See [link](#) for detailed discussion.

Now, at this point, PC1 and PC2 could ping each other, and both could ping the router's fa0/0 interface (192.168.1.1), *and* they could both ping the serial 0/1/0 interface (192.168.3.1) on Router 1 but are unable to ping the serial 0/1/0 interface (192.168.3.2) on Router 2 or any of the devices beyond it.

The same holds true for PC3 and PC4, but in reverse.

The reason is, the routers only know about their immediate networks, but not any of the remote networks. In order to get all the devices communicating across all networks, **static routes** have to be setup in the routers letting the routers know about the other networks, and what interfaces act as portals to these other networks. Let's set up these static routes on both routers using the **CLI**.

```
PC>ping 192.168.3.1
Pinging 192.168.3.1 with 32 bytes of data:
Reply from 192.168.3.1: bytes=32 time=0ms TTL=255
Reply from 192.168.3.1: bytes=32 time=1ms TTL=255
Reply from 192.168.3.1: bytes=32 time=0ms TTL=255
Reply from 192.168.3.1: bytes=32 time=0ms TTL=255
Ping statistics for 192.168.3.1:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 1ms, Average = 0ms
PC>ping 192.168.3.2
Pinging 192.168.3.2 with 32 bytes of data:
Request timed out.
Request timed out.
Request timed out.
Request timed out.
Ping statistics for 192.168.3.2:
    Packets: Sent = 4, Received = 0, Lost = 4 (100% loss),
```

47. Click on **Router 1**, and select the **CLI** tab.

48. At the prompt, type **exit**, then hit the **Enter** key.

49. Hit the Enter key again to bring up the **Router>** prompt

```
Press RETURN to get started!  
  
Router>
```

50. At the **Router>** prompt, type **enable** (or just **en**, for short) then hit the **Enter** key

```
Router>enable
```

51. The **Router>** prompt changes to **privileged exec mode**, showing **Router#**

```
Router>enable  
Router#
```

52. Next, type **configure terminal** (or **config t**, for short), then hit the **Enter** key.

```
Router>enable  
Router#configure t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#
```

53. The **Router#** prompt changes to **global configuration mode**, showing **Router(config)#**

54. At the **Router(config)#** prompt, type

ip route 192.168.2.0 255.255.255.0 serial 0/1/0 then the **Enter** key

```
Router>en  
Router#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#ip route 192.168.2.0 255.255.255.0 serial 0/1/0  
Router(config)#
```

The **static route** has now been set up for **Router 1**. Close the **CLI** window.

55. Click on **Router 2**, and select the **CLI** tab.

56. At the prompt, type **exit**, then hit the **Enter** key.

57. Hit the Enter key again to bring up the **Router>** prompt

```
Press RETURN to get started!  
  
Router>
```

58. At the **Router>** prompt, type **enable** (or just **en**, for short) then hit the **Enter** key

```
Router>enable
```

59. The **Router>** prompt changes to **privileged exec mode**, showing **Router#**

```
Router>enable  
Router#
```

60. Next, type **configure terminal** (or **config t**, for short), then hit the **Enter** key.

```
Router>enable  
Router#configure t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#
```

61. The **Router#** prompt changes to **global configuration mode**, showing **Router(config)#**

62. At the **Router(config)#** prompt, type

ip router 192.168.1.0 255.255.255.0 serial 0/1/0 then the **Enter** key

```
Router>en  
Router#conf t  
Enter configuration commands, one per line. End with CNTL/Z.  
Router(config)#ip route 192.168.1.0 255.255.255.0 serial 0/1/0  
Router(config)#
```

The **static route** has now been set up for **Router 2**. Close the **CLI** window.

63. Now all devices should be able to ping all the interfaces and other devices successfully 😊

64. Click on **PC1**, and select the **Desktop** tab.



65. Select **Command Prompt**, and try pinging each of the following:

- a. Ping 192.168.1.100 (itself)
- b. ping 192.168.1.101 (PC2)
- c. ping 192.168.1.1 (Router 1 fa0/0)
- d. ping 192.168.3.1 (router 1 s0/1/0)
- e. ping 192.168.3.2 (router 2 s0/1/0)
- f. ping 192.168.2.1 (router 2 fa0/0)
- g. ping 192.168.2.100 (PC3)
- h. ping 192.168.2.101 (PC4)

```

Command Prompt
Pinging 192.168.2.101 with 32 bytes of data:

Request timed out.
Reply from 192.168.2.101: bytes=32 time=5ms TTL=126
Reply from 192.168.2.101: bytes=32 time=1ms TTL=126
Reply from 192.168.2.101: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.2.101:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 5ms, Average = 2ms

PC>ping 192.168.2.101

Pinging 192.168.2.101 with 32 bytes of data:

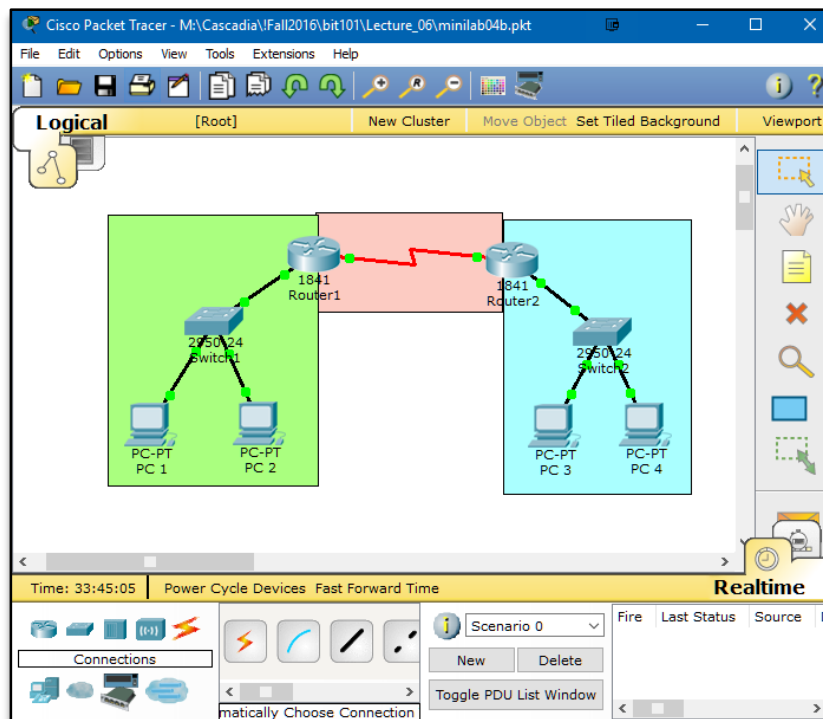
Reply from 192.168.2.101: bytes=32 time=7ms TTL=126
Reply from 192.168.2.101: bytes=32 time=2ms TTL=126
Reply from 192.168.2.101: bytes=32 time=1ms TTL=126
Reply from 192.168.2.101: bytes=32 time=2ms TTL=126

Ping statistics for 192.168.2.101:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 1ms, Maximum = 7ms, Average = 3ms

PC>

```

66. Test doing the same from **PC2**, **PC3**, and **PC4**



END OF MINI-LAB 05

FYI: What is Clock Rate and Why is it Set?

Clock rate is set or provided to fix the speed at which the data is to be received.

DCEs and DTEs are used in WAN connections. The communication via a WAN connection is maintained by providing a clock rate that is acceptable to both the sending and the receiving device.

For example, if a device connected via a WAN link is sending its signal at 1.544 Mbps, each receiving device must use a clock, sending out a sample signal every $1/1,544,000$ th of a second. The timing in this case is extremely short. The devices must be able to synchronize to the signal that is sent and received very quickly. By assigning a clock rate to the router, the timing is set. This allows a router to adjust the speed of its communication operations, thereby synchronizing with the devices connected to it.

Clock rate is set on Router's Serial Interface, if the router is running as a DCE (Data Communication Equipment). Generally, clock rate is provided by teleco or Internet Service Provider through CSU/DSU in this case the router is said to be as DTE (Data Terminal Equipment) Device.

Command to set Clock rate on Cisco Router: **Router(config-if)#clock rate 640000**

Note: New ISR Routers adjust Clock rate automatically by detecting DCE connections and set clock rate to 2000000