**STUDY EXPERIMENT**

| EX. No. | 1 | IP ADDRESSING AND SUBNETTING (VLSM) |
|---|---|---|
| DATE | ___/___/2019 | |

## Introduction

This study experiment provides basic information needed to configure your router for routing IP, such as how addresses are broken down and how subnetting works. You learn how to assign each interface on the router an IP address with a unique subnet. There are examples included in order to help easy understanding of subnetting.

## Requirements

A basic understanding of binary and decimal numbers.

If definitions are helpful to you, use these vocabulary terms in order to get you started:

- **Address -** The unique number ID assigned to one host or interface in a network.
- **Subnet -** A portion of a network that shares a particular subnet address.
- **Subnet mask -** A 32-bit combination used to describe which portion of an address refers to the subnet and which part refers to the host.
- **Interface -** A network connection.

## Understand **IP Addresses**

An IP address is an address used in order to uniquely identify a device on an IP network. The address is made up of 32 binary bits, which can be divisible into a network portion and host portion with the help of a subnet mask. The 32 binary bits are broken into four octets (1 octet = 8 bits). Each octet is converted to decimal and separated by a period (dot). For this reason, an IP address is said to be expressed in dotted decimal format (for example, 172.16.81.100). The value in each octet ranges from 0 to 255 decimal, or 00000000 - 11111111 binary.

Here is how binary octets convert to decimal: The right most bit, or least significant bit, of an octet holds a value of $2^{0}$. The bit just to the left of that holds a value of $2^{1}$. This continues until the left-most bit, or most significant bit, which holds a value of $2^{7}$. So if all binary bits are a one, the decimal equivalent would be 255 as shown here:

1 1 1 1 1 1 1 1

128 64 32 16 8 4 2 1 (128+64+32+16+8+4+2+1=255)

Here is a sample octet conversion when not all of the bits are set to 1.

0 1 0 0 0 0 0 1

0 64 0 0 0 0 0 1 (0+64+0+0+0+0+0+1=65)

And this sample shows an IP address represented in both binary and decimal.

10. 1. 23. 19 (decimal)

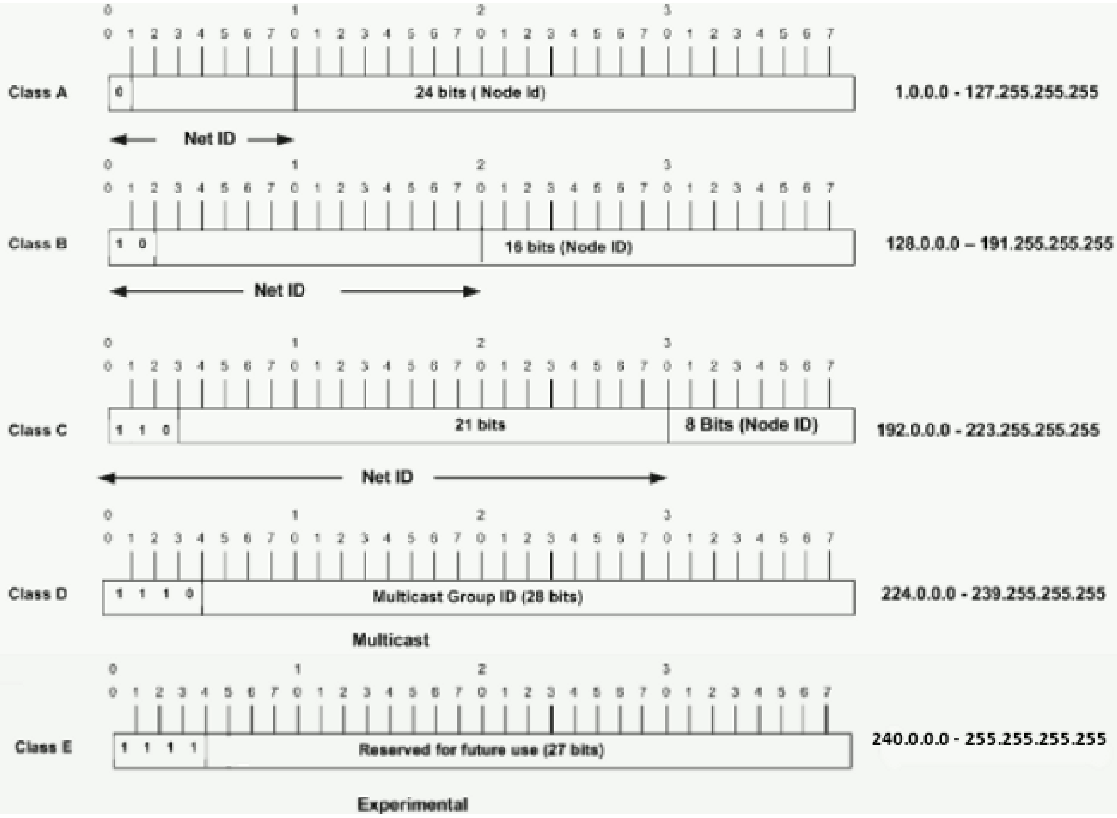
00001010.00000001.00010111.00010011 (binary)

These octets are broken down to provide an addressing scheme that can accommodate large and small networks. There are five different classes of networks, A to E.

Also note that the terms "Class A, Class B" and so on are used in this document in order to help facilitate the understanding of IP addressing and subnetting. These terms are rarely used in the industry anymore because of the introduction of classless interdomain routing (CIDR).

Given an IP address, its class can be determined from the three high-order bits (the three left-most bits in the first octet). Figure 1 shows the significance in the three high order bits and the range of addresses that fall into each class. For informational purposes, Class D and Class E addresses are also shown.

## Figure 1




In a Class A address, the first octet is the network portion, so the Class A example in Figure 1 has a major network address of 1.0.0.0 - 127.255.255.255. Octets 2, 3, and 4 (the next 24 bits) are for the network manager to divide into subnets and hosts as he/she sees fit. Class A addresses are used for networks that have more than 65,536 hosts (actually, up to 16777214 hosts!).

In a Class B address, the first two octets are the network portion, so the Class B example in Figure 1 has a major network address of 128.0.0.0 - 191.255.255.255. Octets 3 and 4 (16 bits) are for local subnets and hosts. Class B addresses are used for networks that have between 256 and 65534 hosts.

In a Class C address, the first three octets are the network portion. The Class C example in Figure 1 has a major network address of 192.0.0.0 - 223.255.255.255. Octet 4 (8 bits) is for local subnets and hosts - perfect for networks with less than 254 hosts.

## Network Masks

A network mask helps you know which portion of the address identifies the network and which portion of the address identifies the node. Class A, B, and C networks have default masks, also known as natural masks, as shown here:

Class A: 255.0.0.0

Class B: 255.255.0.0

Class C: 255.255.255.0

An IP address on a Class A network that has not been subnetted would have an address/mask pair similar to: 8.20.15.1 255.0.0.0. In order to see how the mask helps you identify the network and node parts of the address, convert the address and mask to binary numbers.

8.20.15.1 = 00001000.00010100.00001111.00000001

255.0.0.0 = 11111111.00000000.00000000.00000000

Once you have the address and the mask represented in binary, then identification of the network and host ID is easier. Any address bits which have corresponding mask bits set to 1 represent the network ID. Any address bits that have corresponding mask bits set to 0 represent the node ID.

8.20.15.1 = 00001000.00010100.00001111.00000001

255.0.0.0 = 11111111.00000000.00000000.00000000

-----------------------------------

net id | host id

netid = 00001000 = 8

hostid = 00010100.00001111.00000001 = 20.15.1

## Understand Subnetting

Subnetting allows you to create multiple logical networks that exist within a single Class A, B, or C network. If you do not subnet, you are only able to use one network from your Class A, B, or C network, which is unrealistic.

Each data link on a network must have a unique network ID, with every node on that link being a member of the same network. If you break a major network (Class A, B, or C) into smaller subnetworks, it allows you to create a network of interconnecting subnetworks. Each data link on this network would then have a unique network/subnetwork ID. Any device, or gateway, that connects *n* networks/subnetworks has *n* distinct IP addresses, one for each network / subnetwork that it interconnects.

In order to subnet a network, extend the natural mask with some of the bits from the host ID portion of the address in order to create a subnetwork ID. For example, given a Class C network of 204.17.5.0 which has a natural mask of 255.255.255.0, you can create subnets in this manner:

204.17.5.0 - 11001100.00010001.00000101.00000000

255.255.255.224 - 11111111.11111111.11111111.11100000

By extending the mask to be 255.255.255.224, you have taken three bits (indicated by "sub") from the original host portion of the address and used them to make subnets. With these three bits, it is possible to create eight subnets. With the remaining five host ID bits, each subnet can have up to 32 host addresses, 30 of which can actually be assigned to a device since host ids of all zeros or all ones are not allowed (it is very important to remember this). So, with this in mind, these subnets have been created.

204.17.5.0 255.255.255.224 host address range 1 to 30

204.17.5.32 255.255.255.224 host address range 33 to 62

204.17.5.64 255.255.255.224 host address range 65 to 94

204.17.5.96 255.255.255.224 host address range 97 to 126

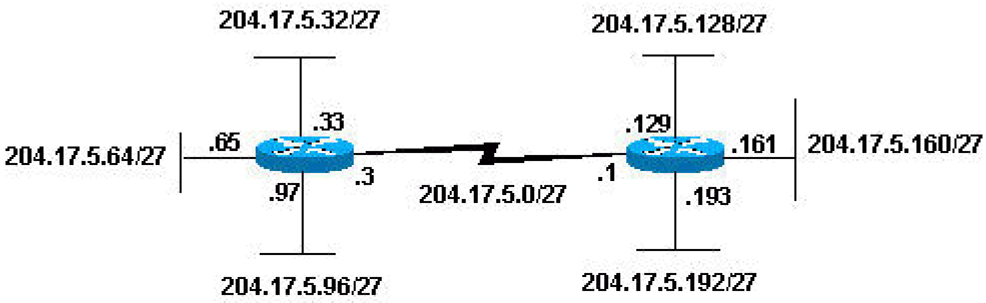
204.17.5.128 255.255.255.224 host address range 129 to 158

204.17.5.160 255.255.255.224 host address range 161 to 190

204.17.5.192 255.255.255.224 host address range 193 to 222

204.17.5.224 255.255.255.224 host address range 225 to 254

**Figure 2**




Notice that each of the routers in Figure 2 is attached to four subnetworks, one subnetwork is common to both routers. Also, each router has an IP address for each subnetwork to which it is attached. Each subnetwork could potentially support up to 30 host addresses.

This brings up an interesting point. The more host bits you use for a subnet mask, the more subnets you have available. However, the more subnets available, the less host addresses available per subnet. For example, a Class C network of 204.17.5.0 and a mask of 255.255.255.224 (/27) allows you to have eight subnets, each with 32 host addresses (30 of which could be assigned to devices). If you use a mask of 255.255.255.240 (/28), the break down is:

204.17.5.0 -      11001100.00010001.00000101.00000000

255.255.255.240 - 11111111.11111111.11111111.11110000

--------------------------|sub |---

Since you now have four bits to make subnets with, you only have four bits left for host addresses. So in this case you can have up to 16 subnets, each of which can have up to 16 host addresses (14 of which can be assigned to devices).

Take a look at how a Class B network might be subnetted. If you have network 172.16.0.0 ,then you know that its natural mask is 255.255.0.0 or 172.16.0.0/16. Extending the mask to anything beyond 255.255.0.0 means you are subnetting. You can quickly see that you have the ability to create a lot more subnets than with the Class C network. If you use a mask of 255.255.248.0 (/21), how many subnets and hosts per subnet does this allow for?

172.16.0.0  -   10101100.00010000.00000000.00000000

255.255.248.0 - 11111111.11111111.11111000.00000000

-----------------| sub |-----------

You use five bits from the original host bits for subnets. This allows you to have 32 subnets ($2^5$). After using the five bits for subnetting, you are left with 11 bits for host addresses. This allows each subnet so have 2048 host addresses ($2^{11}$), 2046 of which could be assigned to devices.

## Examples

### Sample Exercise 1

Now that you have an understanding of subnetting, put this knowledge to use. In this example, you are given two addresses / mask combinations, written with the prefix/length notation, which have been assigned to two devices. Your task is to determine if these devices are on the same subnet or different subnets. You can use the address and mask of each device in order to determine to which subnet each address belongs.

Device A: 172.16.17.30/20

Device B: 172.16.28.15/20

### Determine the Subnet for Device A:

172.16.17.30 - 10101100.00010000.00010001.00011110

255.255.240.0 - 11111111.11111111.11110000.00000000

-----------------| sub|------------

Subnet = 10101100.00010000.00010000.00000000 = 172.16.16.0

Looking at the address bits that have a corresponding mask bit set to one, and setting all the other address bits to zero (this is equivalent to performing a logical "AND" between the mask and address), shows you to which subnet this address belongs. In this case, Device A belongs to subnet 172.16.16.0.

### Determine the Subnet for Device B:

172.16.28.15 - 10101100.00010000.00011100.00001111

255.255.240.0 - 11111111.11111111.11110000.00000000

-----------------| sub|------------

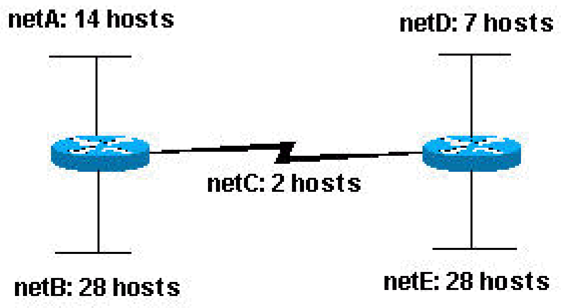
subnet = 10101100.00010000.00010000.00000000 = 172.16.16.0

From these determinations, Device A and Device B have addresses that are part of the same subnet.

### Sample Exercise 2

Given the Class C network of 204.15.5.0/24, subnet the network in order to create the network in Figure 3 with the host requirements shown.

**Figure 3**




Looking at the network shown in Figure 3, you can see that you are required to create five subnets. The largest subnet must support 28 host addresses.

You can start by looking at the subnet requirement. In order to create the five needed subnets you would need to use three bits from the Class C host bits. Two bits would only allow you four subnets ($2^2$).

Since you need three subnet bits, that leaves you with five bits for the host portion of the address. How many hosts does this support? $2^5 = 32$ (30 usable). This meets the requirement.

Therefore you have determined that it is possible to create this network with a Class C network. An example of how you might assign the subnetworks is:

netA: 204.15.5.0/27 host address range 1 to 30

netB: 204.15.5.32/27 host address range 33 to 62

netC: 204.15.5.64/27 host address range 65 to 94

netD: 204.15.5.96/27 host address range 97 to 126

netE: 204.15.5.128/27 host address range 129 to 158

## VLSM Example

In all of the previous examples of subnetting, notice that the same subnet mask was applied for all the subnets. This means that each subnet has the same number of available host addresses. You can need this in some cases, but, in most cases, having the same subnet mask for all subnets ends up wasting address space. For example, in the Sample Exercise 2 section, a class C network was split into eight equal-size subnets; however, each subnet did not utilize all available host addresses, which results in wasted address space. Figure 4 illustrates this wasted address space.

## Figure 4

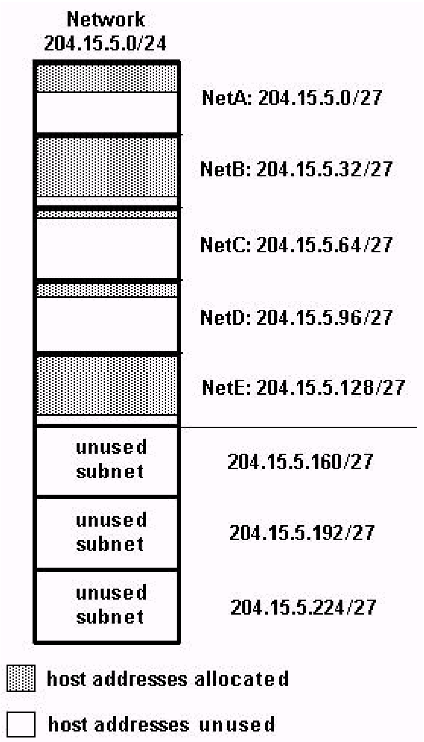



Figure 4 illustrates that of the subnets that are being used, NetA, NetC, and NetD have a lot of unused host address space. It is possible that this was a deliberate design accounting for future growth, but in many cases this is just wasted address space due to the fact that the same subnet mask is used for all the subnets.

Variable Length Subnet Masks (VLSM) allows you to use different masks for each subnet, thereby using address space efficiently.

## VLSM Example

Given the same network and requirements as in Sample Exercise 2 develop a subnetting scheme with the use of VLSM, given:

netA: must support 14 hosts

netB: must support 28 hosts

netC: must support 2 hosts

netD: must support 7 hosts

netE: must support 28 host

Determine what mask allows the required number of hosts.

netA: requires a /28 (255.255.255.240) mask to support 14 hosts

netB: requires a /27 (255.255.255.224) mask to support 28 hosts

netC: requires a /30 (255.255.255.252) mask to support 2 hosts netD*: requires a /28 (255.255.255.240) mask to support 7 hosts

netE: requires a /27 (255.255.255.224) mask to support 28 hosts

The easiest way to assign the subnets is to assign the largest first. For example, you can assign in this manner:

netB: 204.15.5.0/27 host address range 1 to 30

netE: 204.15.5.32/27 host address range 33 to 62

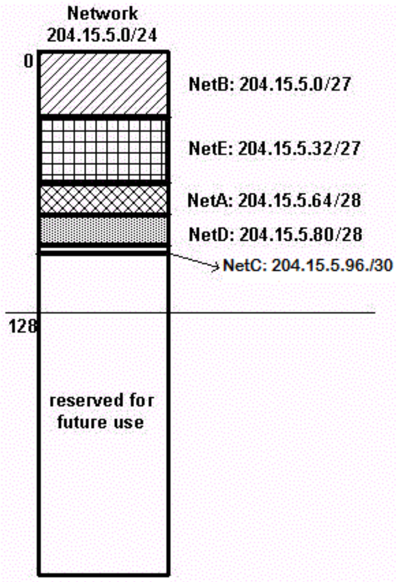
netA: 204.15.5.64/28 host address range 65 to 78

netD: 204.15.5.80/28 host address range 81 to 94

netC: 204.15.5.96/30 host address range 97 to 98

This can be graphically represented as shown in Figure 5:

**Figure 5**




**Result:**

The study experiment on IP addressing and subnetting (VLSM) is completed successfully.

| EX. No. | 2 | TYPES OF NETWORK CABLES |
|---|---|---|
| DATE | ___/___/2019 | |

## Aim

To study about the types of Network cables

## Twisted pair cabling comes in two varieties:

- Shielded
- Unshielded.

## Unshielded Twisted Pair (UTP)

Unshielded twisted pair (UTP) is the most popular and is generally the best option for school networks

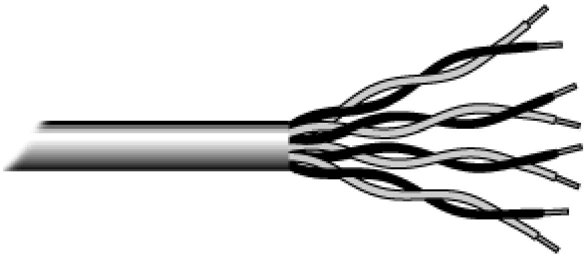


*Fig.1. Unshielded twisted pair*

The quality of UTP may vary from telephone-grade wire to extremely high-speed cable. The cable has four pairs of wires inside the jacket. Each pair is twisted with a different number of twists per inch to help eliminate interference from adjacent pairs and other electrical devices. The tighter the twisting, the higher the supported transmission rate and the greater the cost per foot. The EIA/TIA (Electronic Industry Association/Telecommunication Industry Association) has established standards of UTP and rated six categories of wire (additional categories are emerging).

## Unshielded Twisted Pair Connector

The standard connector for unshielded twisted pair cabling is an RJ-45 connector. This is a plastic connector that looks like a large telephone-style connector

(See fig. 2). A slot allows the RJ-45 to be inserted only one way. RJ stands for Registered Jack, implying that the connector follows a standard borrowed from the telephone industry. This standard designates which wire goes with each pin inside the connector.

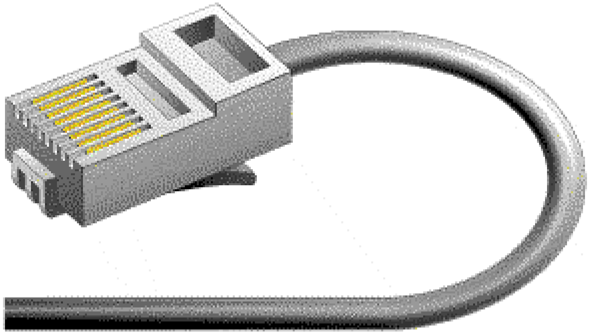


*Fig. 2. RJ-45 connector*

## Shielded Twisted Pair (STP) Cable

Although UTP cable is the least expensive cable, it may be susceptible to radio and electrical frequency interference (it should not be too close to electric motors, fluorescent lights, etc.). If you must place cable in environments with lots of potential interference, or if you must place cable in extremely sensitive environments that may be susceptible to the electrical current in the UTP, shielded twisted pair may be the solution. Shielded cables can also help to extend the maximum distance of the cables.

Shielded twisted pair cable is available in three different configurations:

1. Each pair of wires is individually shielded with foil.
2. There is a foil or braid shield inside the jacket covering all wires (as a group).
3. There is a shield around each individual pair, as well as around the entire group of wires (referred to as double shield twisted pair).

## Coaxial Cable

Coaxial cabling has a single copper conductor at its center. A plastic layer provides insulation between the center conductor and a braided metal shield (See fig. 3). The metal shield helps to block any outside interference from fluorescent lights, motors, and other computers.

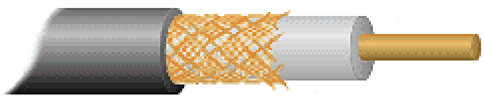


*Fig. 3. Coaxial cable*

Although coaxial cabling is difficult to install, it is highly resistant to signal interference. In addition, it can support greater cable lengths between network devices than twisted pair cable. The two types of coaxial cabling are thick coaxial and thin coaxial.

Thin coaxial cable is also referred to as thinnet. 10Base2 refers to the specifications for thin coaxial cable carrying Ethernet signals. The 2 refers to the approximate maximum segment length being 200 meters. In actual fact the maximum segment length is 185 meters. Thin coaxial cable has been popular in school networks, especially linear bus networks.

Thick coaxial cable is also referred to as thicknet. 10Base5 refers to the specifications for thick coaxial cable carrying Ethernet signals. The 5 refers to the maximum segment length being 500 meters. Thick coaxial cable has an extra protective plastic cover that helps keep moisture away from the center conductor. This makes thick coaxial a great choice when running longer lengths in a linear bus network. One disadvantage of thick coaxial is that it does not bend easily and is difficult to install.

## Coaxial Cable Connectors

The most common type of connector used with coaxial cables is the Bayone-Neill-Concelman (BNC) connector (See fig. 4). Different types of adapters are available for BNC connectors, including a T-connector, barrel connector, and terminator. Connectors on the cable are the weakest points in any network. To help avoid problems with your network, always use the BNC connectors that crimp, rather screw, onto the cable.

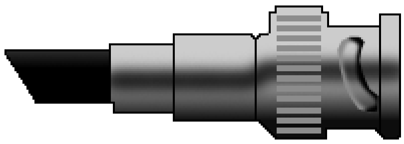


*Fig. 4. BNC connector*

## Fiber Optic Cable

Fiber optic cabling consists of a center glass core surrounded by several layers of protective materials (See fig. 5). It transmits light rather than electronic signals eliminating the problem of electrical interference. This makes it ideal for certain environments that contain a large amount of electrical interference. It has also made it the standard for connecting networks between buildings, due to its immunity to the effects of moisture and lighting.

Fiber optic cable has the ability to transmit signals over much longer distances than coaxial and twisted pair. It also has the capability to carry information at vastly greater speeds. This capacity broadens communication possibilities to include services such as video conferencing and interactive services. The cost of fiber optic cabling is comparable to copper cabling; however, it is more difficult to install and modify. 10BaseF refers to the specifications for fiber optic cable carrying Ethernet signals.

The center core of fiber cables is made from glass or plastic fibers (see fig 5). A plastic coating then cushions the fibercenter, and kevlarfibers help to strengthen the cables and prevent breakage. The outer insulating jacket made of teflon or PVC.

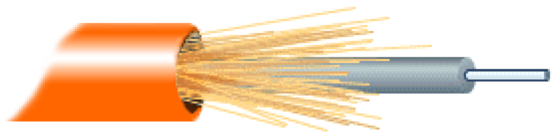


*Fig. 5. Fiber optic cable*

There are two common types of fiber cables -- single mode and multimode. Multimode cable has a larger diameter; however, both cables provide high bandwidth at high speeds. Single mode can provide more distance, but it is more expensive.

## Result

The study experiment about the types of Network cables completed successfully.

| EX. No. | 3 | LAN CONFIGURATION USING STRAIGHT THROUGH AND CROSS OVER CABLES |
|---|---|---|
| DATE | ___/___/2019 | |

## Aim:

To perform LAN configuration using straight through and Cross over cables and test the connection.

## Tools Required:

(i) LAN (cable586B/category-6)

(ii) Modular connector (8P8C plug, aka RJ45)

(iii) Crimping tool

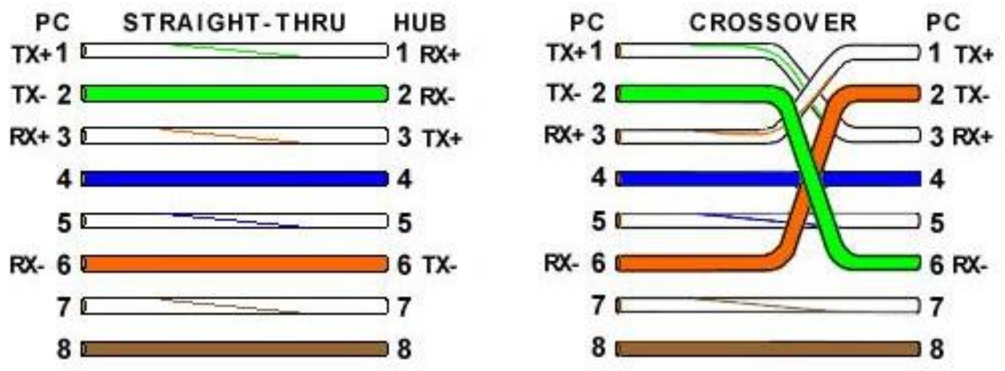
(iv) Cable tester (optional, but recommended)

(v) Shield cutter

## Procedure:

**Step 1:** Take a LAN cable 586B/category-6, by using shield cutter cut the shield over the wire, strip the cable jacket about 1.5 inch down from the end.

**Step 2:** Spread the four pairs of twisted wire apart. You can use the pull string to strip the jacket farther down if you need to, then cut the pull string.




**Step 3:** Untwist the wire pairs and neatly align them in the T568B orientation. Be sure not to untwist them any farther down the cable than where the jacket begins; we want to leave as much of the cable twisted as possible.

**Step 4:** Cut the wires as straight as possible, about 0.5 inch above the end of the jacket and carefully insert the wires all the way into the modular connector, making sure that each wire passes through the appropriate guides inside the connector.

**Step 5:** Push the connector inside the crimping tool and squeeze the crimper all the way down.

**Step 6:** Repeat steps 1-5 for the other end of the cable.

**Step 7:** To make sure you've successfully terminated each end of the cable, use a cable tester to test each pin.


## Result:

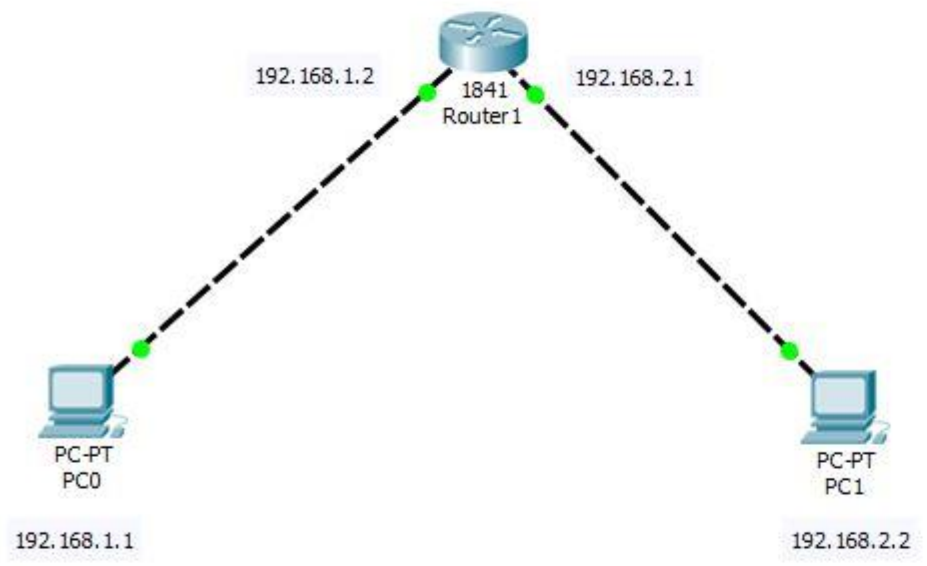
LAN configuration using straight through and Cross over cable is performed successfully.

| EX. No. | 4 (a) | Basic Router Configuration 1 |
|---|---|---|
| DATE | ___/___/2019 | |

## Aim:

To study the basic configuration tasks and to activate Ethernet Interfaces on a Router, and to test and verify configurations done.

## Topology Diagram:




## Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| **R1** | **Fa0/0** | 192.168.1.1 | 255.255.255.0 | N/A |
| | **Fa0/1** | 192.168.2.1 | 255.255.255.0 | N/A |
| **PC1** | **N/A** | 192.168.1.10 | 255.255.255.0 | 192.168.1.1 |
| **PC2** | **N/A** | 192.168.2.10 | 255.255.255.0 | 192.168.2.1 |

## Scenario:

In this Experiment, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly.

## Procedure:

**Task 1:** Cable a network that is similar to the one in the topology diagram. Use the appropriate Ethernet Cable to connect between Router and PC's.

**Task 2:** Perform Basic Configuration of Router R1.

**Step 1:** Establish the Hyper Terminal session to the Router as follows-

Router>enable

Router#configure terminal

Router (config) #

**Step 2:** Assign IP addresses for the respected ethernet interfaces as follows-

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) #exit

Router (config) #interface FastEthernet 0/1

Router (config-if) #ip address 192.168.2.1 255.255.255.0

Router (config-if) #no shutdown

Router (config-if) #exit

**Step 3:** Also assign the Default Gateway address and IP address for PC1,PC2 in GUI mode as in the Addressing Table.

**Task 3:** Now, check for Interfaces created, by passing the messages from

=>PC1->Router, PC2-Router

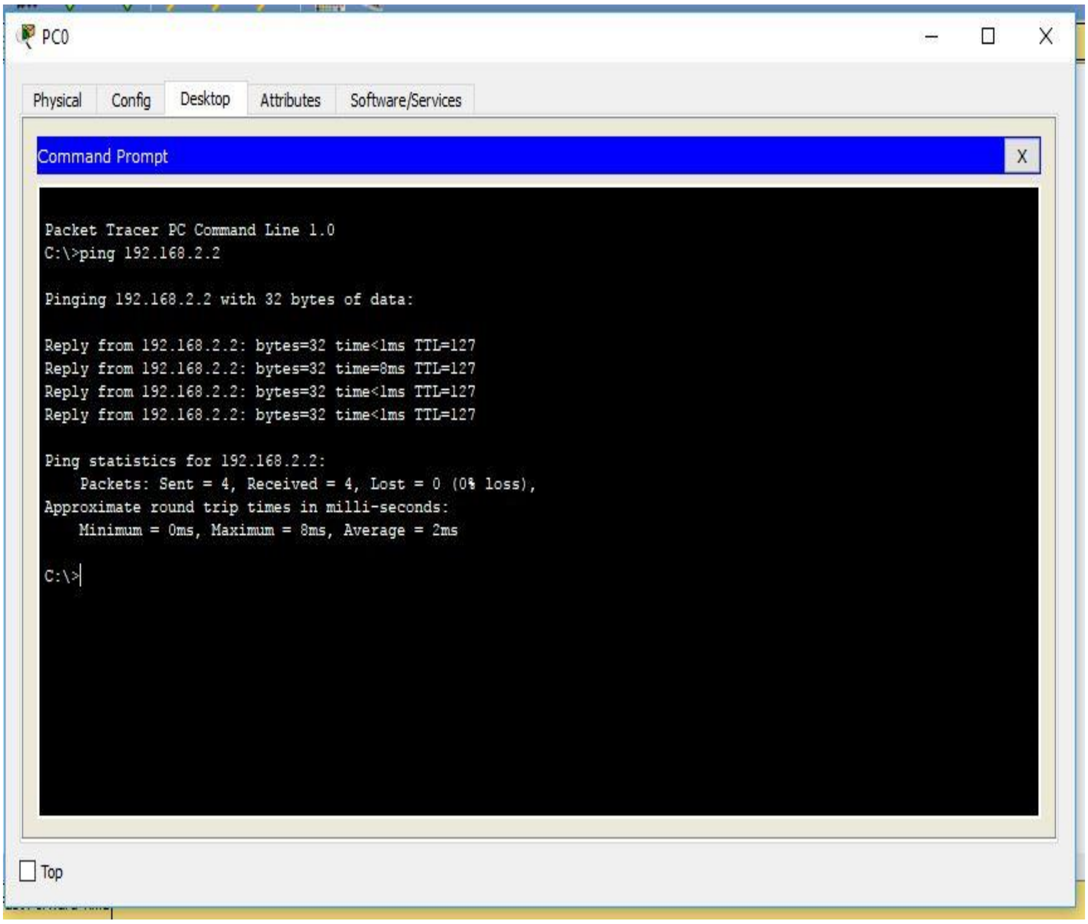
=>Router->PC1, PC2,

=>PC1->PC2.

OR, in command prompt of PC1 use the command ‘ping ip-address of PC2’

i.e., ping 192.168.2.10

**OUTPUT:**




## Result:

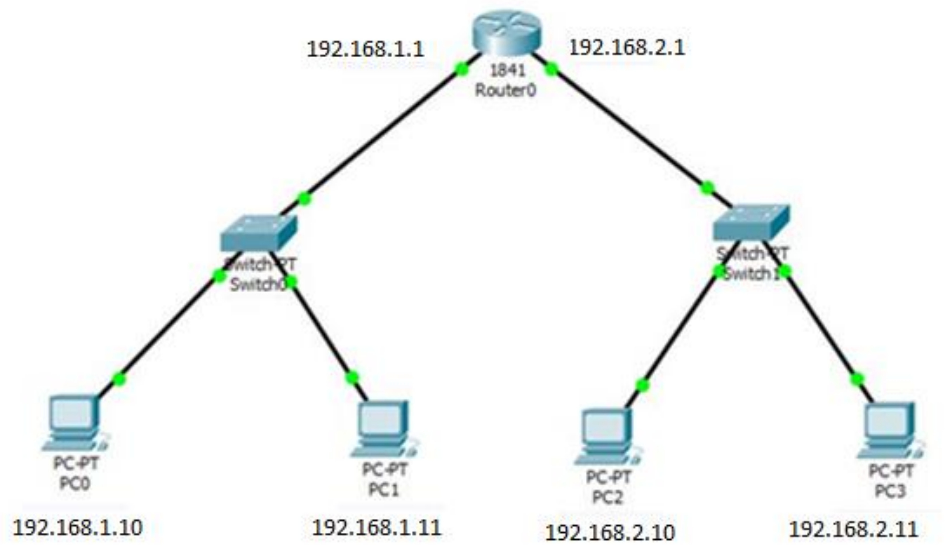
LAN Configuration using straight through and crossover connections is established successfully**.**

| EX. No. | 4 \|(b) | Basic Router Configuration 2 |
|---|---|---|
| DATE | ___/___/2019 | |

Aim**:**

To study the basic configuration tasks and to activate Ethernet Interfaces on a Router using two Switches and 4PC's, and to test and to verify configurations status.

## Topology Diagram:




## Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| **R1** | **Fa0/0** | 192.168.1.1 | 255.255.255.0 | N/A |
| | **Fa0/1** | 192.168.2.1 | 255.255.255.0 | N/A |
| **PC0** | **N/A** | 192.168.1.10 | 255.255.255.0 | 192.168.1.1 |
| **PC1** | **N/A** | 192.168.1.11 | 255.255.255.0 | 192.168.1.1 |
| **PC2** | **N/A** | 192.168.2.10 | 255.255.255.0 | 192.168.2.1 |
| **PC3** | **N/A** | 192.168.2.11 | 255.255.255.0 | 192.168.2.1 |

## Scenario:

In this Experiment, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly.

## Procedure:

**Task 1:** Cable a network that is similar to the one in the topology diagram. Use the appropriate Ethernet Cable to connect between Router and PC's.

**Task 2: Perform Basic Configuration of Router R1.**

**Step 1:** Establish the Hyper Terminal session to the Router as follows-

Router>enable

Router#configure terminal

Router (config) #

**Step 2:** Assign IP addresses for the respected ethernet interfaces as follows-

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) #exit

Router (config) #interface FastEthernet 0/1

Router (config-if) #ip address 192.168.2.1 255.255.255.0

Router (config-if) #no shutdown

Router (config-if) #exit

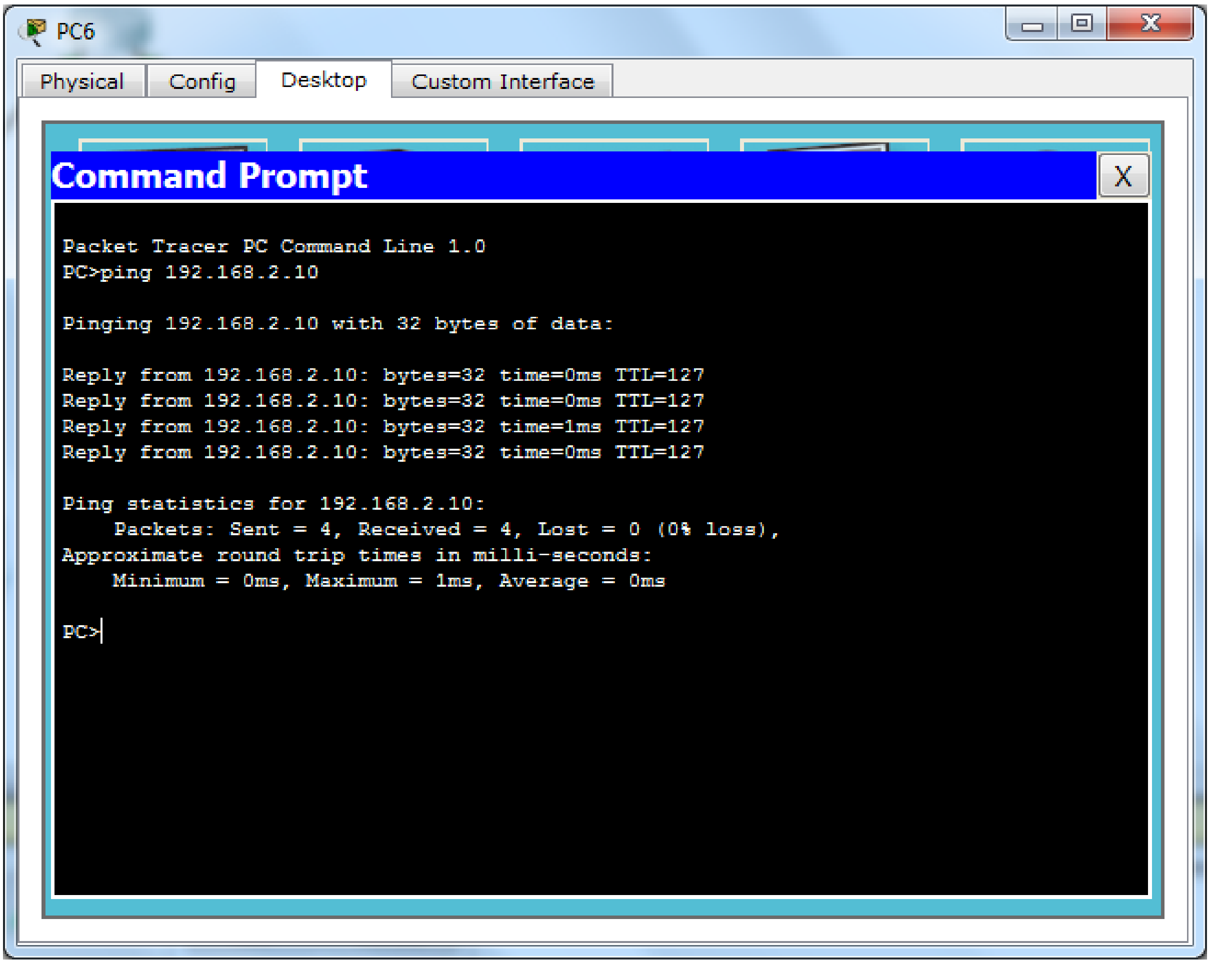
**Step 3:** Also assign the Default Gateway address and IP address for PC1, PC2,PC3,PC4as in the Addressing Table.

**Task 3:** Now, check for Interfaces created, by passing the messages from

=>PC1->Router, PC2-Router

=>Router->PC1, PC2,

=>PC1->PC2, PC1->PC3/PC4 etc.,




## Result:

Therefore, the study the Basic Routing Configuration between 4PC's and router through two switches and to check the connections is studied and established successfully.

| EX. No. | 5 | Static and Default Routing |
|---|---|---|
| DATE | ___/___/2019 | |

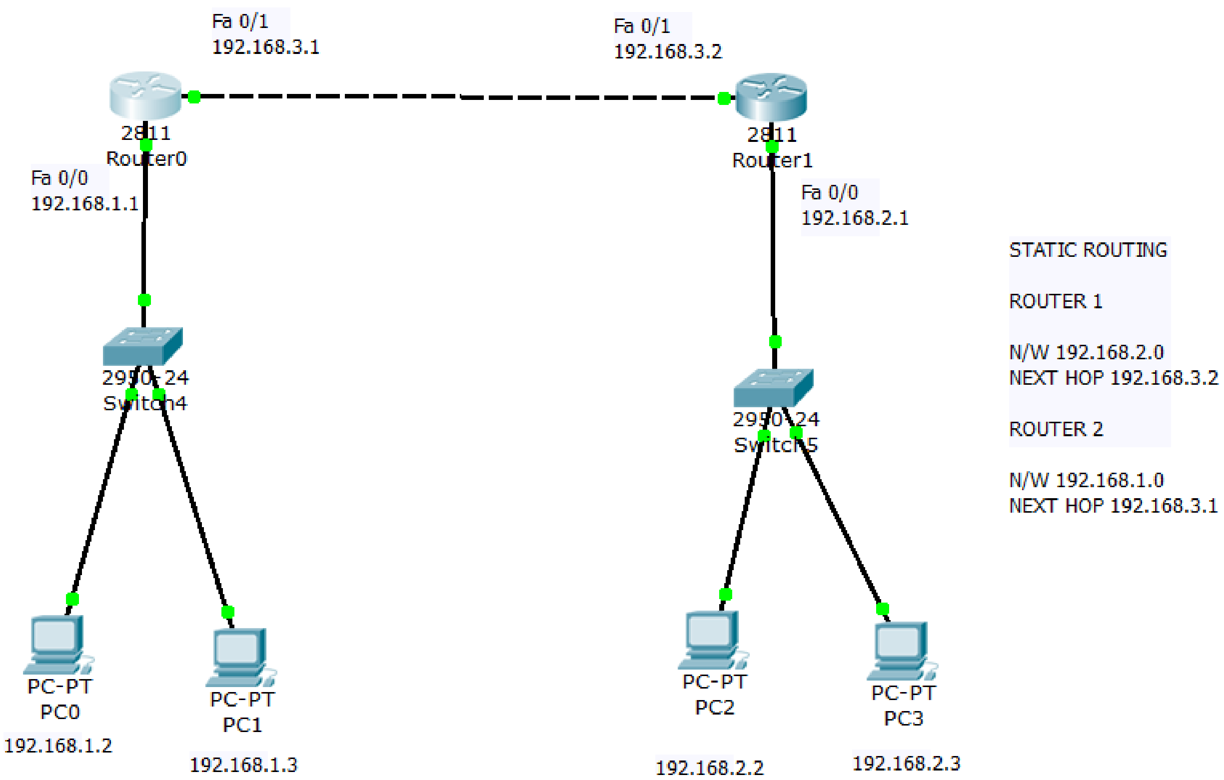
## AIM:

To perform the Static and Default Routing and to activate Ethernet Interfaces on a Router using two Switches and 4PC's, and to test and to verify configurations status.

## Topology Diagram:

## Static Routing

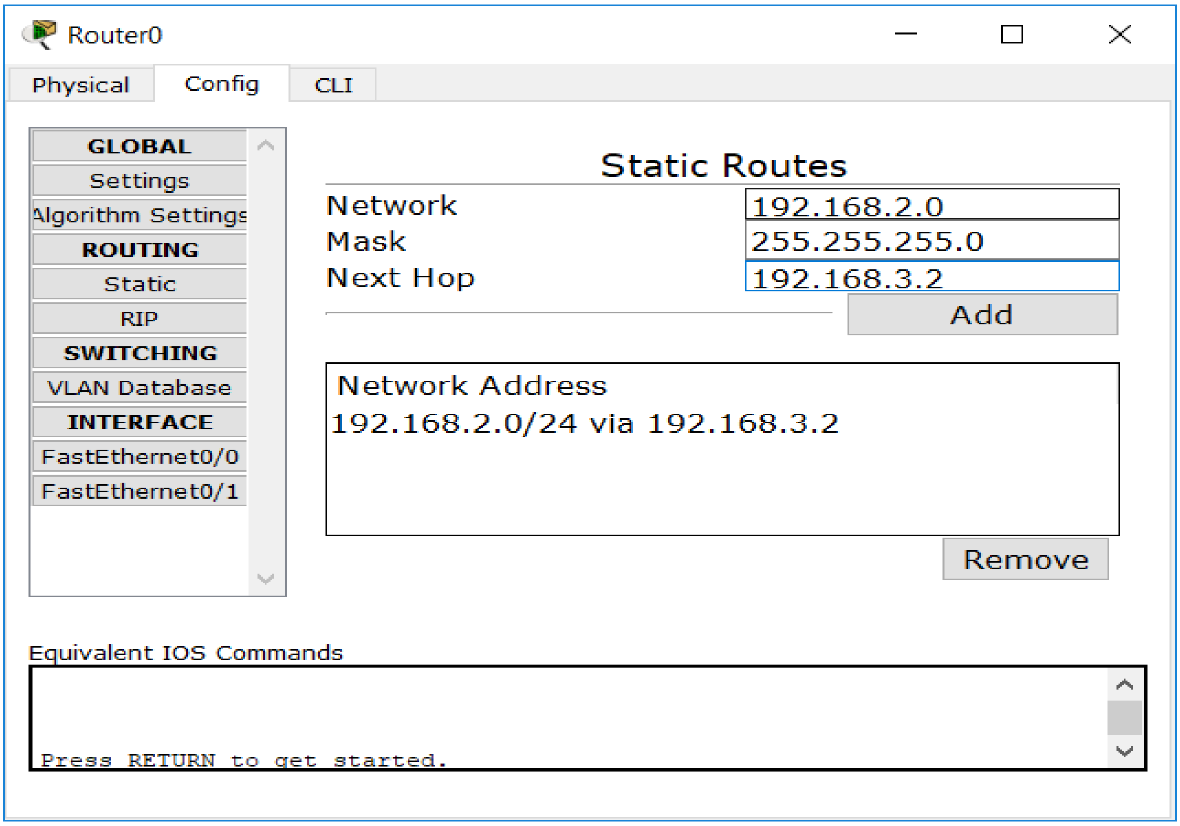
### Topology Diagram:



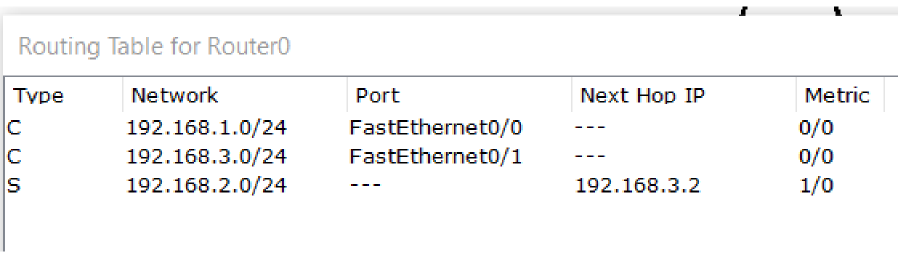

### Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| **R1** | **Fa0/0** | 192.168.1.1 | 255.255.255.0 | N/A |
| **R2** | **Fa0/0** | 192.168.2.1 | 255.255.255.0 | N/A |

| | | | | |
|---|---|---|---|---|
| **PC0** | **N/A** | 192.168.1.2 | 255.255.255.0 | 192.168.1.1 |
| **PC1** | **N/A** | 192.168.1.3 | 255.255.255.0 | 192.168.1.1 |
| **PC2** | **N/A** | 192.168.2.2 | 255.255.255.0 | 192.168.2.1 |
| **PC3** | **N/A** | 192.168.2.3 | 255.255.255.0 | 192.168.2.1 |



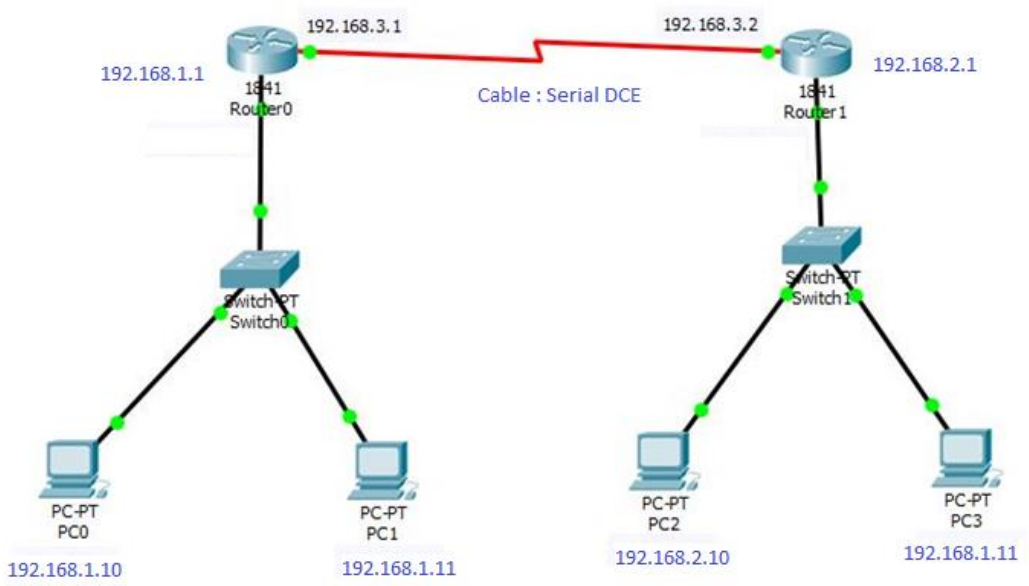

## Output


Routing Table for Router0

| Type | Network | Port | Next Hop IP | Metric |
|---|---|---|---|---|
| C | 192.168.1.0/24 | FastEthernet0/0 | --- | 0/0 |
| C | 192.168.3.0/24 | FastEthernet0/1 | --- | 0/0 |
| S | 192.168.2.0/24 | --- | 192.168.3.2 | 1/0 |

## Default Routing

### Topology Diagram




## Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| R1 | **Fa0/0** | 192.168.1.1 | 255.255.255.0 | N/A |
| | **Se0/1/0** | 192.168.3.1 | 255.255.255.0 | N/A |
| R2 | **Fa0/0** | 192.168.2.1 | 255.255.255.0 | N/A |
| | **Se0/1/1** | 192.168.3.2 | 255.255.255.0 | N/A |
| **PC0** | **N/A** | 192.168.1.10 | 255.255.255.0 | 192.168.1.1 |
| **PC1** | **N/A** | 192.168.1.11 | 255.255.255.0 | 192.168.1.1 |
| **PC2** | **N/A** | 192.168.2.10 | 255.255.255.0 | 192.168.2.1 |
| **PC3** | **N/A** | 192.168.2.11 | 255.255.255.0 | 192.168.2.1 |

## Scenario:

In this Experiment, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly. We can use RIP ver1. Till maximum of 16 hop counts.

## Procedure:

**Task 1:** Cable a network that is similar to the one in the topology diagram. Use the appropriate Ethernet Cable to connect between Router and PC's. And between each Router Connect with serial DCE cable by adding WIC-2T card in the each Router.

## Task 2: Perform Basic Configuration of Router R1.

**Step 1:** Establish the Hyper Terminal session to the Router as follows-

Router>enable

Router#configure terminal

Router (config) #

**Step 2:** Assign IP addresses for the respected ethernet interfaces as follows-

### Router 0:

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)#exit

### Router 1:

Router (config) #interface FastEthernet 0/0

Router (config-if) #ip address 192.168.2.1 255.255.255.0

Router (config-if) #no shutdown

Router (config-if) #exit

**Step 3:** Now, give the serial port address for both the routers as shown-

### Router 0:

Router (config) #interface serial 0/0/0

Router (config-if) #ip address 192.168.3.1 255.255.255.0

Router (config-if) #clock rate 128000

Router (config-if) #no shutdown

Router (config-if) #exit

**Router 1:**

Router (config) #interface serial 0/0/0

Router (config-if) #ip address 192.168.3.2 255.255.255.0

Router (config-if) #no shutdown

Router (config-if) #exit

**Step 4:** Also assign the Default Gateway address and IP address forPC1, PC2, PC3, PC4 as in the Addressing Table.

**Task 3:** Add the networks passing through each router below-

Router (config) #ip route 0.0.0.0 0.0.0.0 192.168.3.2

Router (config-router) #exit

**Task 4:** Now, check for Interfaces created, by passing the messages from

=>PC1->Router, PC2-Router

=>Router->PC1, PC2,

=>PC1->PC2, PC1->PC3/PC4 etc.

Also, you can go through Simulation mode (auto capture/play) to automatically check the configuration status.

**Output:**

Routing Table for Router0

| Type | Network | Port | Next Hop IP | Metric |
|---|---|---|---|---|
| C | 192.168.1.0/24 | FastEthernet0/0 | --- | 0/0 |
| C | 192.168.3.0/24 | FastEthernet0/1 | --- | 0/0 |
| S | 192.168.2.0/24 | --- | 192.168.3.2 | 1/0 |

## Result:

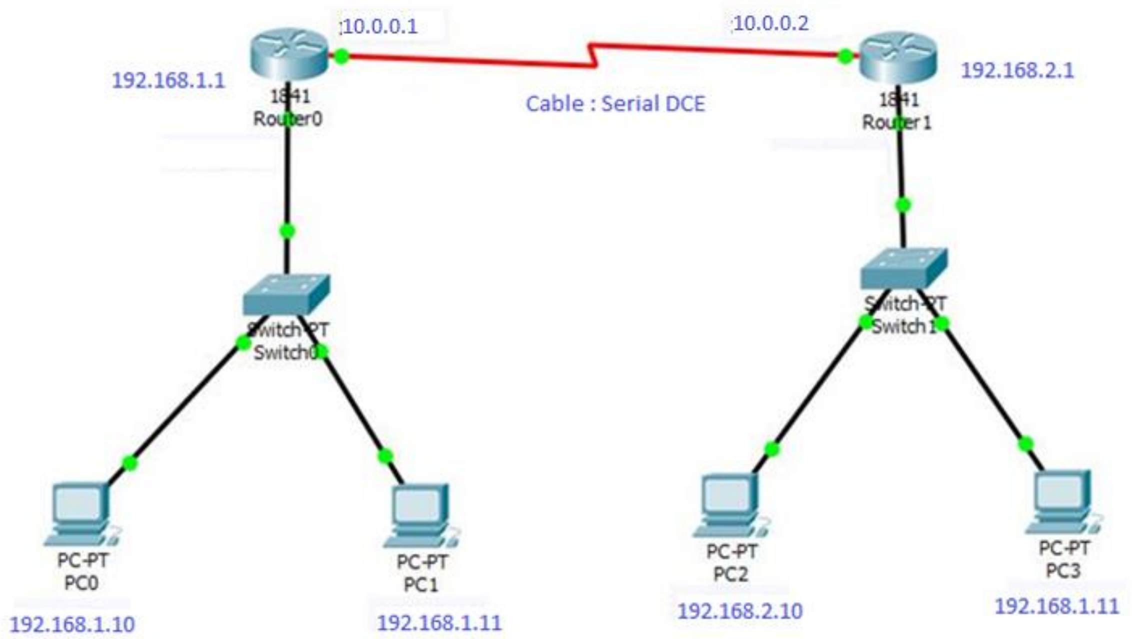
Therefore studied the Static and Default Routing and to activate Ethernet Interfaces on a Router using two Switches and 4PC's, and to test and to verified configurations status successfully.

| EX. No. | 6 | ROUTING INFORMATION PROTOCOL - Version 1 |
|---|---|---|
| DATE | ___/___/2019 | |

## Aim:

To configure routers with RIP ver.1 and to activate the networks with RIP, verify the configuration.

## Topology Diagram:




## Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| R0 | Fa0/0 | 192.168.1.1 | 255.255.255.0 | N/A |
| | Se0/1/0 | 10.0.0.1 | 255.0.0.0 | N/A |
| R11 | Fa0/0 | 192.168.2.1 | 255.255.255.0 | N/A |
| | Se0/1/1 | 10.0.0.2 | 255.0.0.0 | N/A |
| PC0 | N/A | 192.168.1.10 | 255.255.255.0 | 192.168.1.1 |
| PC1 | N/A | 192.168.1.11 | 255.255.255.0 | 192.168.1.1 |
| PC2 | N/A | 192.168.2.10 | 255.255.255.0 | 192.168.2.1 |

| | | | | |
|---|---|---|---|---|
| **PC3** | **N/A** | 192.168.2.11 | 255.255.255.0 | 192.168.2.1 |

## Scenario:

In this Experiment, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly. We can use RIP ver1. Till maximum of 16 hop counts.

## Procedure:

**Task 1:** Cable a network that is similar to the one in the topology diagram. Use the appropriate Ethernet Cable to connect between Router and PC's. And between each Router Connect with serial DCE cable by adding WIC-2T card in the each Router.

## Task 2: Perform Basic Configuration of Router R1.

**Step 1:** Establish the Hyper Terminal session to the Router as follows-

Router>enable

Router#configure terminal

Router(config)#

**Step 2:** Assign IP addresses for the respected ethernet interfaces as follows-

### Router 0:

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)#exit

### Router 1:

Router(config)#interface FastEthernet 0/0

Router(config-if)#ip address 192.168.2.1 255.255.255.0

Router(config-if)#no shutdown

Router(config-if)#exit

**Step 3:** Now, give the serial port address for both the routers as shown-

**Router 0:**

Router(config)#interface serial 0/0/0

Router(config-if)#ip address 10.0.0.1 255.0.0.0

Router(config-if)#clock rate 1200

Router(config-if)#bandwidth 64

Router(config-if)#no shutdown

Router(config-if)#exit

**Router 1:**

Router(config)#interface serial 0/0/0

Router(config-if)#ip address 10.0.0.2 255.0.0.0

Router(config-if)#no shutdown

Router(config-if)#exit

**Step 4:** Also assign the Default Gateway address and IP address forPC1,PC2,PC3,PC4 as in the Addressing Table.

**Task 3:** Add the networks passing through each router in RIP ver.1 as below-

**Router 0:**

Router(config)#router rip

Router(config-router)#network 192.168.1.1

Router(config-router)#network 10.0.0.1

Router(config-router)#end

**Router 1:**

Router(config)#router rip

Router(config-router)#network 192.168.2.1

Router(config-router)#network 10.0.0.2

Router(config-router)#end

**Task 4:** Now, check for Interfaces created, by passing the messages from

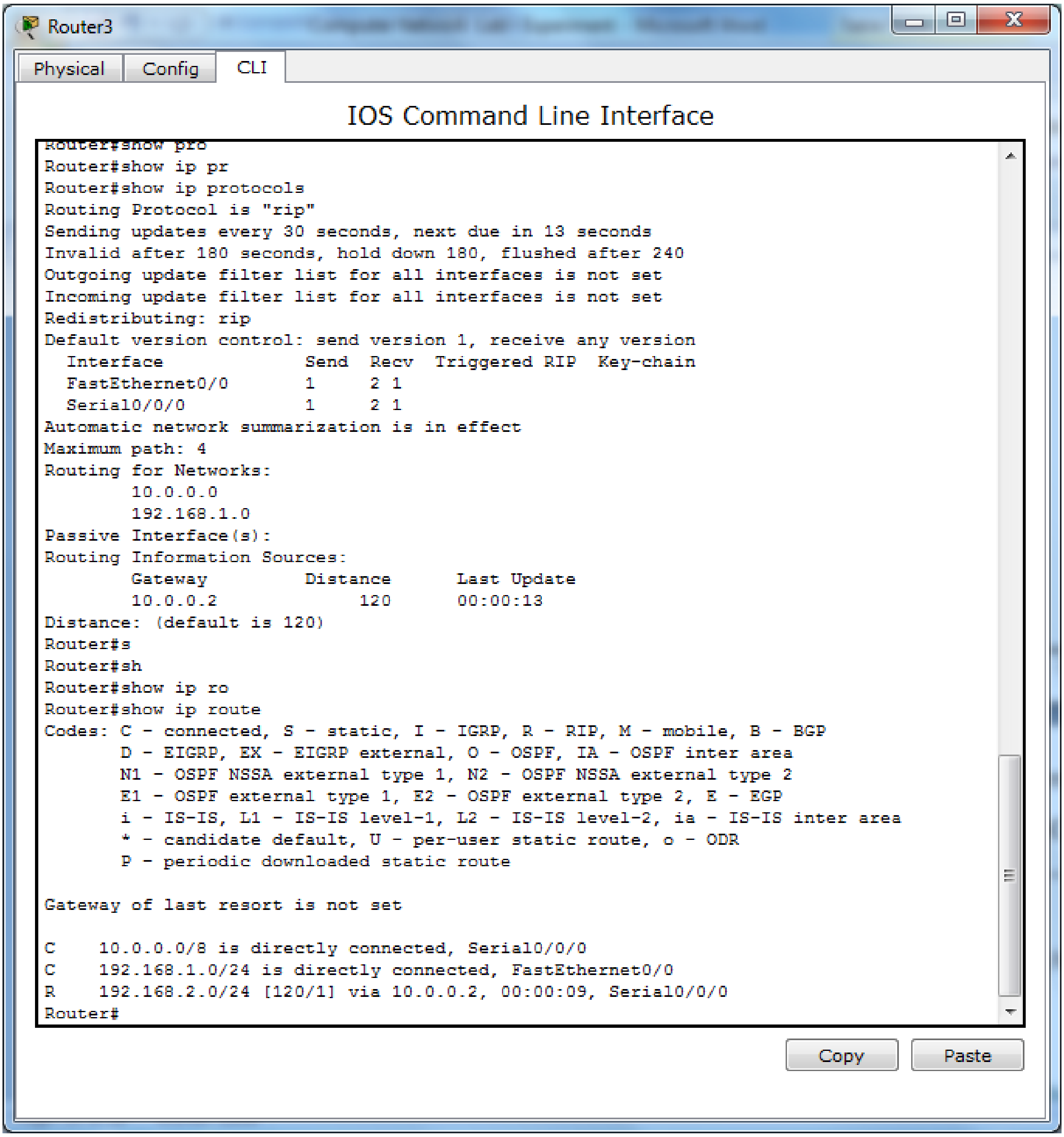
=>PC1->Router,PC2-Router

=>Router->PC1,PC2,

=>PC1->PC2,PC1->PC3/PC4 etc.,

Also, you can go through Simulation mode (auto capture/play) to automatically check the configuration status.

## Output:




## Result:

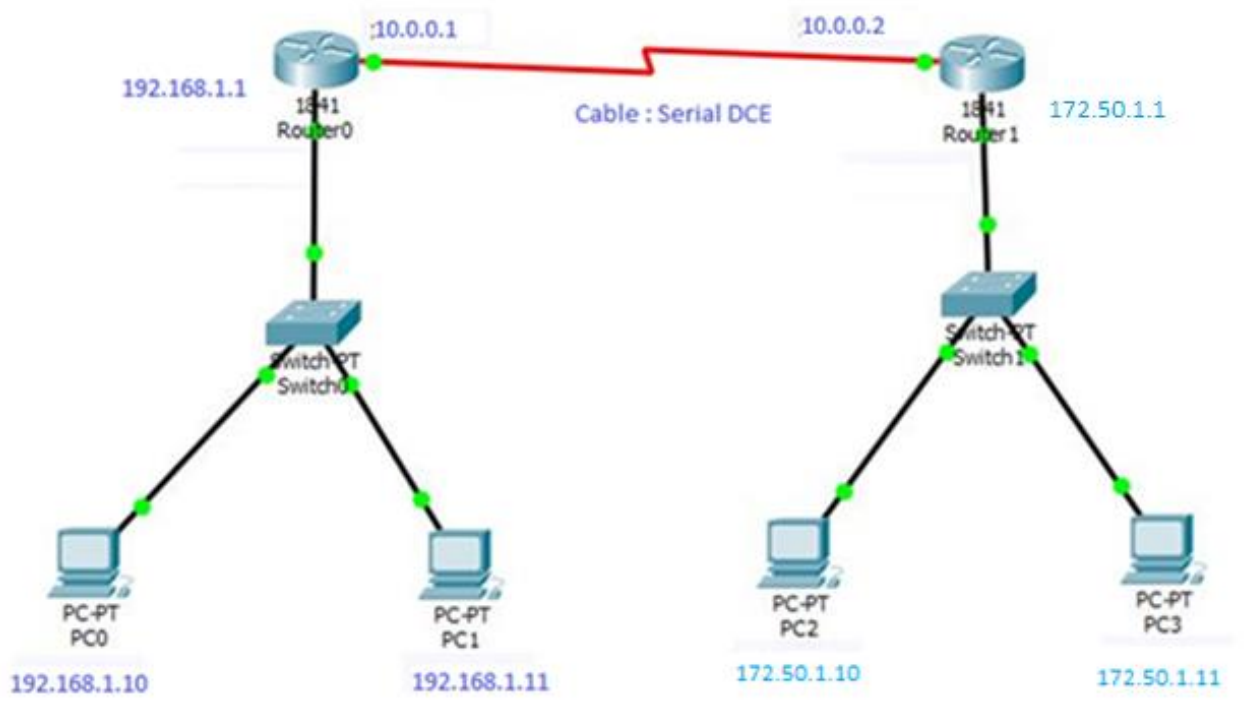
To establish routing configuration with Routing Information Protocol ver.1 is completed successfully.

| EX. No. | 7 | ROUTING INFORMATION PROTOCOL -Version 2 |
|---|---|---|
| DATE | ___/___/2019 | |

## Aim:

To configure routers with RIP ver.2 and to activate the networks with RIP, verify the configuration.

## Topology Diagram:




## Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| R0 | **Fa0/0** | 192.168.10.1 | 255.255.255.192 | N/A |
| | **Se0/1/0** | 10.0.0.1 | 255.255.255.252 | N/A |
| R11 | **Fa0/0** | 172.50.1.1 | 255.255.240.0 | N/A |
| | **Se0/1/1** | 10.0.0.2 | 255.255.255.252 | N/A |
| **PC0** | **N/A** | 192.168.1.10 | 255.255.255.192 | 192.168.10.1 |
| **PC1** | **N/A** | 192.168.1.11 | 255.255.255.192 | 192.168.10.1 |

| | | | | |
|---|---|---|---|---|
| **PC2** | **N/A** | 172.50.1.10 | 255.255.240.0 | 172.50.1.1 |
| **PC3** | **N/A** | 172.50.1.11 | 255.255.240.0 | 172.50.1.1 |

## RIP Version 2

IP Address Calculation

**Router 0:**

<u>Fast Ethernet -fa0/0</u>

IP Address: 192.168.10.1/26

The natural mask is 255.255.255.0

Since the IP address is subnetted as (/26), The Extra bits needed in the prefix notation must be borrowed from the host bits only.

| | | | |
|---|---|---|---|
| 192 | 168 | 10 | 1 |
| 255 | 255 | 255 | 0 |
| 8 bits | 8 bits | 8 bits | 8 bits |

8 bits = $2^7+2^6+2^5+2^4+2^3+2^2+2^1+2^0$

Borrow two most significant bits from the host bits

$2^7+2^6 = 192$

So the new subnet mask calculated is

255.255.255.192

<u>Serial Connection – Se 0/0/0</u>

IP Address: 10.10.10.1/30

The natural mask is 255.0.0.0

Since the IP address is subnetted as (/30), The Extra bits needed in the prefix notation must be borrowed from the host bits only.

| | | | |
|---|---|---|---|
| 10 | 0 | 0 | 1 |
| 255 | 0 | 0 | 0 |
| 8 bits | 8 bits | 8 bits | 8 bits |

8 bits = $2^7+2^6+2^5+2^4+2^3+2^2+2^1+2^0$

Borrow 22 most significant bits from the host bits

22 bits = $(2^7+2^6+2^5+2^4+2^3+2^2+2^1+2^0) + (2^7+2^6+2^5+2^4+2^3+2^2+2^1+2^0) + (2^7+2^6+2^5+2^4+2^3+2^2)$

So the new subnet mask calculated is

255.255.255.252

**Router 1:**

Fast Ethernet -fa0/0

IP Address: 172.50.1.1/20

The natural mask is 255.255.0.0

Since the IP address is subnetted as (/26), The Extra bits needed in the prefix notation must be borrowed from the host bits only.

| | | | |
|---|---|---|---|
| 172 | 50 | 1 | 1 |
| 255 | 255 | 0 | 0 |
| 8 bits | 8 bits | 8 bits | 8 bits |

8 bits = $2^7+2^6+2^5+2^4+2^3+2^2+2^1+2^0$

Borrow four most significant bits from the host bits

$2^7+2^6+2^5+2^4= 240$

So the new subnet mask calculated is

255.255.240.0

## Scenario:

In this Experiment, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly.

We use RIP ver.2 to overcome the count to infinity problem in RIP ver.1.

## Procedure:

**Task 1:** Cable a network that is similar to the one in the topology diagram. Use the appropriate Ethernet Cable to connect between Router and PC's. And between each Router Connect with serial DCE cable by adding WIC-2T card in the each Router.

## Task 2: Perform Basic Configuration of Router R0.

**Step 1:** Establish the Hyper Terminal session to the Router as follows-

Router>enable

Router#configure terminal

Router(config)#

**Step 2:** Assign IP addresses for the respected ethernet interfaces as follows-

### Router 0:

Router(config)#interface FastEthernet 0/0

Router(config-if)#ip address 192.168.10.1 255.255.255.192

Router(config-if)#no shutdown

Router(config-if)#exit

### Router 1:

Router(config)#interface FastEthernet 0/0

Router(config-if)#ip address 172.50.1.1 255.255.240.0

Router(config-if)#no shutdown

Router(config-if)#exit

**Step 3:** Now, give the serial port address for both the routers as shown-

**Router 0:**

Router(config)#interface serial 0/0/0

Router(config-if)#ip address 10.0.0.1 255.255.255.242

Router(config-if)#clock rate 1200

Router(config-if)#bandwidth 64

Router(config-if)#no shutdown

Router(config-if)#exit

**Router 1:**

Router(config)#interface serial 0/0/0

Router(config-if)#ip address 10.0.0.2 255.255.255.242

Router(config-if)#no shutdown

Router(config-if)#exit

**Step 4:** Also assign the Default Gateway address and IP address forPC1,PC2,PC3,PC4 as in the Addressing Table.

**Task 3:** Add the networks passing through each router in RIP ver.2 as below-

**Router 0:**

Router(config)#router rip

Router(config-router)#version 2

Router(config-router)#network 192.168.10.1

Router(config-router)#network 10.0.0.1

Router(config-router)#end

**Router 1:**

Router(config)#router rip

Router(config-router)#version 2

Router(config-router)#network 172.50.1.1

Router(config-router)#network 10.0.0.2

Router(config-router)#end

**Task 4:** Now, check for Interfaces created, by passing the messages from

=>PC1->Router,PC2-Router

=>Router->PC1,PC2,

=>PC1->PC2,PC1->PC3/PC4 etc.,

Also, you can go through Simulation mode (auto capture/play) to automatically check the configuration status.

## Result:

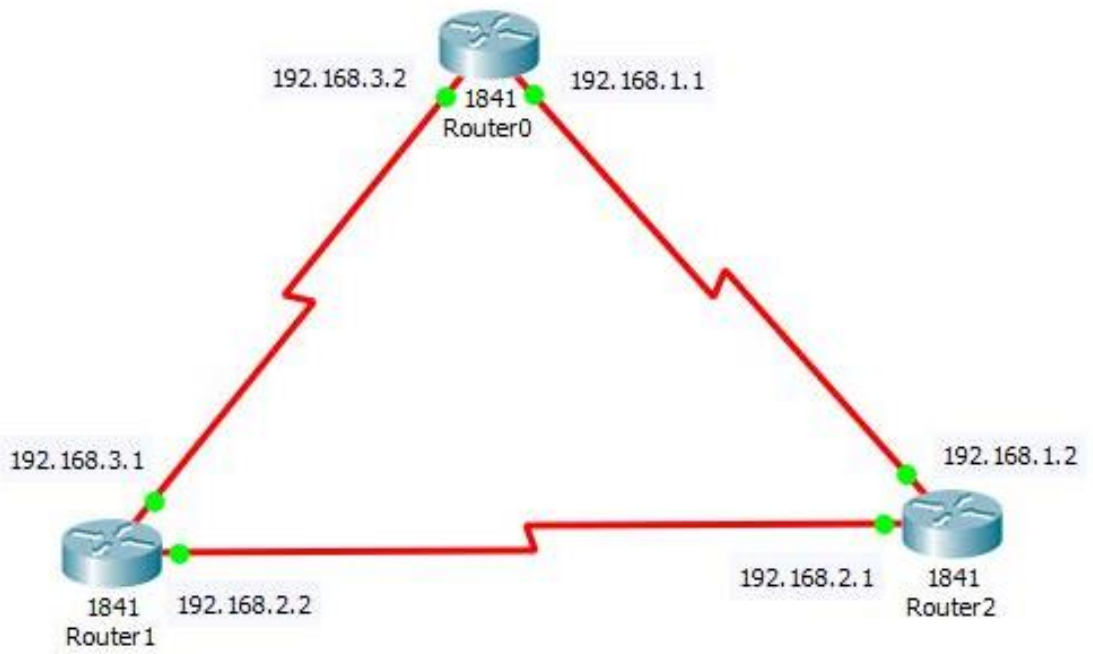
To establish routing configuration with RIP version 2 using 3routers is completed successfully.

| EX. No. | 8 | EIGRP Configuration, Bandwidth, Adjacencies |
|---|---|---|
| DATE | ___/___/2019 | |

## Aim:

To configure Router with EIGRP having bandwidth and adjacencies.

## Topology Diagram:




## Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| **R0** | **Se 0/0/0** | 192.168.1.1 | 255.255.255.0 | N/A |
| | **Se 0/0/1** | 192.168.3.2 | 255.255.255.0 | N/A |
| **R1** | **Se 0/0/0** | 192.168.3.1 | 255.255.255.0 | N/A |
| | **Se 0/0/1** | 192.168.2.2 | 255.255.255.0 | N/A |
| **R2** | **Se 0/0/0** | 192.168.1.2 | 255.255.255.0 | N/A |
| | **Se 0/0/1** | 192.168.2.1 | 255.255.255.0 | N/A |

## Scenario:

In this Experiment, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly.

## Procedure:

**Task 1:** Cable a network that is similar to the one in the topology diagram. Use the appropriate Ethernet Cable to connect the Routers by connecting with serial DCE cable(adding WIC-2T card in each Router).

**Task 2:** Perform Basic Configuration of Router R1.

**Step 1:** Establish the Hyper Terminal session to the Router as follows-

Router>enable

Router#configure terminal

Router(config)#

**Step 2:** Now, give the serial port address for both the routers as shown-

**Router 0:**

Router(config)#interface serial 0/0/0

Router(config-if)#ip address 192.168.1.1 255.255.255.0

Router(config-if)#clock rate 1200

Router(config-if)#bandwidth 64

Router(config-if)#no shutdown

Router(config-if)#exit

Router(config)#interface serial 0/0/1

Router(config-if)#ip address 192.168.3.2 255.255.255.0

Router(config-if)#no shutdown

Router(config-if)#exit

Similarly, do the same for Router 1 and 2

**Task 3:** Assign networks to EIGRP of any autonomous system as follows

Router(config)#router eigrp 44

Router(config-router)#network 192.168.3.2

Router(config-router)#network 192.168.1.1

Router(config-router)#end

**Task 4:** Now, check for Interfaces created, by passing the messages between each router.

Use the following commands to check for eigrp interfaces, neighbors-

Router#show ip protocols

Router#show ip eigrp neighbors

Router#show ip eigrp interfaces

## Output:

IOS Command Line Interface

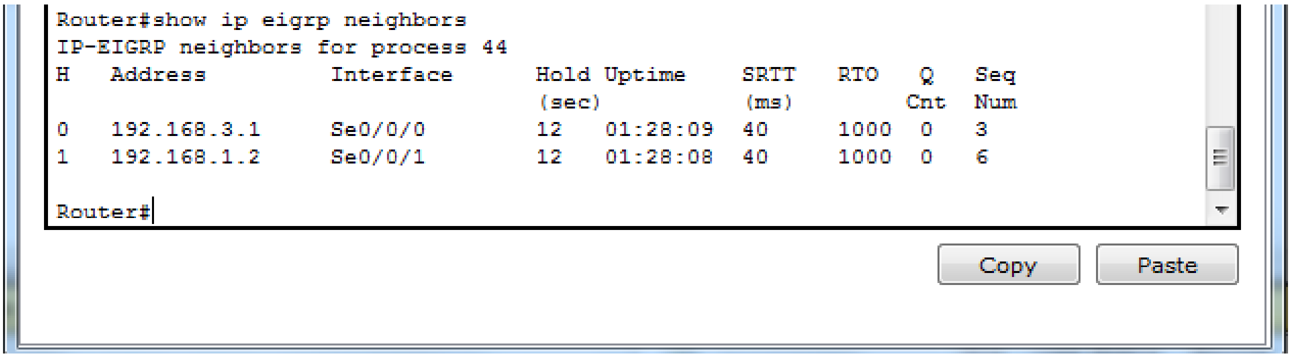
```
Router>enable
Router#show ip eigrp interfaces
IP-EIGRP interfaces for process 44

                        Xmit Queue   Mean   Pacing Time   Multicast    Pending
Interface        Peers  Un/Reliable  SRTT   Un/Reliable   Flow Timer   Routes
Se0/1/0            1        0/0      1236       0/10           0           0
Se0/1/1            1        0/0      1236       0/10           0           0
Router#show ip eigrp neighbors
IP-EIGRP neighbors for process 44
H   Address         Interface      Hold Uptime    SRTT   RTO   Q   Seq
                                   (sec)          (ms)        Cnt  Num
0   192.168.1.2     Se0/1/0        13   00:00:56  40     1000  0   3
1   192.168.3.1     Se0/1/1        14   00:00:51  40     1000  0   4

Router#show ip protocols

Routing Protocol is "eigrp  44 "
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  EIGRP maximum hopcount 100
  EIGRP maximum metric variance 1
Redistributing: eigrp 44
  Automatic network summarization is in effect
  Automatic address summarization:
  Maximum path: 4
  Routing for Networks:
     192.168.1.0
     192.168.3.0
  Routing Information Sources:
    Gateway         Distance      Last Update
    192.168.1.2     90            5065
    192.168.3.1     90            9179
  Distance: internal 90 external 170
```

Copy Paste



```
Router#show ip eigrp neighbors
IP-EIGRP neighbors for process 44
H   Address         Interface      Hold Uptime    SRTT   RTO   Q    Seq
                                   (sec)          (ms)         Cnt  Num
0   192.168.3.1     Se0/0/0        12   01:28:09  40     1000  0    3
1   192.168.1.2     Se0/0/1        12   01:28:08  40     1000  0    6

Router#
```



## Result:

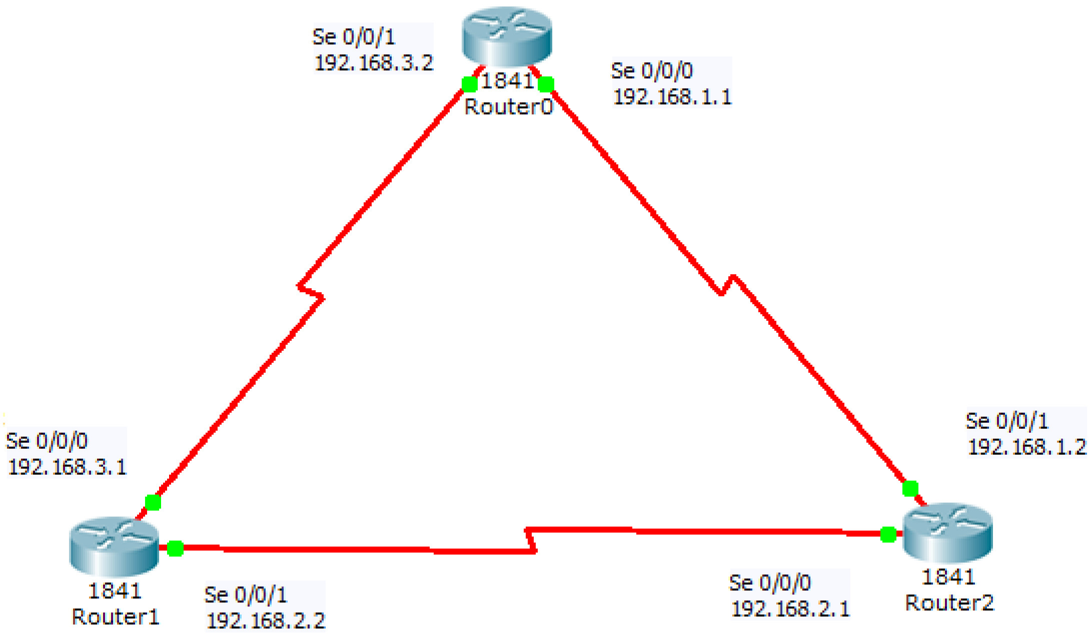
EIGRP configuration of Routers with Bandwidth and Adjacencies is established successfully

| EX. No. | 9 | EIGRP Authentication and Timers |
|---|---|---|
| DATE | ___/___/2019 | |

## Aim:

To perform routers with basic EIGRP and to configure EIGRP with authentication keys, link authentication. Also manipulate EIGRP Timers.

## Topology Diagram:




### Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| R0 | **Se0/0/0** | 192.168.1.1 | 255.255.255.0 | N/A |
| | **Se0/0/1** | 192.168.3.2 | 255.255.255.0 | N/A |
| R1 | **Se0/0/0** | 192.168.3.1 | 255.255.255.0 | N/A |
| | **Se0/0/1** | 192.168.2.2 | 255.255.255.0 | N/A |
| R2 | **Se0/0/0** | 192.168.2.1 | 255.255.255.0 | N/A |
| | **Se0/0/1** | 192.168.1.2 | 255.255.255.0 | N/A |

## Scenario:

In this Experiment, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly.

## Procedure:

**Task 1:** Cable a network that is similar to the one in the topology diagram. Use the appropriate Ethernet Cable to connect the Routers by connecting with serial DCE cable(adding WIC-2T card in each Router).

**Task 2: Perform Basic Configuration of Router R1.**

**Step 1:** Establish the Hyper Terminal session to the Router as follows-

Router>enable

Router#configure terminal

Router(config)#

**Step 2:** Now, give the serial port address for both the routers as shown-

**Router 0:**

Router(config)#interface serial 0/1/0

Router(config-if)#ip address 192.168.1.1 255.255.255.0

Router(config-if)#clock rate 1200

Router(config-if)#bandwidth 64

Router(config-if)#no shutdown

Router(config-if)#exit

Router(config)#interface serial 0/1/1

Router(config-if)#ip address 192.168.3.2 255.255.255.0

Router(config-if)#no shutdown

Router(config-if)#exit

Similarly, do the same for Router 1 and 2

**Task 3:** Perform basic eigrp configuration as follows -

Router(config)#router eigrp 44

Router(config-router)#network 192.168.3.2

Router(config-router)#network 192.168.1.1

Router(config-router)#end

**Task 4:EIGRP Authentication and modify EIGRP timers,**

**Step 1:** Now, Configure Authentication keysfor all routers as follows –

Router (config)#key chain my_chain

Router (config-keychain)#key 2

Router (config-keychain-key)#key-string abc

Router (config-keychain-key)#end

**Step 2:** Also, configure EIGRP link authentication to all serial ports in each router-

Router(config)#int se 0/1/0

Router(config-if)#ip **authentication key-chain eigrp 20 my_chain**

Router(config-if)#ip authentication mode eigrp 20 md5

Router(config-if)#exit

Router(config)#int se 0/1/1

Router(config-if)#ip authentication key-chain eigrp 20 my_chain

Router(config-if)#ip authentication mode eigrp 20 md5

Router(config-if)#end

**Task 6:** Now, check for Interfaces created, by passing the messages between each router.Use the following commands to check for eigrp interfaces, neighbors and to debug the EIGRP packets.

Router#show ip protocols

Router#show ip eigrp interfaces

Router#debug eigrp packets

```
Router#show ip protocols

Routing Protocol is "eigrp  44 "
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  Redistributing: eigrp 44
  EIGRP-IPv4 Protocol for AS(44)
    Metric weight K1=1, K2=0, K3=1, K4=0, K5=0
    NSF-aware route hold timer is 240
    Router-ID: 192.168.2.1
    Topology : 0 (base)
      Active Timer: 3 min
      Distance: internal 90 external 170
      Maximum path: 4
      Maximum hopcount 100
      Maximum metric variance 1

  Automatic Summarization: disabled
  Automatic address summarization:
  Maximum path: 4
  Routing for Networks:
     192.168.1.0
     192.168.2.0
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: internal 90 external 170

Router#
Router#
```

```
Router#show ip eigrp interfaces
IP-EIGRP interfaces for process 44

                        Xmit Queue   Mean   Pacing Time   Multicast    Pending
Interface        Peers  Un/Reliable  SRTT   Un/Reliable   Flow Timer   Routes
Se0/0/1            0        0/0      1236       0/10           0           0
Router#
```

IOS Command Line Interface

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

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


Router>enable
Router#show ip eigrp interfaces
IP-EIGRP interfaces for process 44

                        Xmit Queue   Mean   Pacing Time   Multicast    Pending
Interface        Peers  Un/Reliable  SRTT   Un/Reliable   Flow Timer   Routes
Se0/1/0            0        0/0      1236       0/10           0           0
Se0/1/1            0        0/0      1236       0/10           0           0
Router#
Router#debug eigrp packets
EIGRP Packets debugging is on
    (UPDATE, REQUEST, QUERY, REPLY, HELLO, ACK )
Router#
EIGRP: Sending HELLO on Serial0/1/1
  AS 44, Flags 0x0, Seq 1/0 idbQ 0/0 iidbQ un/rely 0/0

EIGRP: Received packet with MD5 authentication, key id = 2

EIGRP: Received HELLO on Serial0/1/1 nbr 192.168.3.1
  AS 44, Flags 0x0, Seq 1/0 idbQ 0/0

EIGRP: Received packet with MD5 authentication, key id = 2

EIGRP: Received HELLO on Serial0/1/0 nbr 192.168.1.2
  AS 44, Flags 0x0, Seq 1/0 idbQ 0/0

EIGRP: Sending HELLO on Serial0/1/0
  AS 44, Flags 0x0, Seq 1/0 idbQ 0/0 iidbQ un/rely 0/0

EIGRP: Sending HELLO on Serial0/1/1
  AS 44, Flags 0x0, Seq 1/0 idbQ 0/0 iidbQ un/rely 0/0
```

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## Result:

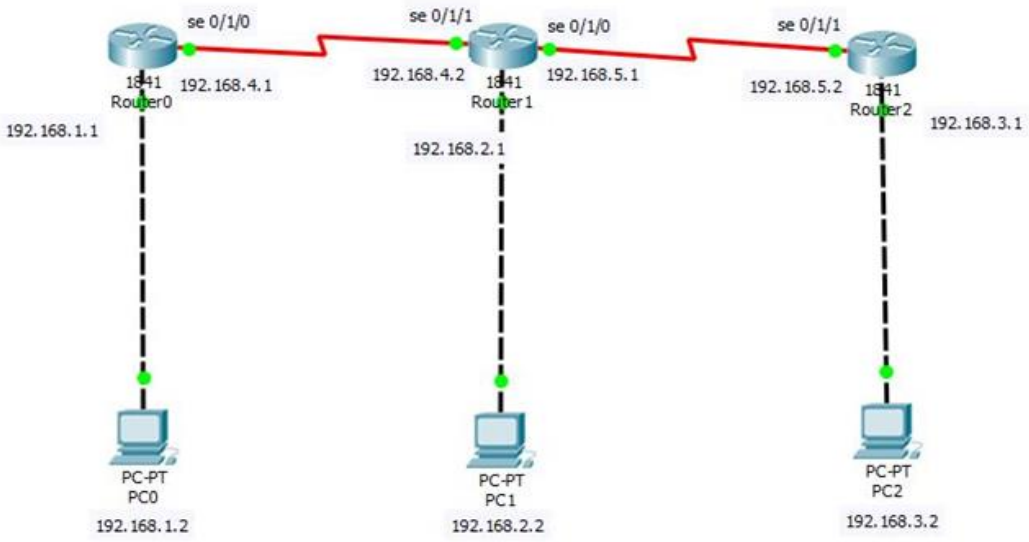
Configure routers with basic EIGRP and to configure EIGRP with authentication keys, link authentication, manipulate EIGRP timers is established successfully.

| EX. No. | 10 | Single-Area OSPF Link Costs and Interface |
|---|---|---|
| DATE | ___/___/2019 | |

## Aim:

To configure Router with Single-Area OSPF (Open Shortest Path First), and to get the link costs of each router.

## Topology Diagram:




## Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| **R0** | **Fa0/0** | 192.168.1.1 | 255.255.255.0 | N/A |
| | **Se0/0/0** | 192.168.4.1 | 255.255.255.0 | N/A |
| **R1** | **Fa0/0** | 192.168.2.1 | 255.255.255.0 | N/A |
| | **Se0/0/0** | 192.168.5.1 | 255.255.255.0 | N/A |
| | **Se0/0/1** | 192.168.4.2 | 255.255.255.0 | N/A |
| **R2** | **Fa0/0** | 192.168.3.1 | 255.255.255.0 | N/A |
| | **Se0/0/0** | 192.168.6.1 | 255.255.255.0 | N/A |
| **PC0** | **N/A** | 192.168.1.2 | 255.255.255.0 | 192.168.1.1 |
| **PC1** | **N/A** | 192.168.2.2 | 255.255.255.0 | 192.168.2.1 |

| | | | | |
|---|---|---|---|---|
| **PC2** | **N/A** | 192.168.3.2 | 255.255.255.0 | 192.168.3.1 |

**Scenario:**

In this Experiment, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly.

## Procedure:

**Task 1:** Cable a network that is similar to the one in the topology diagram. Use the appropriate Ethernet Cable to connect the Router and PC's and between each Router connect serial DCE cable(adding WIC-2T card in each Router).

**Task 2: Perform Basic Configuration of Router R1.**

**Step 1:** Establish the Hyper Terminal session to the Router as follows-

Router>enable

Router#configure terminal

Router(config)#

**Step 2:** Now, give the serial port address for both the routers as shown-

**Router 0:**

Router(config)#interface FastEthernet 0/0

Router(config-if)#ip address 192.168.1.1 255.255.255.0

Router(config-if)#exit

Router(config)#interface serial 0/0/0

Router(config-if)#ip address 192.168.4.1 255.255.255.0

Router(config-if)#clock rate 1200

Router(config-if)#bandwidth 64

Router(config-if)#no shutdown

Router(config-if)#exit

Similarly, do the same for Router 1 and 2

**Task 3:** Assign networks to OSPF with same area 0 along with wild-mask address ( example-for class A address the wild mask is 0.0.0.255) for all routers as follows-

**Router 0:**

Router(config)#router ospf 50

Router(config-router)#network 192.168.4.1 0.0.0.255 area 0

Router(config-router)#network 192.168.1.1 0.0.0.255 area 0

Router(config-router)#end

**Router 1:**

Router(config)#router ospf 50

Router(config-router)#network 192.168.4.2 0.0.0.255 area 0

Router(config-router)#network 192.168.2.1 0.0.0.255 area 0

Router(config-router)#network 192.168.5.1 0.0.0.255 area 0

Router(config-router)#end

**Router 2:**

Router(config)#router ospf 50

Router(config-router)#network 192.168.5.2 0.0.0.255 area 0

Router(config-router)#network 192.168.3.1 0.0.0.255 area 0

Router(config-router)#end

**Task 4:**Now, check for Interfaces created, by passing the messages between each router. Use the following commands to check for ospf interfaces, database to get link count of each network.

Router#show ip route ospf

Router#show ip ospf interface

Router#show ip ospf database

IOS Command Line Interface

```
Router#show ip ospf database
            OSPF Router with ID (192.168.4.1) (Process ID 45)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
192.168.4.1     192.168.4.1     109         0x80000003 0x00de42 3
192.168.5.1     192.168.5.1     20          0x80000005 0x009a94 5
192.168.5.2     192.168.5.2     21          0x80000003 0x0023f4 3
Router#
Router#show ip route ospf
O    192.168.2.0 [110/65] via 192.168.4.2, 00:03:11, Serial0/1/0
O    192.168.3.0 [110/129] via 192.168.4.2, 00:02:02, Serial0/1/0
O    192.168.5.0 [110/128] via 192.168.4.2, 00:03:22, Serial0/1/0

Router#show ip ospf interface

FastEthernet0/0 is up, line protocol is up
  Internet address is 192.168.1.1/24, Area 0
  Process ID 45, Router ID 192.168.4.1, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.4.1, Interface address 192.168.1.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:04
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
Serial0/1/0 is up, line protocol is up
  Internet address is 192.168.4.1/24, Area 0
  Process ID 45, Router ID 192.168.4.1, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
```

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**Task 5: Ping and Trace commands :**

Router#ping 192.168.3.2

Router#trace 192.168.3.2

**(A) In CLI Mode**(Tracing to PC3):

IOS Command Line Interface

```
Router#
Router#
Router#trace 192.168.3.12
Type escape sequence to abort.
Tracing the route to 192.168.3.12

  1   192.168.4.2     8 msec    0 msec    1 msec
  2   192.168.5.2     0 msec    6 msec    0 msec
  3   192.168.3.12    3 msec    0 msec    1 msec
Router#ping 192.168.3.12

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.3.12, timeout is 2
seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max =
2/7/27 ms

Router#
Router#
```

## (B) In Command Prompt:

Command Prompt

```
Packet Tracer PC Command Line 1.0
C:\>ping 192.168.2.12

Pinging 192.168.2.12 with 32 bytes of data:

Request timed out.
Reply from 192.168.2.12: bytes=32 time=1ms TTL=126
Reply from 192.168.2.12: bytes=32 time=1ms TTL=126
Reply from 192.168.2.12: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.2.12:
    Packets: Sent = 4, Received = 3, Lost = 1 (25% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 1ms, Average = 1ms

C:\>
```

## Result:

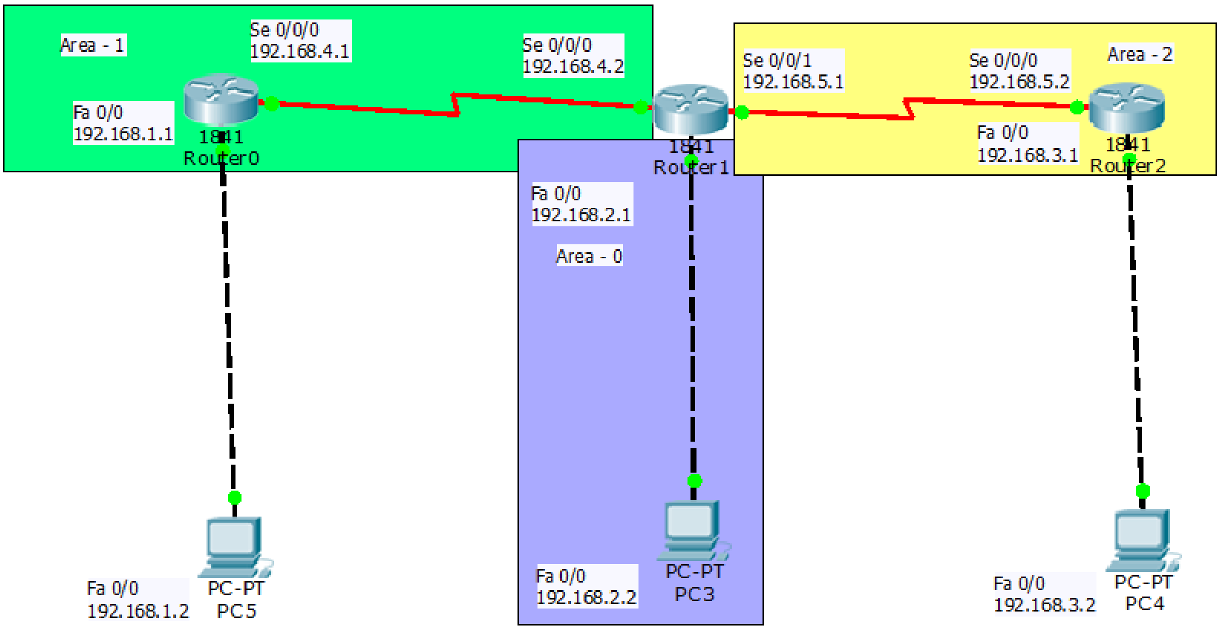
Thus, configured Router with Single-Area OSPF (Open Shortest Path First), and to got the link costs of each router is completed successfully.

| EX. No. | 11 | Multi-Area OSPF With Stub Areas and Authentication |
|---|---|---|
| DATE | ___/___/2019 | |

## Aim:

To configure Router with Multi-Area OSPF(open shortest path first), and to authenticate each router.

## Topology Diagram:




## Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| R0 | Fa0/0 | 192.168.1.1 | 255.255.255.0 | N/A |
| | Se0/0/0 | 192.168.4.1 | 255.255.255.0 | N/A |
| R1 | Fa0/0 | 192.168.2.1 | 255.255.255.0 | N/A |
| | Se0/0/0 | 192.168.5.1 | 255.255.255.0 | N/A |
| | Se0/0/1 | 192.168.4.2 | 255.255.255.0 | N/A |
| R2 | Fa0/0 | 192.168.3.1 | 255.255.255.0 | N/A |
| | Se0/0/0 | 192.168.6.1 | 255.255.255.0 | N/A |
| PC0 | N/A | 192.168.1.2 | 255.255.255.0 | 192.168.1.2 |

| | | | | |
|---|---|---|---|---|
| **PC1** | **N/A** | 192.168.2.2 | 255.255.255.0 | 192.168.1.2 |
| **PC2** | **N/A** | 192.168.3.2 | 255.255.255.0 | 192.168.1.2 |

## Scenario:

In this Experiment, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly.

## Procedure:

**Task 1:** Cable a network that is similar to the one in the topology diagram. Use the appropriate Ethernet Cable to connect the Router and PC's and between each Router connect serial DCE cable(adding WIC-2T card in each Router).

**Task 2: Perform Basic Configuration of Router R1.**

**Step 1:** Establish the Hyper Terminal session to the Router as follows-

Router>enable

Router#configure terminal

Router(config)#

**Step 2:** Now, give the serial port address for both the routers as shown-

**Router 0:**

Router(config)#interface FastEthernet 0/0

Router(config-if)#ip address 192.168.1.1 255.255.255.0

Router(config-if)#exit

Router(config)#interface serial 0/0/0

Router(config-if)#ip address 192.168.4.1 255.255.255.0

Router(config-if)#clock rate 1200

Router(config-if)#bandwidth 64

Router(config-if)#no shutdown

Router(config-if)#exit

Similarly, do the same for Router 1 and 2

**Task 3:** Assign networks to OSPF with same area 0 along with wild-mask address ( example-for class A address the wild mask is 0.0.0.255)for all routers as follows-

**Router 0:**

Router(config)#router ospf 50

Router(config-router)#network 192.168.4.1 0.0.0.255 area 1

Router(config-router)#network 192.168.1.1 0.0.0.255 area 1

Router(config-router)#end

**Router 1:**

Router(config)#router ospf 50

Router(config-router)#network 192.168.4.2 0.0.0.255 area 1

Router(config-router)#network 192.168.2.1 0.0.0.255 area 0

Router(config-router)#network 192.168.5.1 0.0.0.255 area 2

Router(config-router)#end

**Router 2:**

Router(config)#router ospf 50

Router(config-router)#network 192.168.5.2 0.0.0.255 area 2

Router(config-router)#network 192.168.3.1 0.0.0.255 area 2

Router(config-router)#end

The areas of OSPF networks are given in each router as mentionedabove.

**Task 4:** Now, check for Interfaces created, by passing the messages between each router. Use the following commands to check for ospf interfaces, database to get link count of each network.

## (A) DISPLAY THE ROUTES:

```
00:00:10: %OSPF-5-ADJCHG: Process 45, Nbr 192.168.5.1 on Serial0/1/1 from LOADING to
FULL, Loading Done


Router>enable
Router#show ip route ospf
O IA 192.168.1.0 [110/129] via 192.168.5.1, 00:11:15, Serial0/1/1
O IA 192.168.2.0 [110/65] via 192.168.5.1, 00:11:25, Serial0/1/1
O IA 192.168.4.0 [110/128] via 192.168.5.1, 00:11:15, Serial0/1/1

Router#show ip ospf database
            OSPF Router with ID (192.168.6.1) (Process ID 45)

                Router Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum Link count
192.168.6.1     192.168.6.1     722         0x80000004 0x001ff7 3
192.168.5.1     192.168.5.1     722         0x80000002 0x004e49 2

                Summary Net Link States (Area 2)
Link ID         ADV Router      Age         Seq#       Checksum
192.168.2.0     192.168.5.1     717         0x80000001 0x0096ec
192.168.4.0     192.168.5.1     707         0x80000002 0x00f64a
192.168.1.0     192.168.5.1     707         0x80000003 0x002022
Router#
```

## (B) DISPLAY INTERFACES:

```
Router#show ip ospf interface

FastEthernet0/0 is up, line protocol is up
  Internet address is 192.168.1.1/24, Area 1
  Process ID 24, Router ID 192.168.6.2, Network Type BROADCAST, Cost: 1
  Transmit Delay is 1 sec, State DR, Priority 1
  Designated Router (ID) 192.168.6.2, Interface address 192.168.1.1
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:02
  Index 1/1, flood queue length 0
  Next 0x0(0)/0x0(0)
  Last flood scan length is 1, maximum is 1
  Last flood scan time is 0 msec, maximum is 0 msec
  Neighbor Count is 0, Adjacent neighbor count is 0
  Suppress hello for 0 neighbor(s)
Serial0/1/0 is up, line protocol is up
  Internet address is 192.168.4.1/24, Area 1
  Process ID 24, Router ID 192.168.6.2, Network Type POINT-TO-POINT, Cost: 64
  Transmit Delay is 1 sec, State POINT-TO-POINT, Priority 0
  No designated router on this network
  No backup designated router on this network
  Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
 --More--
```

## (C) DISPLAY DATABASE:

Router 1:

```
IOS Command Line Interface
Router#
Router#show ip ospf database
            OSPF Router with ID (192.168.5.1) (Process ID 86)

                Router Link States (Area 0)

Link ID         ADV Router      Age         Seq#       Checksum Link count
192.168.5.1     192.168.5.1     601         0x80000002 0x007097 1

                Summary Net Link States (Area 0)
Link ID         ADV Router      Age         Seq#       Checksum
192.168.5.0     192.168.5.1     587         0x80000001 0x00ed53
192.168.3.0     192.168.5.1     582         0x80000002 0x000c35
192.168.4.0     192.168.5.1     577         0x80000003 0x00f44b
192.168.1.0     192.168.5.1     577         0x80000004 0x001e23

                Router Link States (Area 1)

Link ID         ADV Router      Age         Seq#       Checksum Link count
192.168.5.1     192.168.5.1     592         0x80000003 0x004254 2
192.168.6.2     192.168.6.2     591         0x80000004 0x00a871 3

                Summary Net Link States (Area 1)
Link ID         ADV Router      Age         Seq#       Checksum
192.168.2.0     192.168.5.1     587         0x80000001 0x0096ec
192.168.5.0     192.168.5.1     587         0x80000002 0x00eb54
192.168.3.0     192.168.5.1     582         0x80000003 0x000a36

                Router Link States (Area 2)

Link ID         ADV Router      Age         Seq#       Checksum Link count
192.168.5.1     192.168.5.1     592         0x80000002 0x004e49 2
192.168.6.1     192.168.6.1     592         0x80000004 0x001ff7 3

                Summary Net Link States (Area 2)
Link ID         ADV Router      Age         Seq#       Checksum
192.168.2.0     192.168.5.1     587         0x80000001 0x0096ec
192.168.4.0     192.168.5.1     577         0x80000002 0x00f64a
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```

Router 0:

```
                Router Link States (Area 1)

Link ID         ADV Router      Age         Seq#       Checksum Link count
192.168.6.2     192.168.6.2     410         0x80000004 0x00a871 3
192.168.5.1     192.168.5.1     410         0x80000003 0x004254 2

                Summary Net Link States (Area 1)
Link ID         ADV Router      Age         Seq#       Checksum
192.168.2.0     192.168.5.1     405         0x80000001 0x0096ec
192.168.5.0     192.168.5.1     405         0x80000002 0x00eb54
192.168.3.0     192.168.5.1     400         0x80000003 0x000a36
Router#
```

## (D)Ping Command in command prompt:

```
Command Prompt                                                    X

Packet Tracer PC Command Line 1.0
C:\>ping 192.168.3.12

Pinging 192.168.3.12 with 32 bytes of data:

Reply from 192.168.3.12: bytes=32 time=15ms TTL=126
Reply from 192.168.3.12: bytes=32 time=1ms TTL=126
Reply from 192.168.3.12: bytes=32 time=1ms TTL=126
Reply from 192.168.3.12: bytes=32 time=1ms TTL=126

Ping statistics for 192.168.3.12:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 15ms, Average = 4ms

C:\>
```

## Result:

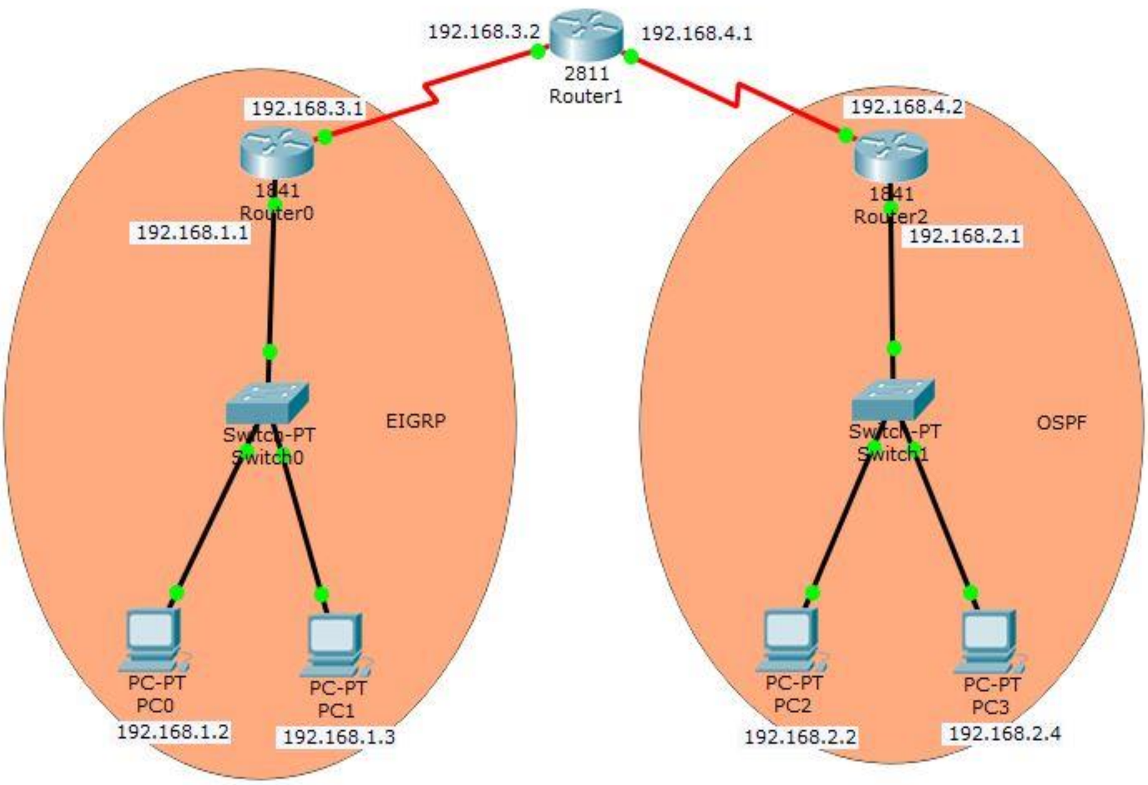
To configure Router with Multi-Area OSPF(Open Shortest Path First), and to authenticate each router is completed successfully.

| EX. No. | 12 | Redistribution Between Eigrp and OSPF |
|---|---|---|
| DATE | ___/___/2019 | |

## Aim:

To establish a connection between the routers and pc's with both eigrp and ospf

## Topology Diagram:




## Addressing Table:

| Device | Interface | IP address | Subnet Mask | Def. Gateway |
|---|---|---|---|---|
| R0 | **Fa0/0** | 192.168.1.1 | 255.255.255.0 | N/A |
| | **Se0/0/0** | 192.168.3.1 | 255.255.255.0 | N/A |
| R2 | **Fa0/0** | 192.168.2.1 | 255.255.255.0 | N/A |
| | **Se0/0/1** | 192.168.4.2 | 255.255.255.0 | N/A |
| R1 | **Se0/0/0** | 192.168.4.1 | 255.255.255.0 | N/A |
| | **Se0/0/1** | 192.168.3.2 | 255.255.255.0 | N/A |

| | | | | |
|---|---|---|---|---|
| **PC0** | **N/A** | 192.168.1.2 | 255.255.255.0 | 192.168.1.1 |
| **PC1** | **N/A** | 192.168.1.3 | 255.255.255.0 | 192.168.1.1 |
| **PC2** | **N/A** | 192.168.2.2 | 255.255.255.0 | 192.168.1.1 |
| **PC3** | **N/A** | 192.168.2.4 | 255.255.255.0 | 192.168.1.1 |

## Scenario:

In this Experiment, you will create a network that is similar to the one shown in the Topology Diagram. Begin by cabling the network as shown in the Topology Diagram. You will then perform the initial router configurations required for connectivity. Use the IP addresses that are provided in the Topology Diagram to apply an addressing scheme to the network devices. When the network configuration is complete, examine the routing tables to verify that the network is operating properly.

-Use Router 2811 for redistribution, and redistribution is done in router 2811 only.

## Procedure:

**Task 1:** Cable a network that is similar to the one in the topology diagram. Use the appropriate Ethernet Cable to connect the Router and PC's and between each Router connect serial DCE cable(adding WIC-2T card in each Router).

**Task 2: Perform Basic Configuration of Router R1.**

**Step 1:** Establish the Hyper Terminal session to the Router as follows-

Router>enable

Router#configure terminal

Router(config)#

**Step 2:** Now, give the serial port address for both the routers as shown-

**Router 0:**

Router(config)#interface FastEthernet 0/0

Router(config-if)#ip address 192.168.1.1 255.255.255.0

Router(config-if)#exit

Router(config)#interface serial 0/0/0

Router(config-if)#ip address 192.168.4.1 255.255.255.0

Router(config-if)#clock rate 1200

Router(config-if)#bandwidth 64

Router(config-if)#no shutdown

Router(config-if)#exit

**Router 1:**

Router(config)#interface serial 0/0/0

Router(config-if)#ip address 192.168.4.1 255.255.255.0

Router(config-if)#clock rate 1200

Router(config-if)#bandwidth 64

Router(config-if)#no shutdown

Router(config-if)#exit

Router(config)#interface serial 0/0/1

Router(config-if)#ip address 192.168.3.2 255.255.255.0

Router(config-if)#no shutdown

Router(config-if)#exit

**Router 2:**

Router(config)#interface FastEthernet 0/0

Router(config-if)#ip address 192.168.2.1 255.255.255.0

Router(config-if)#exit

Router(config)#interface serial 0/1/1

Router(config-if)#ip address 192.168.4.2 255.255.255.0

Router(config-if)#no shutdown

Router(config-if)#exit

**Task 3:** Assign networks to OSPF for Router 0, EIGRP networks for Router 2

And both configurations for router 1

**Router 0:**

Router(config)#router eigrp 20

Router(config-router)#network 192.168.3.1

Router(config-router)#network 192.168.1.1

Router(config-router)#end

**Router 1:**

Router(config)#router ospf 10

Router(config-router)#network 192.168.3.2 0.0.0.255 area 0

Router(config-router)#network 192.168.4.1 0.0.0.255 area 0

Router(config-router)#exit

Router(config)#router eigrp 20

Router(config-router)#network 192.168.3.2

Router(config-router)#network 192.168.4.1

Router(config-router)#end

**Router 2:**

Router(config)#router ospf 10

Router(config-router)#network 192.168.4.2 0.0.0.255 area 0

Router(config-router)#network 192.168.2.1 0.0.0.255 area 0

Router(config-router)#end

**Task 4: Redistribute eigrp and ospf in router 1(<u>2811</u>):**

Router(config)#route eigrp 20

Router(config-router)#redistribute ospf 10 metric ?

<1-4294967295> Bandwidth metric in Kbits per second

Router(config-router)#redistribute ospf 10 metric 1000 ?

Router(config-router)#redistribute ospf 10 metric 1000 100 ?

Router(config-router)#redistribute ospf 10 metric 1000 100 20 ?

Router(config-router)#redistribute ospf 10 metric 1000 100 20 20 ?

Router(config-router)#redistribute ospf 10 metric 1000 100 20 20 100

Router(config-router)#exit

Router(config)#route ospf 10

Router(config-router)#redistribute eigrp 20 ?

Router(config-router)#redistribute eigrp 20 metric ?

Router(config-router)#redistribute eigrp 20 metric ?

Router(config-router)#redistribute eigrp 20 metric 1000 ?

Router(config-router)#redistribute eigrp 20 metric 1000 subnets

Router(config-router)#exit

**Task 5:** Now, check for the connections established by sending messages between Routers and PC's

**Display Command:** show ip protocols

IOS Command Line Interface

```
Router>
Router>show ip protocols

Routing Protocol is "eigrp  44 "
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Default networks flagged in outgoing updates
  Default networks accepted from incoming updates
  EIGRP metric weight K1=1, K2=0, K3=1, K4=0, K5=0
  EIGRP maximum hopcount 100
  EIGRP maximum metric variance 1
Redistributing: eigrp 44, ospf 45
  Automatic network summarization is in effect
  Automatic address summarization:
  Maximum path: 4
  Routing for Networks:
     198.168.3.0
     198.168.4.0
  Routing Information Sources:
    Gateway         Distance      Last Update
  Distance: internal 90 external 170


Routing Protocol is "ospf 45"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 198.168.4.1
  It is an autonomous system boundary router
  Redistributing External Routes from,
    eigrp 44
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    198.168.3.0 0.0.0.255 area 0
    198.168.4.0 0.0.0.255 area 0
  Routing Information Sources:
    Gateway         Distance      Last Update
    198.168.4.1          110      00:20:26
  Distance: (default is 110)

Router>
```

## Result:

Connections are established between Routers and PC’s, redistribution between EIGRP and OSPF is done successfully.