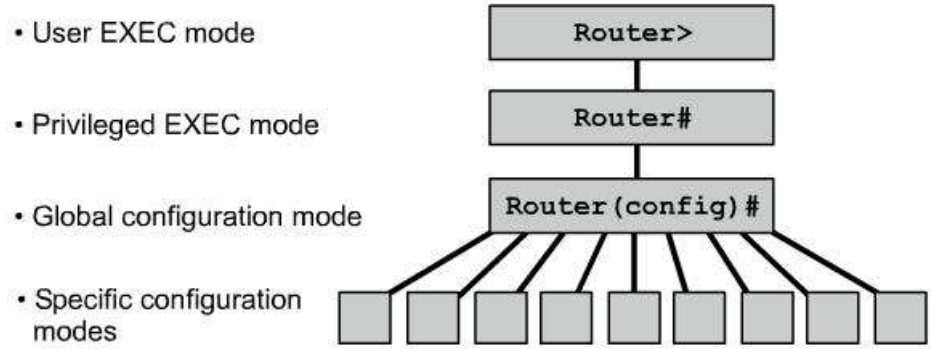
Computer Networks
2nd Year, 2nd Semester
2020
Lab 2 - Introduction to Router Configurations

** Follow the lab sheet and if you need any clarifications get assistance from a lab instructor.

Activity 1 – Understanding Cisco IOS software

- Cisco **IOS** stands for **Internetwork Operating System**provides a **Command Line Interface (CLI)** to configure various settings of the devices.

Activity 2 – Understanding the modes of a router



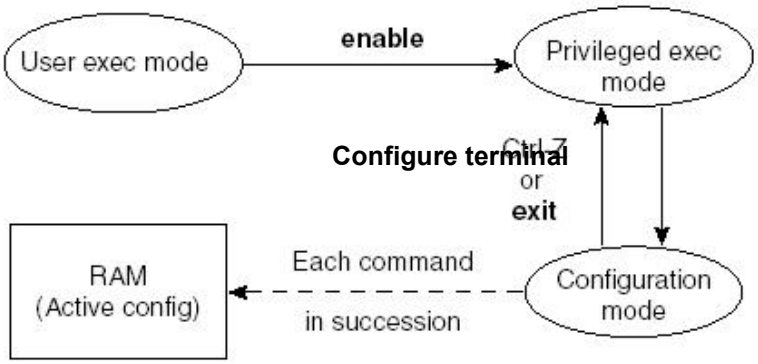
Note: Notice how the prompt changes when you enter different modes.

- *User EXEC mode*
  Mainly for checking router status.

- *Privileged EXEC mode*
  To perform additional status monitoring and entering into configuration mode.

- *Global configuration mode*
  To configure global configurations which will affect the router as a whole and to enter into specific configuration modes.

Use the following commands to navigate between various modes,



Activity 3 – Help command

In IOS, help command is the **?** (question mark).

- You can issue this in any mode to view all the supported commands in that particular mode.

```
Router>?
Exec commands:
  <1-99>      Session number to resume
  connect     Open a terminal connection
  disable     Turn off privileged commands
  disconnect  Disconnect an existing network connection
  enable      Turn on privileged commands
  exit        Exit from the EXEC
  logout      Exit from the EXEC…
```

- You can also issue this as a way of finding the additional options of a command
  E.g.

```
Router>show ?
```

Important: Help command can be used as a powerful learning tool when configuring network devices.

Activity 4 – Basic configurations with a router

1. Changing the **hostname** of a router.
   a. Add a router to the packet tracer work space.
   b. Configure the *hostname* of the router to Malabe (Hint: You should be in global configuration mode and use the help command).

What is the command you used: ……

Click on the Router and go to the CLI tab.

To change the settings of a router you should be in the global configuration mode.

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

2. Set a **password** for privileged mode.
    a. Configure the privilege mode **password** to malabe123
    (Hint: You should be in global configuration mode and use the help command).

What is the command you used ……?

```
Malabe(config)#
Malabe(config)#enable password malabe123
Malabe(config)#
```

3. Set a **secret** for privileged mode.
    a. Configure the privilege mode **secret** to malabe987
    (Hint: You should be in global configuration mode and use the help command).

What is the command you used? ……

```
Malabe(config)#
Malabe(config)#enable secret malabe987
Malabe(config)#
```

What is difference between privilege mode password and secret?

Privileged mode password can be viewed in a plain text and the secret password is encrypted.

In case both are configured, which will have the priority?

Secret password has the priority

4. Set a **message-of-the-day banner** for the router.
    a. Configure **message-of-the-day banner** to !!!Authorized Personal Only!!!
    (Hint: You should be in global configuration mode and use the help command).

```
Malabe>enable
Password:
Malabe#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Malabe(config)#banner motd @ !!! Authorized Personal Only !!! @
Malabe(config)#
```

***Then go back to the user mode. And you can see the banner is activated*.**

```
 !!! Authorized Personal Only !!!

Malabe>
Malabe>
```

What is the command you used? ……

5. **Remove** the privilege mode **password** (Hint: use the **no** keyword).

What is the command you used?*No enable password malabe123*

```
Malabe(config)#no enable password
Malabe(config)#
```

Activity 5 – Verifying router status

What is the difference between running-config and startup-config?

When you immediately type a command in the CLI it will be immediately save in the running configuration. The running configuration is residing inside the device's RAM. When the device loss the power all the commands stored will be erased.

Startup – configuration is stored inside the NVRAM. NVRAM is the non-volatile memory of the device. All the configuration changes are saved in the start-up configuration even when its loss the power.

Activity 6 – Saving running-config to startup-config

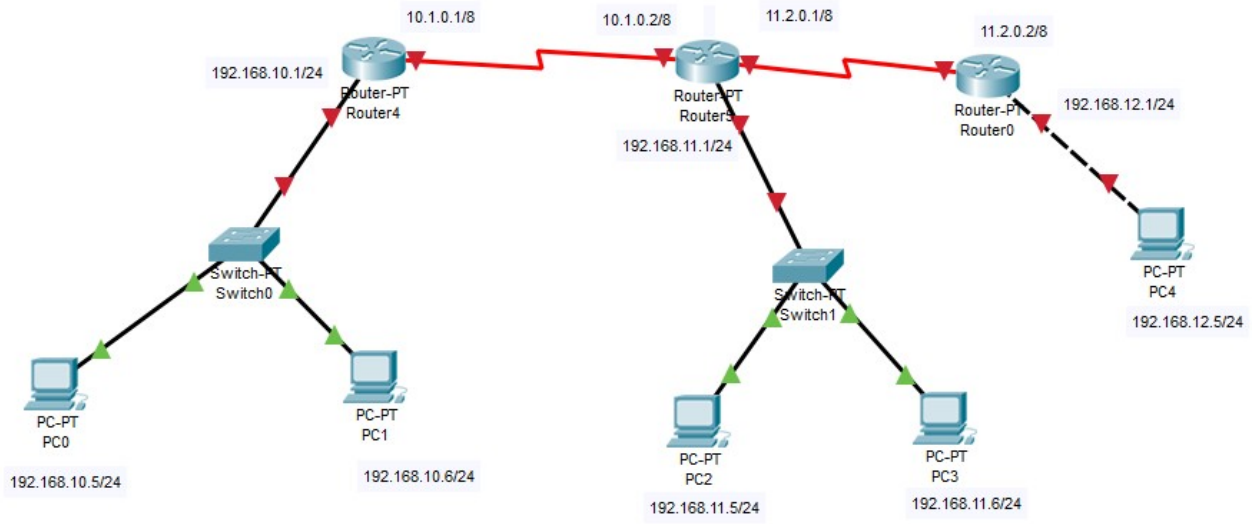
1. What is the command to save the running-config to startup-config?
   (Hint: You have to be in the privilege mode).

```
Malabe>en
Password:
Malabe#copy running-config startup-config
Destination filename [startup-config]?
Building configuration...
[OK]
Malabe#
```

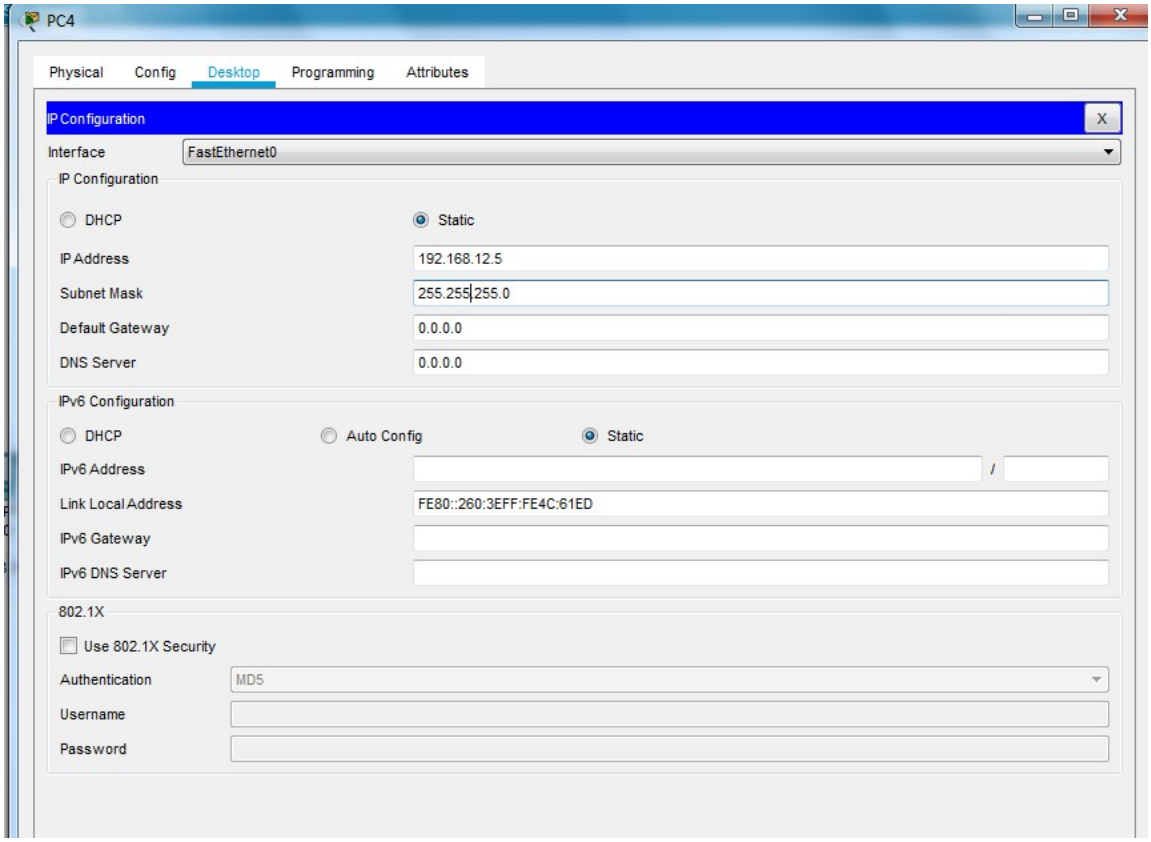
2. Why do you have to save the running-config to startup-config?

If there are any power losses or a reboot, everything stored inside the RAM will be loss. To store the running-config file permanently it should be copied to the NVRAM.

Activity 7 - IP Address Configurations& Static and Default Routing



1. Assign IP Addresses and subnet masks with the given IP Address plan.
    i. Click on the PCs to assign IP address and the go the Desktop tab.
    ii. Assign IP addresses given in the diagram.



iii. Assign IP addresses to the router interfaces.

Router 4

```
Router_4(config)#interface fa0/0
Router_4(config-if)#ip address 192.168.10.1 255.255.255.0
Router_4(config-if)#no shutdown

Router_4(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
```

```
Router_4(config)#interface se2/0
Router_4(config-if)#ip address 10.1.0.1 255.0.0.0
Router_4(config-if)#clock rate 64000
Router_4(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router_4(config-if)#exit
```

You need to assign clock rate to the DCE in a serial link. There will be a clock sign in the one end of a serial link.

Router 5

```
Router(config)#interface se3/0
Router(config-if)#ip add
Router(config-if)#ip address 10.1.0.2 255.0.0.0
Router(config-if)#no shutdown
```

```
Router(config)#interface se2/0
Router(config-if)#ip address 11.2.0.1 255.0.0.0
Router(config-if)#clock rate 64000
Router(config-if)#no shutdown
```

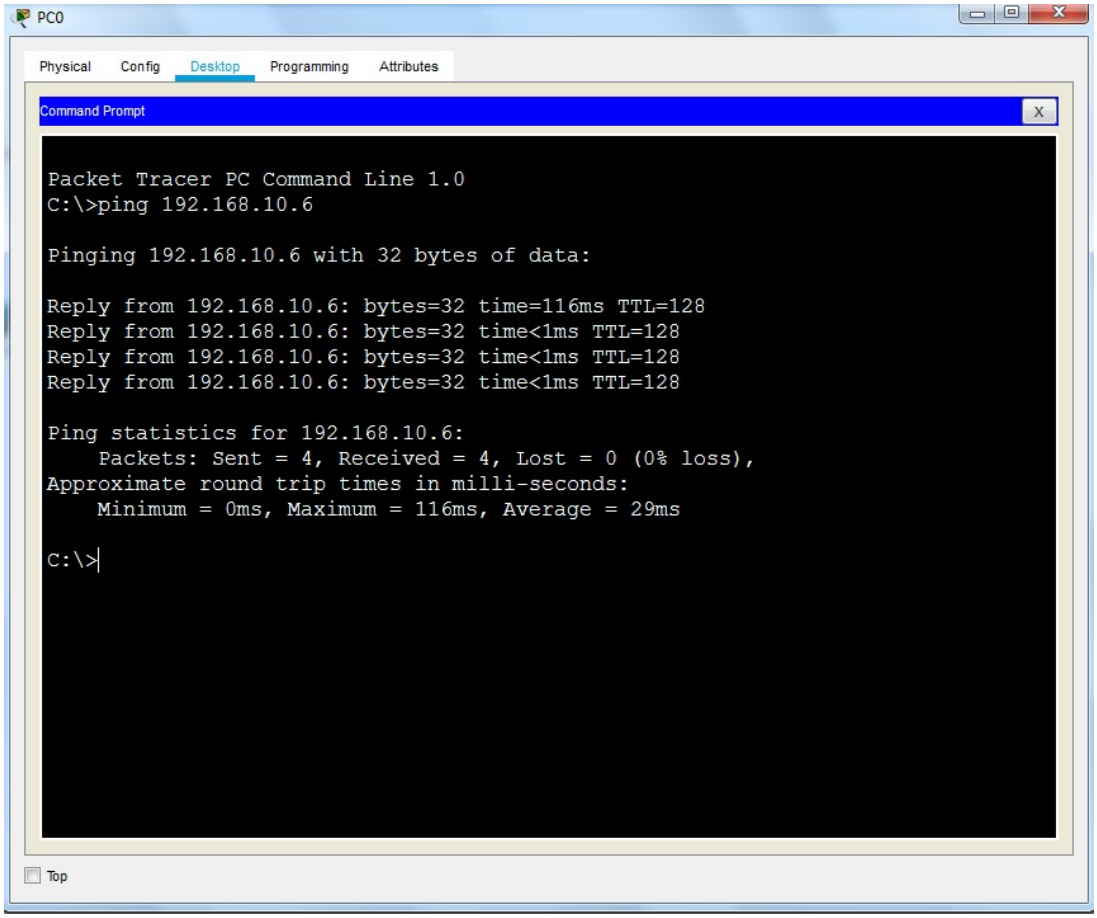
```
Router(config)#interface fa0/0
Router(config-if)#ip address 192.168.11.1 255.255.255.0
Router(config-if)#no shutdown
```

Router 0

```
Router(config)#interface se2/0
Router(config-if)#ip address 11.2.0.2 255.0.0.0
Router(config-if)#no shutdown
```

```
Router(config)#interface fa0/0
Router(config-if)#ip address 192.168.12.1 255.255.255.0
Router(config-if)#no shutdown
```

2. Verify the connectivity within the LANs.



3. View the routing table with directly connected networks.

   Router#Showip route

   Click on the routers and issue the command show ip route in the privilege mode

```
Router4#
Router4#show ip route
Codes: C - connected, S - static, I - IGRP, 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
```

Router 5

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, 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

C    10.0.0.0/8 is directly connected, Serial3/0
C    11.0.0.0/8 is directly connected, Serial2/0
C    192.168.11.0/24 is directly connected, FastEthernet0/0
```

Router 0

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, 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

C    11.0.0.0/8 is directly connected, Serial2/0
C    192.168.12.0/24 is directly connected, FastEthernet0/0
```

4. Enable inter LAN communication by configuring Static routing and Default routing.

   Router(config)#ip route <Destination network address><Destination network subnetmask><exit interface name | next hop ip address>

   Router 4

```
Router_4(config)#ip route 192.168.11.0 255.255.255.0 10.1.0.2
Router_4(config)#ip route 192.168.12.0 255.255.255.0 10.1.0.2
Router_4(config)#ip route 0.0.0.0 0.0.0.0 10.1.0.2
Router_4(config)#
```

Router 5

```
Router(config)#ip route 192.168.10.0 255.255.255.0 10.1.0.1
Router(config)#ip route 192.168.12.0 255.255.255.0 11.2.0.2
```

Router 0

```
Router(config)#ip route 192.168.10.0 255.255.255.0 11.2.0.1
Router(config)#ip route 192.168.11.0 255.255.255.0 11.2.0.1
Router(config)#ip route 0.0.0.0 0.0.0.0 11.2.0.1
Router(config)#
Router(config)#
```

5. Analyze the entries of the routing table again.

Router 4

```
Router_4#show ip route
Codes: C - connected, S - static, I - IGRP, 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 10.1.0.2 to network 0.0.0.0

C    10.0.0.0/8 is directly connected, Serial2/0
C    192.168.10.0/24 is directly connected, FastEthernet0/0
S    192.168.11.0/24 [1/0] via 10.1.0.2
S    192.168.12.0/24 [1/0] via 10.1.0.2
S*   0.0.0.0/0 [1/0] via 10.1.0.2
```

Router 5

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, 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

C    10.0.0.0/8 is directly connected, Serial3/0
C    11.0.0.0/8 is directly connected, Serial2/0
S    192.168.10.0/24 [1/0] via 10.1.0.1
C    192.168.11.0/24 is directly connected, FastEthernet0/0
S    192.168.12.0/24 [1/0] via 11.2.0.2
```

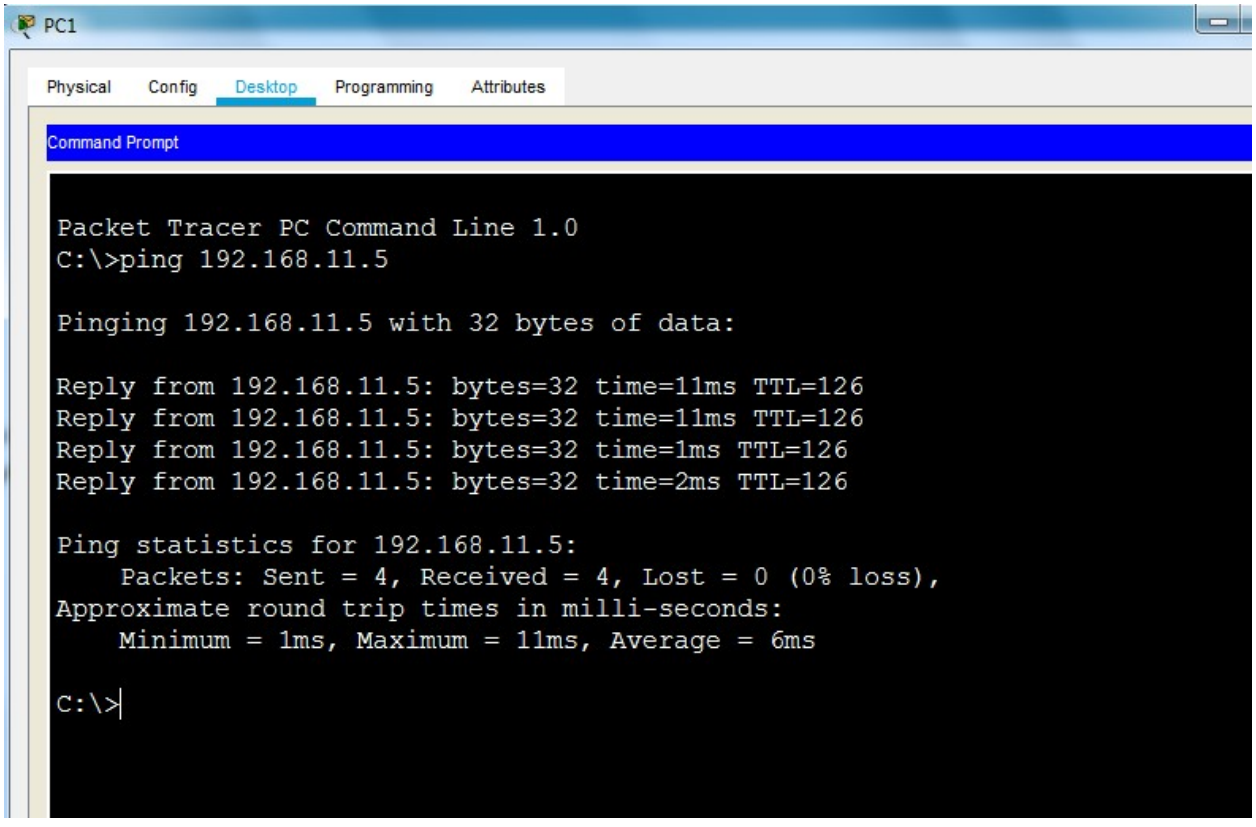
Router 0

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, 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 11.2.0.1 to network 0.0.0.0

C    11.0.0.0/8 is directly connected, Serial2/0
S    192.168.10.0/24 [1/0] via 11.2.0.1
S    192.168.11.0/24 [1/0] via 11.2.0.1
C    192.168.12.0/24 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 11.2.0.1
```

6. Verify the inter LAN communication.



Check the connectivity between the LANs by sending ping messages between LAN devices

Useful Commands

Router4(Config)#interface fastethernet 0/0
Router4(Config-if)#ip address 192.168.10.1 255.255.255.0
Router4(Config-if)#no shutdown

Router4Config)#interface serial 2/0
Router4(Config-if)#ip address 10.1.0.1 255.0.0.0
Router4(Config-if)#clock rate 9600
Router4(Config-if)#no shutdown

Router4(config)#ip route 192.168.11.0 255.255.255.0 10.1.0.2
Router4(config)#ip route 0.0.0.0 0.0.0.0 10.1.0.2

Router5(config)#ip route 192.168.10.0 255.255.255.0 10.1.0.1
Router5(config)#ip route 0.0.0.0 0.0.0.0 11.2.0.2

Router0(config)#ip route 0.0.0.0 0.0.0.0 11.2.0.1