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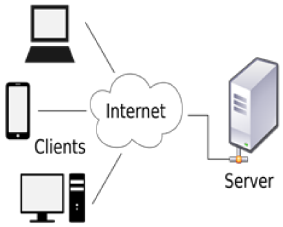


Department of IT

Lab Manual for

Computer Communication & Networks

of

All B.S. Programs

Table of Content

CERTIFICATE

Department of Computer Science
Computer Communication & Networks (CEN303)

This is to certify that Mr/Ms. _____ So/Do _____ having Roll No. _____ has successfully completed Laboratory work during Spring 2018.

Course Supervisor:

Laboratory Exercise No: 1

Student's ID: Student's Name:

Objective:

To learn how to make a crossover cable and straight through cable connector.

Required Tools / Equipment:

- RJ45 connector
- Crimper Tool
- Twisted Pair cable
- Cutter

Procedure:

Making of Straight cable:

- At both connectors, straight through cable have same color coding.
- Color coding for straight through cable is

1. Green White
2. Green
3. Orange White
4. Blue
5. Blue White
6. Orange
7. Brown White
8. Brown

- By using this color coding grab all the wires together and with the help of cutters, cut the upper portion of wires
- Insert the wire in RJ45 Connector and press the connector by using Crimper Tool in the end.

Making of Crossover cable

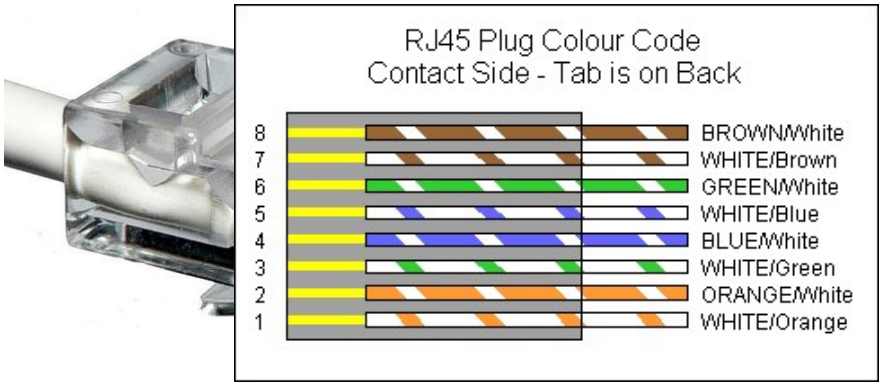
- Crossover Cable has different color coding at both connectors.

➢ Color coding for Crossover cable is:

Connector 1	Connector 2
1. Green White	1. Orange White
2. Green	2. Orange
3. Orange White	3. Green White
4. Blue	4. Blue
5. Blue White	5. Blue White
6. Orange	6. Green
7. Brown White	7. Brown White
8. Brown	8. Brown

By using this color coding grab all the wires together and cut the upper portion of wires by using cutter.

Insert the wire in RJ45 Connector and press the connector by using Crimper Tool.



Result:

A Connector was successfully connected to Crossover and Straight-through cable.

LAB TASK: Students will make straight and cross cable themselves.

Laboratory Exercise No: 2

Objective:

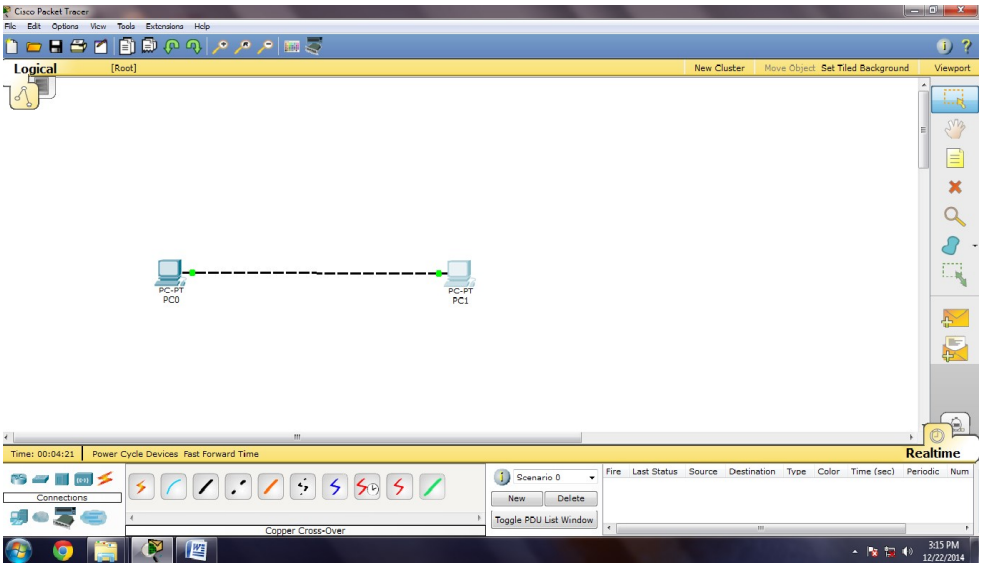
To learn how to establish connection and communication between two PCs.

Required Tools / Equipment:

- Cisco Packet Tracer
- PCs
- Crossover cable

Procedure:

1. Take two PCs.
2. Connect both by Cross over cable at Fast Ethernet Port.
3. Now give IP to both PCs. For example
   PC 1: 10.0.0.1
   PC 2: 10.0.0.2
4. Now give default gateway of the same IP class.
   Default Gateway: 10.0.0.10
5. Open command Line Interface of any PC and ping another PC. For example
   PC 1>ping 10.0.0.2



Result:

Successfully communicated between two PCs

LAB TASK: Create a scenario. Connect three Pcs together through a Switch. Check connectivity by using Ping command.

Laboratory Exercise No: 3

Objective:

To learn and understand the concept of IP address.

Required Tools / Equipment:

- Cisco Packet Tracer
- Switch
- PCs

Theory:

IP address is a logical/Unique address that identifies the devices. It consist of 32 bits address (4 Bytes). IP address have 2 addresses

Internal Address: Made by organization

External Address: Made by ISO

There are two types of IPS:

Dynamic IP: Assign Different IP every time

Static IP: Assign fix IP

There are public and private IP addresses

Private: Made by internal Administration

IP address Formula: 2n

1 IP address is divided into 4 octant.

Classful addressing:

- IANA gives IP address Structure by Dividing into classes.
- In Classful Addressing the Address divided in 5 classes.
- Class A,B,C,D,E
- Class A is used by Government organizations.
- Class B and C mostly used for public and private purpose.
- Class D used for Multicasting.
- Class E used for Experimental and Practical purpose.

Now we will create a network of 10 PCs for message passing between them with the help of a switch in Packet Tracer environment.

Procedure:

1. Place 10 PCs and connect them with a switch using straight-through cable on Fast Ethernet Port.
2. Assign IP address of any class to all PCs.
3. Turn all connected ports on and select one IP to make default gateway, for example.
4. Default Gateway : 10.0.0.1
5. Provide each PC the default gateway.
6. Ping any computer to test connection for example PC 1 to PC 8
7. PC 1> ping 10.0.0.5
8. Similarly ping PC 2 to PC 8
9. After successful ping, send message from any Computer.

Result:

Successfully communicated between “10 PCs”.

LAB TASK: Create a scenario. Connect multiple PCs to Switch0 and Switch1. Connect both switches with each other. Now, ping from any one PC from Switch0 to Switch1.

Laboratory Exercise No: 4

Objective:

To learn how to access operating system of a switch.

Required Tools / Equipment:

- Cisco Packet Tracer
- Switch

Theory:

In packet tracer, there is an option of CLI. It is the primary user interface used for configuring, monitoring, and maintaining Cisco devices. This user interface allows user to directly and simply execute Cisco IOS commands, whether using a router console or terminal, or using remote access methods.

CLI interface has three modes.

1. User mode
2. Privilege/Executive mode
3. Global configuration mode

User mode: In this mode, only limited switch contents/configuration can be viewed. It is default mode.

Privilege/Executive mode: Full contents/configuration of switch can be viewed in this mode.

Global configuration mode: Any configuration can be changed in this mode.

Uni-Cast: Unicast is used when two network nodes need to talk to each other.

Multi-Cast: Multicast is like a broadcast that can cross subnets, but unlike broadcast does not touch all nodes

Broadcast: If all of the nodes are on the same subnet, then **broadcast** becomes a viable solution. All nodes on the subnet will see all traffic.

Domain: A group of computers and devices on a network that are administered as a unit with common rules and procedures. Within the Internet, domains are defined by the IP address. All devices sharing a common part of the IP address are said to be in the same domain.

A switch has only one domain by default. Domain is also called 'VLan'. Different ports can be managed under one or more than one domain. It is also called VLan.

Procedure:

1. Start packet tracer 6.2 and select switch 2950T-24.
2. Double click on it and an interface window will be opened. It has three tabs; Physical, config and CLI. Select CLI tab as shown in fig below.
3. CLI stands for "Command Line Interface

4. Press RETURN (Enter Key) to start using CLI. Command prompt Switch> shows default user mode.

To enter into Privilege/Executive mode from User mode and vice versa:

Switch>enable ---------- To enable Privilege mode
Switch# ---------- # shows Privilege mode
Switch#disable ---------- To disable Privilege mode

Switch> ---------- Returned to User mode

To enter into Global configuration mode from Privilege mode and vice versa:

It is not possible to enter into Global configuration mode directly. It is mandatory to enter into Privilege mode first then switch to Global configuration mode.

Switch#configure terminal ---------- To enable Global configuration mode
Switch(config)# ---------- (config)# shows Global configuration mode
Switch(config)#exit ---------- To disable Global configuration mode
Switch# ---------- Returned to Privilege mode

end command can also be used for this purpose.

To change Host name of Switch:

Switch(config)#hostname CS ---------- To change Host name from Switch to CS
CS(config)# ---------- Host name is changed to CS

To display version information:

CS>show version

To enable inter VLan routing:

CS(config)#interface vlan 1
CS(config-if)#ip address 192.168.2.2 255.255.255.0 --------- IP has been assigned to VLan1
CS#show interface vlan1

Vlan1 is administratively down, line protocol is down…….

To UP ports logically:

CS(config-if)#no shutdown

CS(config-if)#
%LINK-5-CHANGED: Interface Vlan1, changed state to up

To Set Privilege mode password:

CS(config)#enable password SMIU ------ Set Privilege mode password **SMIU**

To verify Privilege mode password:

CS>enable
Password: <type SMIU>
CS#

To Set Privilege mode password in encrypted form:

CS(config)#enable secret COMPUTERSCIENCE

To verify Privilege mode password in encrypted form:

CS>enable
Password: <type SMIU>
Password: <type COMPUTERSCIENCE>
CS#

To remove Privilege mode password:

CS(config)#no enable password

CS>enable
Password: <you have to type only **encrypted form** password now if set before>
CS#

To remove Privilege mode password in encrypted form:

CS(config)#no enable secret

CS>enable
CS# ------ You will have to enter Privilege mode password here if set before

Show contents of Current Configuration (RAM)

CS#show running-config

interface FastEthernet0/24
!
interface GigabitEthernet0/1
!
interface GigabitEthernet0/2
!
interface Vlan1
ip address 192.168.2.2 255.255.255.0
!
!
!
!
line con 0
!
line vty 0 4
login
line vty 5 15
login
!
!
end

LAB TASK: Students will replace default Switch name with their Name. They are required to create Vlan and will detect if they have successfully created it. Also will check switch version.

Laboratory Exercise No: 5

Objective:

To learn how to configure operating system of a switch.

Required Tools / Equipment:

- Cisco Packet Tracer
- Switch

Theory:

Procedure:

To Assign password to console mode in Switch:

```
Switch(config)# line console 0
Switch(config-line)#password SMIU
```

To ask for Login:

```
Switch(config-line)# Login
```

To enable password for the user who is accessing through remote PC/Telnet:

```
Switch(config)#interface vlan1
Switch(config-if)#ip address 192.168.1.2 255.255.255.0
Switch(config-if)#no shutdown
```

Vty is used to access switch from remote PC or Telnet

```
Switch(config)# line Vty 0 2  (for 2 telnet users)
Switch(config-line)# password 1234
Switch(config-line)# Login
```

Now go to command prompt of PC:

```
Pc> ipconfig

C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Request timed out.
Reply from 192.168.1.2: bytes=32 time<1ms TTL=255
```

Reply from 192.168.1.2: bytes=32 time<1ms TTL=255
Reply from 192.168.1.2: bytes=32 time<1ms TTL=255

Ping statistics for 192.168.1.2:
Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum = 0ms, Average = 0ms

If it Replies then:

Pc> telnet 192.168.1.2

C:\>telnet 192.168.1.2
Trying 192.168.1.2 ...Open

User Access Verification

Password: <1234>

To show the Mac Address of PC:

We can use this command either on telnet interface or to CLI

On telnet:

Switch>show mac-address-table
Mac Address Table

Vlan Mac Address Type Ports
---- ----------- -------- -----

1 00d0.bc81.a4de DYNAMIC Fa0/1

On CLI:

Switch>show mac-address-table
Mac Address Table

Vlan Mac Address Type Ports
---- ----------- -------- -----

1 00d0.bc81.a4de DYNAMIC Fa0/1

Access Mode: If any Fast-Ethernet port exist, we can turn its mode to access mode for devices like PC, Routers; this is not applied to Switch.

Trunk Mode: If any fastEthernet port, we turn its mode to trunk mode for Switch only.

To port to access mode:

Switch(config)#interface fastethernet 0/1
Switch(config-if)#Switchport mode access

To port to trunk mode:

Switch(config)#interface fastethernet 0/1
Switch(config-if)#Switchport mode trunk

To port security:

Switch(config-if)# Switchport port-security

Mac binding to port:

#Switchport port-security Mac-address 00d0.bc81.a4de ----- Mac Address displayed before

Binding with connected PC at current line: (we use Sticky)

Switch(config-if)# Switchport port-security Mac-address Sticky

This command directs Switch to give access only to the specified device which is defined by Mac Address.

Violation: (If occurs)

Switch(config-if)# Switchport port-security violation shutdown
Switch(config-if)# Switchport port-security violation restricted
Switch(config-if)# Switchport port-security violation protect

Port Security:

1. Violation

It sends message to administrator for un-authorized person

   a) Restricted (not provide service and will not only notify network administrator by messages but also provide mac address of the intruder pc)
   b) Shutdown (This will logically shut down the port)
   c) Protect (not provide service and will notify network administrator by messages)

2. Maximum (Hint-rate count how many time a person tries to port)

3. MAC address (Bind the MAC address to port)

LAB TASK: Students will replace default Switch name with their Name. They are required to connect pcs and will apply a) console password, secret, and will telnet to connected pc. B) port securities will be applied and connected pc will bind with mac address. Replace it with another pc and observe port security behavior.

Laboratory Exercise No: 6

Objective: To learn how to access router.

Required Tools / Equipment:

- ➢ Cisco Packet Tracer
- ➢ Router

Theory:

Router works on 3rd layer which is named as “Network Layer”.

How to identify an IP address?

Ping your network using a broadcast address, i.e. "ping 192.168.1.255". After that, perform "arp -a" to determine all the computing devices connected to the network. 3. You may also use "netstat -r" command to find an IP address of all network routes.

What are Routing Table & Routing Protocol?

A routing table is a set of rules, often viewed in table format, which is used to determine where data packets is traveling over an Internet Protocol (IP) network will be directed. All IP-enabled devices, including routers and switches, use routing tables

A routing protocol specifies how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the specific choice of route. Each router has a priori knowledge only of networks attached to it directly.

How many types of firewall are used for network security purpose?

A firewall is a hardware or software system that prevents unauthorized access to or from a network. It can be implemented in both hardware and software, or a combination of both. Firewalls are frequently used to prevent unauthorized Internet users from accessing private networks connected to the Internet. All data entering or leaving the intranet pass through the firewall, which examines each packet and blocks those that do not meet the specified security criteria.

The National Institute of Standards and Technology (NIST) 800-10 divide firewalls into three basic types:

- Packet filters
- Stateful inspection
- Proxys

What is Backhaul in networking?

In a hierarchical telecommunications network the backhaul portion of the network comprises the intermediate links between the core network, or backbone network and the small sub networks at the "edge" of the entire hierarchical network.

2620 CISCO Router is used.

- 1 console port

- 2 network (ethernet) ports

Procedure:

To see Details of interface:

```
Router>show ip interface brief

Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 unassigned YES unset administratively down down
FastEthernet1/0 unassigned YES unset administratively down down
Serial2/0 unassigned YES unset administratively down down
Serial3/0 unassigned YES unset administratively down down
FastEthernet4/0 unassigned YES unset administratively down down
FastEthernet5/0 unassigned YES unset administratively down down
```

Set IP address for Router (2620-CISCO):

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

Router(config)#interface ?

Ethernet IEEE 802.3
FastEthernet FastEthernet IEEE 802.3
GigabitEthernet GigabitEthernet IEEE 802.3z
Loopback Loopback interface
Serial Serial
Virtual-Template Virtual Template interface
range interface range command

Router(config)#Interface fastEthernet 0/0
Router(config-if)#ip address 192.168.1.2 255.255.255.0
Router(config-if)#no shutdown

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

Router(config-if)#exit
Router(config)#exit
```

Router#exit
Router>

To set password on console mode:

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.

Router(config)#line console 0
Router(config-line)#password SMIU
Router(config-line)#login
Router(config-line)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#exit

Router con0 is now available
Press RETURN to get started.
User Access Verification
Password: <type password given above ------> SMIU>

To set password for those user (remote computer) who want to access the router through 'telnet' command:

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#line vty 0 2
Router(config-line)#password SMIU
Router(config-line)#login
Router(config-line)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#exit

Set Hostname:

Router>enable
Router#configure
Configuring from terminal, memory, or network [terminal]? <Press Enter>
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#hostname SmartRouter
SmartRouter(config)#exit
SmartRouter#
%SYS-5-CONFIG_I: Configured from console by console

SmartRouter#exit

To save all commands on RAM:

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

To set Password on privilege (enable) Mode:

```
Router>enable
Router#configure
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable password SMIU
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#exit
Router con0 is now available
Press RETURN to get started.
Router>enable
Password: <Write Password SMIU here>
```

To set Secret on privilege (enable) Mode:

```
Router>enable
Router#configure
Configuring from terminal, memory, or network [terminal]?
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#enable secret password SMIU
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#exit

Router con0 is now available
Press RETURN to get started.

Router>enable
Password: <Ask for Privilege mode password here>
Password: <Ask for Secret on privilege mode here>
Router#exit
```

LAB TASK:

Students will connect two PC with two routers named as Name:0 & Name:1. Practice all commands mentioned in this lab 6. And ping from one Pc connected to one router to second pc connected with second router.

Laboratory Exercise No: 7

Objective:

To learn how to configure a router.

Required Tools / Equipment:

- Cisco Packet Tracer
- Router

Theory:

How to get detail of interface:

Open CLI interface of router and write following:

```
Router>enable
Router#show ip interface brief
Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 unassigned YES unset administratively down down
FastEthernet1/0 unassigned YES unset administratively down down
Serial2/0 unassigned YES unset administratively down down
Serial3/0 unassigned YES unset administratively down down
FastEthernet4/0 unassigned YES unset administratively down down
FastEthernet5/0 unassigned YES unset administratively down down
Router#
```

Set IP address for Router (2620-CISCO):

Go to CLI interface of router

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface fastEthernet 0/0
Router(config-if)#ip address 192.168.1.2 255.255.255.0
Router(config-if)#no shutdown

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

Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#exit

Router con0 is now available
Press RETURN to get started.
Router>
```

How to connect two routers:

Connect two routers; each using serial port 2/0 as shown in fig.

Open CLI interface of Router0 and write following commands:

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface serial 2/0
Router(config-if)#ip address 10.10.10.1 255.255.255.0
Router(config-if)#no shutdown

%LINK-5-CHANGED: Interface Serial2/0, changed state to down
Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip interface brief
Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 unassigned YES unset administratively down down
FastEthernet1/0 unassigned YES unset administratively down down
Serial2/0 10.10.10.1 YES manual down down
Serial3/0 unassigned YES unset administratively down down
FastEthernet4/0 unassigned YES unset administratively down down
FastEthernet5/0 unassigned YES unset administratively down down
Router#exit

Router con0 is now available
Press RETURN to get started.
Router>

Above configuration shows that Router0 serial interface 2/0 is now assigned with IP 10.10.10.1 and it is manual down (serial port interface will be UP only if both sides of interfaces are UP).

Now open CLI interface of router1 and write following commands:

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.

```
Router(config)#interface serial 2/0
Router(config-if)#ip address 10.10.10.2 255.255.255.0
Router(config-if)#no shutdown

Router(config-if)#
%LINK-5-CHANGED: Interface Serial2/0, changed state to up

Router(config-if)#
%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to up

Router(config-if)#exit
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

Router#show ip interface brief
Interface IP-Address OK? Method Status Protocol
FastEthernet0/0 unassigned YES unset administratively down down
FastEthernet1/0 unassigned YES unset administratively down down
Serial2/0 10.10.10.2 YES manual up up
Serial3/0 unassigned YES unset administratively down down
FastEthernet4/0 unassigned YES unset administratively down down
FastEthernet5/0 unassigned YES unset administratively down down
Router#
```

Above configuration shows that Router1 serial interface 2/0 is now assigned with IP 10.10.10.2 and it is manually up (serial port interface is UP because both sides of interfaces are UP now).

To allow any router to be connected with Router0:

Open CLI interface of Router0 and write following commands:

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 0.0.0.0 0.0.0.0 10.10.10.2
Router(config)#do show running-config
Building configuration...

Current configuration : 753 bytes
!
```

```
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
no ip address
duplex auto
speed auto
shutdown
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
ip address 10.10.10.1 255.255.255.0
clock rate 2000000
!
interface Serial3/0
```

```
no ip address
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.10.10.2
!
ip flow-export version 9
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end
```

Note: ip route 0.0.0.0 0.0.0.0 10.10.10.2 shows that any terminal having any network IP and any network subnet mask is permitted to connected via 10.10.10.2 (IP address of router1 serial 2/0 interface). Similarly this can also be checked with ip route command as shown below:

```
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

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 10.10.10.2 to network 0.0.0.0

10.0.0.0/24 is subnetted, 1 subnets
C 10.10.10.0 is directly connected, Serial2/0
S* 0.0.0.0/0 [1/0] via 10.10.10.2

Note: S* shows that static route has been created for any network via 10.10.10.2 (which is IP address assigned to router1 serial interface 2/0).

Router#

To allow any router to be connected with Router1:

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#ip route 0.0.0.0 0.0.0.0 10.10.10.1
Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console

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 10.10.10.1 to network 0.0.0.0

10.0.0.0/24 is subnetted, 1 subnets
C 10.10.10.0 is directly connected, Serial2/0
S* 0.0.0.0/0 [1/0] via 10.10.10.1

Note: S* shows that static route has been created for any network via 10.10.10.1 (which is IP address assigned to router0 serial interface 2/0).

To reset ip address for router0:

Open CLI interface of router0 and write following commands:

Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface serial 2/0
Router(config-if)#no ip address [** this reset any ip assigned to router0 serial 2/0 interface]
Router(config-if)#shutdown [** this turns router0 serial 2/0 interface down]

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

%LINEPROTO-5-UPDOWN: Line protocol on Interface Serial2/0, changed state to down

Router(config-if)#exit
Router(config)#do show running-config
Building configuration...

Current configuration : 741 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
no ip address
duplex auto
speed auto
shutdown
!
```

```
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
no ip address          [** this shows any ip assigned to router0 serial 2/0 interface has been cleared]
clock rate 2000000
shutdown
!
interface Serial3/0
no ip address
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.10.10.2
!
ip flow-export version 9
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end
```

Router(config)#

To reset ip address for router1:

Open CLI interface of router1 and write following commands:

```
Router>enable
Router#configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#interface serial 2/0
Router(config-if)#no ip address
Router(config-if)#shutdown

%LINK-5-CHANGED: Interface Serial2/0, changed state to administratively down
Router(config-if)#exit
Router(config)#do show running-config
Building configuration...

Current configuration : 721 bytes
!
version 12.2
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Router
!
!
!
!
!
!
!
!
ip cef
no ipv6 cef
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
!
interface FastEthernet0/0
no ip address
duplex auto
```

```
speed auto
shutdown
!
interface FastEthernet1/0
no ip address
duplex auto
speed auto
shutdown
!
interface Serial2/0
no ip address
shutdown
!
interface Serial3/0
no ip address
shutdown
!
interface FastEthernet4/0
no ip address
shutdown
!
interface FastEthernet5/0
no ip address
shutdown
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.10.10.1
!
ip flow-export version 9
!
!
!
!
!
!
!
line con 0
!
line aux 0
!
line vty 0 4
login
!
!
!
end


Router(config)#exit
Router#
%SYS-5-CONFIG_I: Configured from console by console
```

Router#exit

Router con0 is now available
Press RETURN to get started.
Router>

LAB TASK:

Students will connect two routers using serial port named as Name:0 & Name:1. Practice all commands mentioned in this lab 6. And ping from one Pc connected to one router to second pc connected with second router.

Student's ID:
Student's Name:

Laboratory Exercise No: 8

Objective: To create multiple Vlan and establish communication between hosts connected with different switches.

Required Tools / Equipment:

- Cisco Packet Tracer
- Switch

Theory:

- Create Scenario as shown below:

- Create multiple Vlan in switch0 and assign names as shown below:

```
Switch>enable
Switch#config t
Enter configuration commands, one per line. End with CNTL/Z.

Switch(config)#vlan 10                    [*New Vlan has been created as Vlan10]
Switch(config-vlan)#name HR               [*Vlan10 is assigned name HR]

Switch(config-vlan)#vlan 20               [*New Vlan has been created as Vlan20]
Switch(config-vlan)#name Finance          [*Vlan10 is assigned name HR]

Switch(config-vlan)#vlan 90               [*New Vlan has been created as Vlan20]
Switch(config-vlan)#name Mgt              [*Vlan10 is assigned name HR]


Switch(config-vlan)#do show vlan
```

```
Switch(config-vlan)#do show vlan

VLAN Name                                Status    Ports
---- ----------------------------------- --------- -------------------------------
1    default                             active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                   Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                   Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                   Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                                   Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                   Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                                   Gig0/1, Gig0/2
10   HR                                  active
20   Finance                             active
90   Mgt                                 active
1002 fddi-default                        active
1003 token-ring-default                  active
1004 fddinet-default                     active
1005 trnet-default                       active

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
10   enet  100010     1500  -      -      -        -    -        0      0
20   enet  100020     1500  -      -      -        -    -        0      0
90   enet  100090     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

Remote SPAN VLANs
------------------------------------------------------------------------------

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
Switch(config-vlan)#
```

Three Vlans have been created namely HR, Finance and Mgt (Management) on three different ports as shown above. It is worth to note that default Vlan is Vlan1 and all ports are assigned to Vlan1. We have created three Vlans, they are active but no port has been assigned to them yet as shown in figure above.

- Assign each Vlan different physical ports and set port security mode as access.

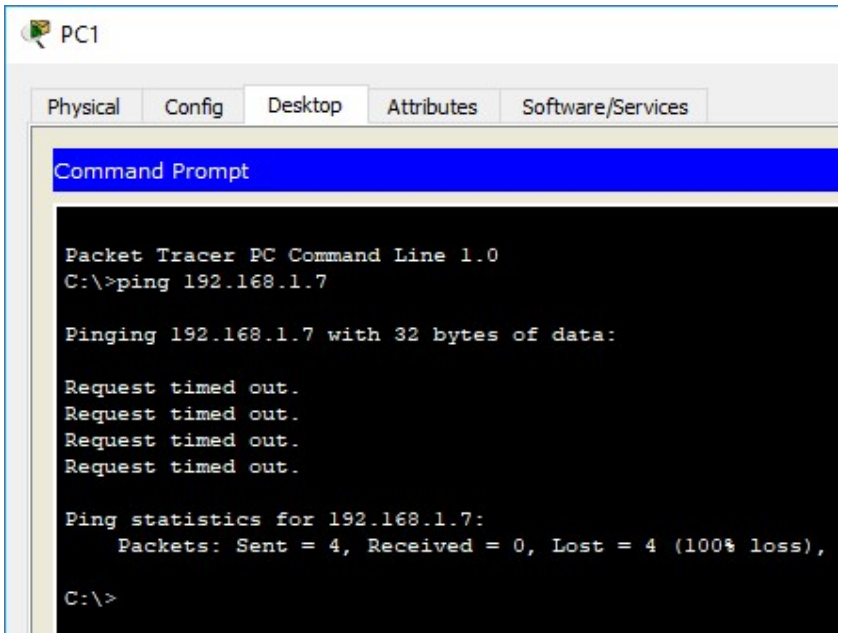
```
Switch(config-vlan)#exit
Switch(config)#interface range fastEthernet 0/1-8      [*Enter in interface of FastEthernet ports from 0 to 8]
Switch(config-if-range)#switchport mode access         [* Set selected ports mode as access]
Switch(config-if-range)#switchport access vlan 10      [* Assign Vlan10 physical ports from 0 to 8]
Switch(config-if-range)#exit

Switch(config)#interface range fastEthernet 0/9-16
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 20
Switch(config-if-range)#exit
Switch(config)#interface fastEthernet 0/24
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 90
Switch(config-if)#exit
```

```
Switch(config-vlan)#do show vlan

VLAN Name                              Status    Ports
---- --------------------------------- --------- -------------------------------
1    default                           active    Fa0/1, Fa0/2, Fa0/3, Fa0/4
                                                 Fa0/5, Fa0/6, Fa0/7, Fa0/8
                                                 Fa0/9, Fa0/10, Fa0/11, Fa0/12
                                                 Fa0/13, Fa0/14, Fa0/15, Fa0/16
                                                 Fa0/17, Fa0/18, Fa0/19, Fa0/20
                                                 Fa0/21, Fa0/22, Fa0/23, Fa0/24
                                                 Gig0/1, Gig0/2
10   HR                                active
20   Finance                           active
90   Mgt                               active
1002 fddi-default                      active
1003 token-ring-default                active
1004 fddinet-default                   active
1005 trnet-default                     active

VLAN Type  SAID       MTU   Parent RingNo BridgeNo Stp  BrdgMode Trans1 Trans2
---- ----- ---------- ----- ------ ------ -------- ---- -------- ------ ------
1    enet  100001     1500  -      -      -        -    -        0      0
10   enet  100010     1500  -      -      -        -    -        0      0
20   enet  100020     1500  -      -      -        -    -        0      0
90   enet  100090     1500  -      -      -        -    -        0      0
1002 fddi  101002     1500  -      -      -        -    -        0      0
1003 tr    101003     1500  -      -      -        -    -        0      0
1004 fdnet 101004     1500  -      -      -        ieee -        0      0
1005 trnet 101005     1500  -      -      -        ibm  -        0      0

Remote SPAN VLANs
------------------------------------------------------------------------------

Primary Secondary Type              Ports
------- --------- ----------------- ------------------------------------------
Switch(config-vlan)#
```

Switch(config-vlan)#exit
Switch(config)#interface range fa 0/1-8
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 10
Switch(config-if-range)#exit
Switch(config)#interface range fa 0/9-16
Switch(config-if-range)#switchport mode access
Switch(config-if-range)#switchport access vlan 20
Switch(config-if-range)#exit
Switch(config)#interface fa 0/24
Switch(config-if)#switchport mode access
Switch(config-if)#switchport access vlan 90
Switch(config-if)#exit
Switch(config)#do show vlan

- Now, Open PC2 command prompt and ping PC3

- Open PC1 command prompt and ping PC4



Communication established between PC2 and PC3 because they belonged to same Vlan (HR) but not between PC1 and PC4 even though they belonged to same Vlan (Fiance). Reason is that both switches are connected together through fastEthernet port 0/3 and this port mode is access mode. In access mode, one port only convey data that belong to that port Vlan only (i-e port 0/3 is included in HR vlan so it will carry only HR data in access mode). If we want to establish communication between more than one Vlan (i-e HR to HR, Finance to Finance and Mgt to Mgt), we will have to change mode of port 0/3 to Trunk and also have to mention which Vlan data is allowed to pass through it.

- Execute following command in Switch1 CLI:

Switch(config)#interface fastEthernet 0/3 [* Enter in FastEthernet 0/3 interface]

Switch(config-if)#switchport mode trunk [* Change port 0/3 mode to Trunk]

Switch(config-if)#switchport trunk allowed vlan 1-100 [* Allow data from Vlan0 to Vlan100 through port 0/3 Trunk]

Switch(config-if)#do show running-config

```
no service timestamps log datetime msec
no service timestamps debug datetime msec
no service password-encryption
!
hostname Switch
!
!
!
!
!
spanning-tree mode pvst
!
interface FastEthernet0/1
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/2
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/3
 switchport access vlan 10
 switchport trunk allowed vlan 1-100
 switchport mode trunk
!
interface FastEthernet0/4
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/5
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/6
 switchport access vlan 10
 switchport mode access
!
 --More--
```

Switch1 port 0/3 configuration shows that this port mode is trunk and this port is included in Vlan10 and this allows data in trunk mode to pass between two switches. Allowed data from Vlan1 to Vlan100.

- Execute following commands in Switch0 SLI:

Switch(config)#interface fastEthernet 0/3
Switch(config-if)#switchport mode trunk

Switch(config-if)#switchport trunk allowed vlan 1-100
Switch(config-if)#do show running-config

```
!
interface FastEthernet0/3
 switchport access vlan 10
 switchport trunk allowed vlan 1-100
 switchport mode trunk
!
interface FastEthernet0/4
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/5
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/6
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/7
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/8
 switchport access vlan 10
 switchport mode access
!
interface FastEthernet0/9
 switchport access vlan 20
 switchport mode access
!
interface FastEthernet0/10
 switchport access vlan 20
 switchport mode access
!
interface FastEthernet0/11
 switchport access vlan 20
 switchport mode access
!
 --More--
```

- Now, Open PC1 command prompt and ping PC4

As we can see, communication between PC1 and PC4 is established.

Switch(config)#do show interfaces trunk

Above command shows which interface is assigned trunk mode and how many Vlan can communicate through trunk port.

Initialize RIP in router0:

3. Open CLI interface of router0 and write following commands

```
R-0>enable
R-0#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R-0(config)#router rip                                    [**Initialize RIP in router0]
R-0(config-router)#network 192.168.2.0 [**Network 192.168.2.0 is directly connect with
                                          router0]

R-0(config-router)#network 14.14.1.0  [**Network 14.14.1.0 is directly connect with
                                          router0]

R-0(config-router)#exit
```

Note: router rip command initialize RIP in router. After that we have to describe each network which is connected directly with this router using Network command and its network IP.

Initialize RIP in router1:

4. Open CLI interface of router1 and write following commands

```
R-1>enable
R-1#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R-1(config)#router rip
R-1(config-router)#network 14.14.1.0
R-1(config-router)#network 13.13.1.0
R-1(config-router)#exit
R-1(config)#
```

Initialize RIP in router2:

5. Open CLI interface of router2 and write following commands

```
R-2>enable
R-2#conf t
Enter configuration commands, one per line. End with CNTL/Z.
R-2(config)#router rip
R-2(config-router)#network 13.13.1.0
R-2(config-router)#network 12.12.1.0
R-2(config-router)#exit
R-2(config)#
```

Initialize RIP in router3:

6. Open CLI interface of router3 and write following commands

```
Router>enable
```

```
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 12.12.1.0
Router(config-router)#network 11.11.1.0
Router(config-router)#exit
Router(config)#
```

Initialize RIP in router4:

7. Open CLI interface of router4 and write following commands

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 11.11.1.0
Router(config-router)#network 90.90.1.0
Router(config-router)#exit
Router(config)#
```

Initialize RIP in router5:

8. Open CLI interface of router5 and write following commands

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 90.90.1.0
Router(config-router)#network 80.80.1.0
Router(config-router)#exit
```

Initialize RIP in router6:

9. Open CLI interface of router6 and write following commands

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 80.80.1.0
Router(config-router)#network 70.70.1.0
Router(config-router)#exit
Router(config)#
```

Initialize RIP in router7:

10. Open CLI interface of router7 and write following commands

```
Router>enable
Router#conf t
```

```
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 70.70.1.0
Router(config-router)#network 60.60.1.0
Router(config-router)#exit
Router(config)#
```

Initialize RIP in router8:

11. Open CLI interface of router8 and write following commands

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 60.60.1.0
Router(config-router)#network 50.50.1.0
Router(config-router)#exit
Router(config)#
```

Initialize RIP in router9:

12. Open CLI interface of router9 and write following commands

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 50.50.1.0
Router(config-router)#network 40.40.1.0
Router(config-router)#exit
Router(config)#
```

Initialize RIP in router10:

13. Open CLI interface of router10 and write following commands

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 40.40.1.0
Router(config-router)#network 30.30.1.0
Router(config-router)#exit
Router(config)#
```

Initialize RIP in router11:

14. Open CLI interface of router11 and write following commands

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 30.30.1.0
Router(config-router)#network 20.20.1.0
Router(config-router)#exit
Router(config)#
```

Initialize RIP in router12:

15. Open CLI interface of router12 and write following commands

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 20.20.1.0
Router(config-router)#network 10.10.1.0
Router(config-router)#exit
Router(config)#
```

Initialize RIP in router13:

16. Open CLI interface of router13 and write following commands

```
Router>enable
Router#conf t
Enter configuration commands, one per line. End with CNTL/Z.
Router(config)#router rip
Router(config-router)#network 10.10.1.0
Router(config-router)#network 192.168.1.0
Router(config-router)#exit
Router(config)#
```

Check if RIP has identified all nodes

Check If RIP has created dynamic routing above mentioned networks

Go to CLI interface of router0 and check number of ip routes.

```
R-0#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

R 10.0.0.0/8 [120/12] via 14.14.1.1, 00:00:03, Serial2/0
R 11.0.0.0/8 [120/3] via 14.14.1.1, 00:00:03, Serial2/0
R 12.0.0.0/8 [120/2] via 14.14.1.1, 00:00:03, Serial2/0
R 13.0.0.0/8 [120/1] via 14.14.1.1, 00:00:03, Serial2/0
14.0.0.0/24 is subnetted, 1 subnets
C 14.14.1.0 is directly connected, Serial2/0
R 20.0.0.0/8 [120/11] via 14.14.1.1, 00:00:03, Serial2/0
R 30.0.0.0/8 [120/10] via 14.14.1.1, 00:00:03, Serial2/0
R 40.0.0.0/8 [120/9] via 14.14.1.1, 00:00:03, Serial2/0
R 50.0.0.0/8 [120/8] via 14.14.1.1, 00:00:03, Serial2/0
R 60.0.0.0/8 [120/7] via 14.14.1.1, 00:00:03, Serial2/0
R 70.0.0.0/8 [120/6] via 14.14.1.1, 00:00:03, Serial2/0
R 80.0.0.0/8 [120/5] via 14.14.1.1, 00:00:03, Serial2/0
R 90.0.0.0/8 [120/4] via 14.14.1.1, 00:00:03, Serial2/0
R 192.168.1.0/24 [120/13] via 14.14.1.1, 00:00:03, Serial2/0
C 192.168.2.0/24 is directly connected, FastEthernet1/0

R stands for dynamic route performed with RIP protocol. As there are total 15 networks. Two networks 192.168.2.0 and 14.14.1.0 are connected directly to router0. Other 13 networks are connected to router by using RIP protocol (dynamic routing).

Open command prompt of PC0 and ping PC1.

Packet Tracer PC Command Line 1.0
C:\>ping 192.168.1.2

Pinging 192.168.1.2 with 32 bytes of data:

Reply from 192.168.1.2: bytes=32 time=195ms TTL=114
Reply from 192.168.1.2: bytes=32 time=59ms TTL=114
Reply from 192.168.1.2: bytes=32 time=39ms TTL=114
Reply from 192.168.1.2: bytes=32 time=42ms TTL=114

Ping statistics for 192.168.1.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 39ms, Maximum = 195ms, Average = 83ms

LAB TASK: Students will replace default Router names with their Name. They are required to connect 8 routers in series and two pc at both ends. Initiate RIP on each router. Connect connectivity and show ip route command on any one of the router