

Implementing and Administering Cisco Solutions [CCNA 200-301]

Thesis dissertation submitted in the partial fulfilment of the requirements for the award
of the course completion of

Implementing and Administering Cisco Solutions In Jetking - Masters in Network Administration [JK-MNA]

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Declaration Certificate

This is to certify that **Y. Rohit sai**, bearing **Roll no:10087**, a student of **JK-MNA Batch-2122-KY-1943**, has done his project and submitted to the Faculty **D.Nikhil Duth**. The project work entitled **“Implementing and Administering Cisco Solutions [CCNA]”** done by **Y. Rohit sai** during his training period of **module 2**.

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Abbreviations & Full forms:

ACL	:	Access Control List
ARP	:	Address Resolution Protocol
BPDU	:	Broadcast Protocol Datagram unit
CAN	:	Campus Area Network
CPU	:	Central Processing Unit
CRC	:	Cyclic Redundancy Check
CAM	:	Content Addressable Memory
CCNA	:	Cisco Certified Network Associate
DHCP	:	Dynamic Host Configuration Protocol
DNS	:	Domain Name Service
DNS	:	Domain Name Service
DAI	:	Dynamic ARP Inspection
DDOS	:	Distribute Denial of Service
DOS	:	Denial Of Service
EIGRP	:	Enhanced interior Gateway Routing Protocol
EGP	:	External Gateway Protocol
FTP	:	File Transfer Protocol
FTPS	:	File Transfer Protocol over Protocol
FQDN	:	Fully Qualified Domain Name
FCS	:	Frame Check Sequence
GARP	:	Gratuitous Address Resolution Protocol
HTTP	:	Hyper Text Transfer Protocol
HRC	:	Horizontal redundancy Check
HTTPS	:	Hyper Text Transfer Protocol Secured
IGP	:	Internal Gateway Protocol
IOS	:	Interworking Operating System
ICMP	:	Internet Control Message Control Protocol
IEEE	:	Institute of Electric and Electronic Engineering
ISO	:	International Standard Organization
IP	:	Internet Protocol
IMAP	:	Internet Message Access Protocol
IGMP	:	Internet Group Message Protocol
IANA	:	Internet Assigned Numbered Authority
LAN	:	Local Area Network
MAN	:	Metropolitan Area Network
MTU	:	Maximum Transmission Unit
NAT	:	Network Address Translation
NV RAM	:	Non-Volatile RAM

NTP	:	Network Time Protocol
OSPF	:	Open Shortest Path First
OSI model	:	Open System Interconnect model
PING	:	Packet Internet Network Group
PAT	:	Port Address Translation
PAN	:	Personal Area Network
PPS	:	Packet Per Second
POST	:	Power On Self-Test
POP	:	Post Office Protocol
RAM	:	Read Access Memory
ROM	:	Read Only Memory
RIP	:	Routing Information Protocol
RSA	:	Rivest, Shamir, Adleman
SMTP	:	Simple Mail Transfer Protocol
SSH	:	Secured Shell
SFTP	:	SSH File Transfer Protocol
SSL	:	Secured Socket Layer
STP	:	Spanning Tree Protocol
TTL	:	Time To Live
Telnet	:	Teletype network
TFTP	:	Trivial File Transfer Protocol
TCP	:	Transmission Control Protocol
UDP	:	User Datagram Protocol
VLAN	:	Virtual Local Area Network
VRC	:	Vertical Redundancy Check
WAN	:	Wide Area Network
WLAN	:	Wireless Local Area Network
VTY	:	Virtual Teletype
VLAN	:	Virtual local area network
VTP	:	Virtual trunking protocol

INTRODUCTION

Identifying Cisco Devices & Interface:

Cisco 1841 Router: Cisco 1841 integrated Services Router is part of the Cisco 1800 Integrated Services Router Series. Cisco 1841 router offers embedded hardware-based encryption that enabled by an optional Cisco IOS Software security image.

WAN Ports: A WAN port is used to connect to an internet source, such as broadband modem

Smart Serial Port: It is used to access the router console for administration and configuration.

LAN Ports: A LAN port is also known as an Ethernet port.

Fast Ethernet Port: Ethernet cables are used to provide an internet connection, connect devices to a local network.

Speed: 100 Mbps

ADMIN ports:

AUX ports: This port is commonly used as a dial-up port for remote management.

CONSOLE ports: Console port is used to connect a computer directly to the router or switch and manage the router or switch since there is no display device for a router or switch.

Cisco 2960 Catalyst Switch: Catalyst switches offer advanced customization and manageability.

CONSOLE ports: console port is used to connect a computer directly to a router or switch and manage the router or switch since there is no display device for a router or switch.

FAST-ETHERNET ports: Fast Ethernet is an extension of the 10-megabit Ethernet standard.

Cables used:

Smart Serial Cable: A serial cable is a cable used to transfer information between two devices using a serial communication protocol.

Fast Ethernet Cable: It is an extension of the 10-megabit Ethernet standard.

Passwords in Cisco Routers

There are five types of passwords:

1. Enable password
2. Enable secret password
3. Console password
4. Auxiliary password
5. VTY password (Virtual Terminal)

1. Enable password:

This password is used when you want to enter to privilege mode from user mode

Syntax:

Router> enable
Router# configure terminal
Router(config)# host Ameerpel
Ameerpel(config)# password Jet@123#
Ameerpel(config)# exit

2. Secret Password:

This password is used when you want to change to privilege mode from user mode

Syntax:

Router> enable
Router# configure terminal
Router(config)# host Ameerpel
Ameerpel(config)# enable secret Jet@123#
Ameerpel(config)# exit

3. Console Password:

This password is used to enter on-premises.

Syntax:

Router> enable
Router# configure terminal

Router(config)# host Ameerpel
Ameerpel(config)# line console 0
Ameerpel(config-line)# password Jet@123#
Ameerpel(config-line)# login
Ameerpel(config-line)# exit

4. Auxiliary Password:

This password is used to enter into router remotely

Syntax:

Router> enable
Router# configure terminal
Router(config)# host Ameerpel
Ameerpel(config)# line auxiliary 0
Ameerpel(config-line)# password Jet@123#
Ameerpel(config-line)# login
Ameerpel(config-line)# exit

5. VTY Password: (Virtual Terminal)

It refers to telnet password by using telnet you can access the router and can change anything.

Syntax:

Router> enable
Router# configure terminal
Router(config)# host Ameerpel
Ameerpel(config)# line vty 0 4
Ameerpel(config-line)# password Jet@123#
Ameerpel(config-line)# login
Ameerpel(config-line)# exit

Encrypting cisco passwords:

- By default, all the passwords of cisco are in readable format in config file.
- **“Service password-encryption”** is a command used to encrypt cisco passwords (except secret).

```
Router (config)# service password-encryption
```

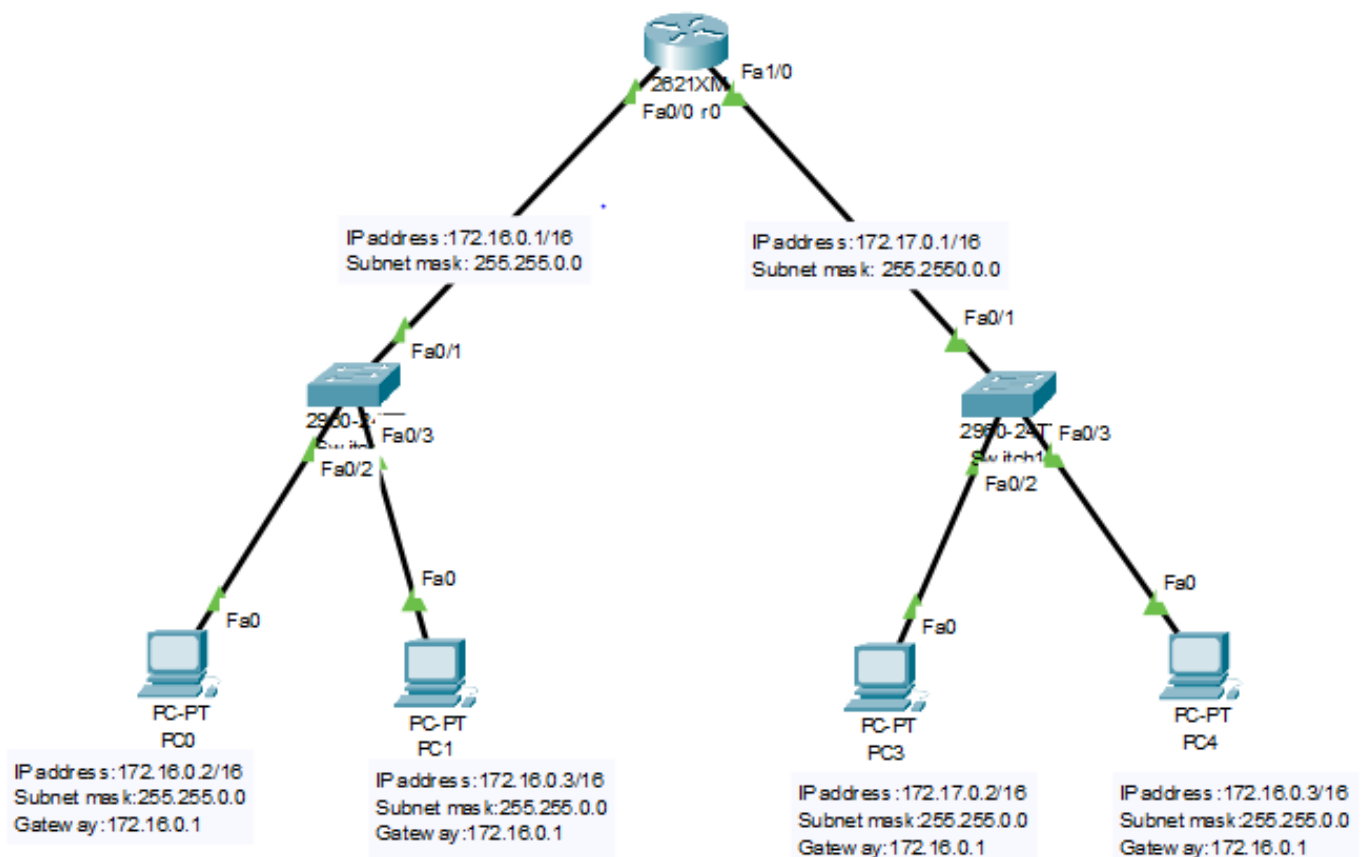
Routing

Choosing the best path or transmitting the data from source to destination is called routing ways

Routing ways:

1. Connected network
2. Static routing
3. Dynamic routing
4. Default routing

1. Connected Network



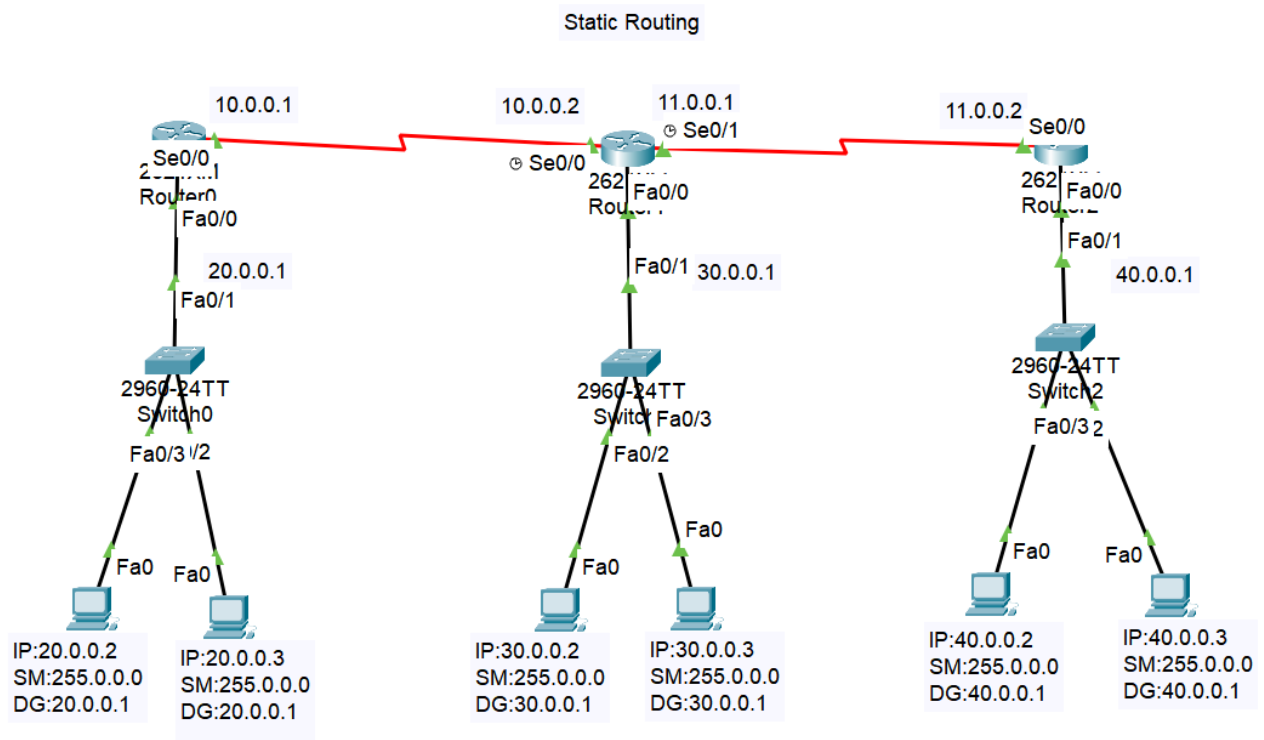
- In this case both the networks are directly connected router interface.
- In this following figure above PC0 is connected to 172.16.1.0/16 and it is directly connected to fast ethernet 0/0 and PC2 is connected to fast ethernet 0/1 with 192.16.1.0/24.
- A router will automatically route packets between there connected network.

Syntax:

Router>enable
Router# config terminal
Router(config)# interface fastethernet 0/0
Router(config-int)# ip address 172.16.0.1 255.255.0.0
Router(config-int)# no shutdown
Router(config-int)# exit

Router>enable
Router# config terminal
Router(config)# interface fastethernet 0/0
Router(config-int)# ip address 172.17.0.1 255.255.0.0
Router(config-int)# no shutdown
Router(config-int)# exit

2. Static Routing



STATIC ROUTING: In this router are configure manually to the routers.

The administrator must configure all the possible routes for each and every router to ensure full connectivity

If any link goes down, the router will not take alternate path, the administrator as to change the path manually

SYNTAX: Router (config) # IP Route <destination network address> <subnet mask> <next hop address>

STATIC ROUTING CONFIGURATION

ROUTER 1:

Assigning IP Address to serial Interface 0/0

Router >enable
Router# configure terminal
Router(config)# interface serial 0/0

Router (config -if)# ip address 10.0.0.1 255.0.0.0
--

Router (config -if)# exit

Router (config) #

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# Interface FastEthernet 0/0

Router (config-if)#ip address 20.0.0.1 255.0.0.0
--

Router (config-if)# no shutdown

Router (config-if)# exit

CONFIGURING STATIC ROUTING

Router (config) # ip route 10.0.0.0 255.0.0.0 10.0.0.2
--

Router (config) # ip route 30.0.0.0 255.0.0.0 10.0.0.2
--

ROUTER 2:

Assigning IP Address to Serial Interface 0/0

Router > enable

Router # configure terminal

Router (config) #intser 0/0

Router (config)#ip add 10.0.0.2 255.0.0.0

Router (config-if)#no shutdown

Router (config-if)#exit

Router (config)#

Assigning IP Address to FastEthernet interface 0/0

Router (config)# interface fastethernet 0/0

Router (config-if)# ip Address 30.0.0.1 255.0.0.0

Router (config-if)# no shutdown

Router (config-if)# exit

Router (config)#

Configuring static

Router (config)# ip router 40.0.0.0 255.0.0.0 11.0.0.2
--

Router (config)# ip router 20.0.0.0 255.0.0.0 10.0.0.1
--

ROUTER 3:

Assigning IP Address to Serial Interface 0/0

Router> enable

Router# configure terminal

Router (config)# interface serial 0/0

Router (config-if)# ip address 11.0.0.2 255.0.0.0

Router (config-if)#no shutdown

Router (config-if)# exit

Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0

Router (config-if)# ip address 40.0.0.1 255.0.0.0

Router (config-if)# no shutdown

Router (config-if)# Exit

Router (config)#

Configuring static

Router (config)# ip router 30.0.0.0 255.0.0.0 11.0.0.1
--

Router (config)# ip router 20.0.0.0 255.0.0.0 11.0.0.1
--

Router (config)# Exit

OUTPUT:

```
C:\>ping 30.0.0.2
```

```
Pinging 30.0.0.2 with 32 bytes of data:
```

```
Reply from 30.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 30.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 30.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 30.0.0.2: bytes=32 time=1ms TTL=126
```

```
Ping statistics for 30.0.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 1ms, Maximum = 1ms, Average = 1ms
```

```
C:\>PING 20.0.0.2
```

```
Pinging 20.0.0.2 with 32 bytes of data:
```

```
Reply from 20.0.0.2: bytes=32 time=2ms TTL=126
```

```
Reply from 20.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 20.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 20.0.0.2: bytes=32 time=2ms TTL=126
```

```
Ping statistics for 20.0.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 1ms, Maximum = 2ms, Average = 1ms
```

```
C:\>PING 30.0.0.2
```

```
Pinging 30.0.0.2 with 32 bytes of data:
```

```
Reply from 30.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 30.0.0.2: bytes=32 time=2ms TTL=126
```

```
Reply from 30.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 30.0.0.2: bytes=32 time=4ms TTL=126
```

```
Ping statistics for 30.0.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 1ms, Maximum = 4ms, Average = 2ms
```


Router-1

```
Router(config)#do show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, Serial0/0
C    20.0.0.0/8 is directly connected, FastEthernet0/0
S    30.0.0.0/8 [1/0] via 10.0.0.2
S    40.0.0.0/8 [1/0] via 10.0.0.2

Router(config)#%DHCPD-4-PING_CONFLICT: DHCP address conflict:  server pinged 20.0.0.1.
```

Router-2

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

C    10.0.0.0/8 is directly connected, Serial0/0
C    11.0.0.0/8 is directly connected, Serial0/1
S    20.0.0.0/8 [1/0] via 10.0.0.1
C    30.0.0.0/8 is directly connected, FastEthernet0/0
S    40.0.0.0/8 [1/0] via 11.0.0.2
```

Router-3

```
Router#show ip route
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
        D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
        N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
        E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
        i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
        * - candidate default, U - per-user static route, o - ODR
        P - periodic downloaded static route

Gateway of last resort is not set

C    11.0.0.0/8 is directly connected, Serial0/0
S    20.0.0.0/8 [1/0] via 11.0.0.1
S    30.0.0.0/8 [1/0] via 11.0.0.1
C    40.0.0.0/8 is directly connected, FastEthernet0/0
```

3. DYNAMIC ROUTING

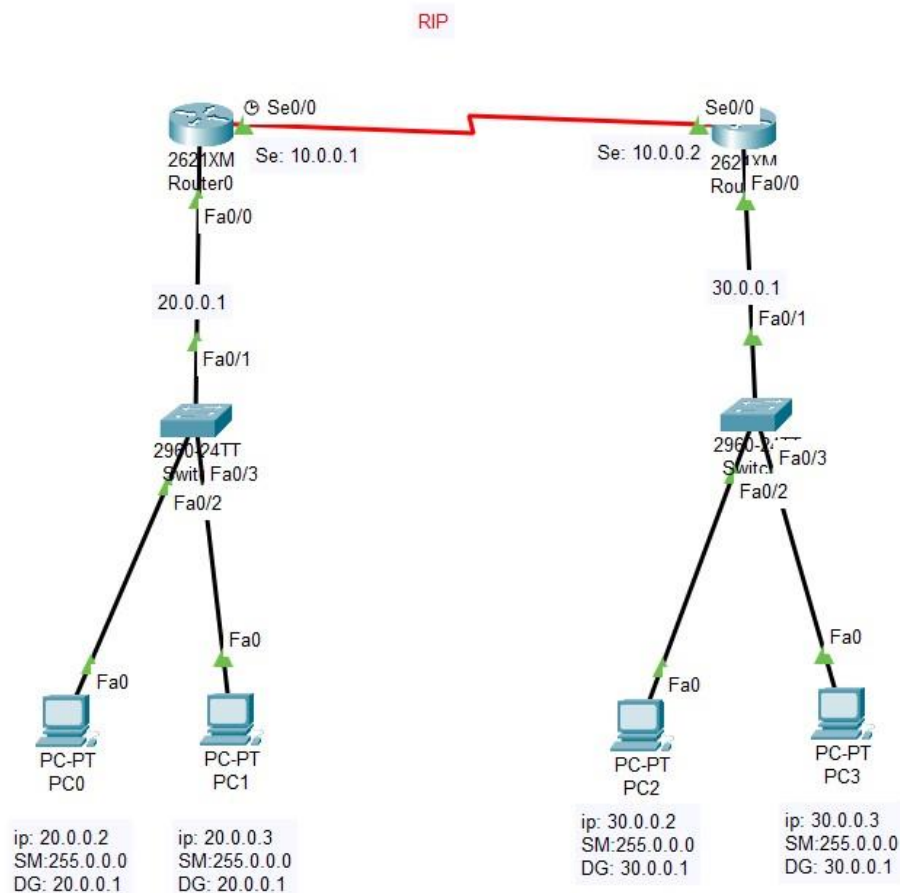
In dynamic routing the routing table will change based on the networks. Hence the administrator will only add the network to the router and the router figures out the best path. It will calculate the best path on routing protocols.

There are 3 protocols majorly used:

RIP	:	Routing Information Protocol
EIGRP	:	Enhanced Interior Gateway Routing Protocol
OSPF	:	Open Shortest Path First

RIP (Routing information protocol):

It is a dynamic protocol. It is used to find the best route or path from source to destination over a network by using a routing metric/hop count algorithm. This algorithm is used to determine the shortest path from the source to destination, which allows the data to be delivered at high speed in the shortest time.



ROUTER 1:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 10.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 20.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

ROUTER 2:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 10.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 30.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

Configuring RIP

Router (config)# network 20.0.0.0
Router (config)# network 10.0.0.0
Router (config)# Exit

OUTPUT:

```
C:\>ping 20.0.0.2
```

```
Pinging 20.0.0.2 with 32 bytes of data:
```

```
Reply from 20.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 20.0.0.2: bytes=32 time=10ms TTL=126
```

```
Reply from 20.0.0.2: bytes=32 time=3ms TTL=126
```

```
Reply from 20.0.0.2: bytes=32 time=4ms TTL=126
```

```
Ping statistics for 20.0.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:
```

```
    Minimum = 1ms, Maximum = 10ms, Average = 4ms
```

```
C:\>PING 30.0.0.2
```

```
Pinging 30.0.0.2 with 32 bytes of data:
```

```
Reply from 30.0.0.2: bytes=32 time=2ms TTL=126
```

```
Reply from 30.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 30.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 30.0.0.2: bytes=32 time=11ms TTL=126
```

```
Ping statistics for 30.0.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:
```

```
    Minimum = 1ms, Maximum = 11ms, Average = 3ms
```

Router-1

Router#show ip route

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

```
C    10.0.0.0/8 is directly connected, Serial0/0
C    20.0.0.0/8 is directly connected, FastEthernet0/0
R    30.0.0.0/8 [120/1] via 10.0.0.2, 00:00:00, Serial0/0
```

Router-2

Router#show ip route

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

```
C    10.0.0.0/8 is directly connected, Serial0/0
R    20.0.0.0/8 [120/1] via 10.0.0.1, 00:00:08, Serial0/0
C    30.0.0.0/8 is directly connected, FastEthernet0/0
```

EIGRP (Enhanced Interior Gateway Routing Protocol):

This is a cisco proprietary enhanced distance vector routing protocol EIGRP has faster convergence, & has fewer network overheads. It sends traditional distance vector updates containing info about network is including the cost of reaching then from perspective of the advertising routes.

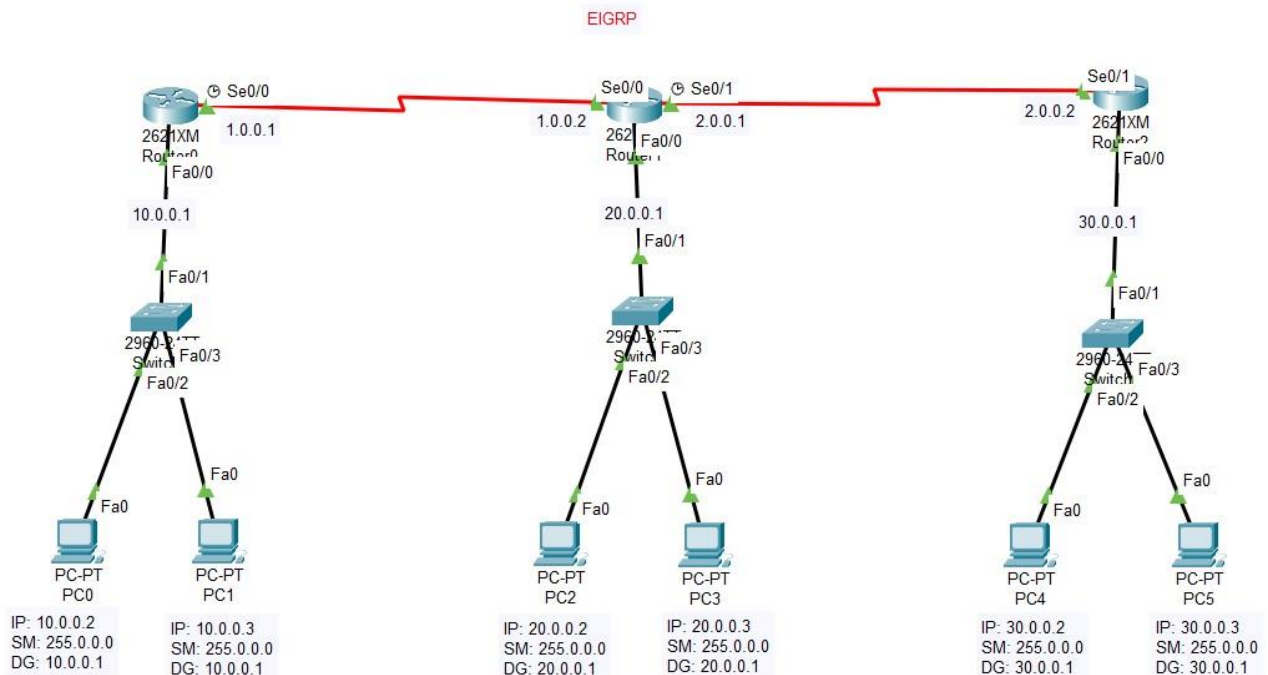
EIGRP synchronizes routing table between neighbour at start up and then it sends specific updates when there is a change in the network topology.

EIGRP Syntax:

EIGRP can be configured by using the following ISO commands

Router(config)#router eigrp ASN

Router(config-router)# network N/w ID



ROUTER 1:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config-if)#ip address 1.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 10.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

ROUTER 2:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 1.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to serial Interface 0/1

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 2.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 20.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

ROUTER 3:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 2.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 30.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

Configuring EIGRP: (Router 1)

Router (config)# router eigrp 9
Router (config-router)#network 10.0.0.0
Router (config-router)#network 1.0.0.0
Router (config-router)# Exit
Router (config)#

Configuring EIGRP: (Router 2)

Router (config)# router eigrp 9
Router (config-router)#network 20.0.0.0
Router (config-router)#network 1.0.0.0
Router (config-router)#network 1.0.0.0
Router (config-router)# Exit
Router (config)#

Configuring EIGRP: (Router 3)

Router (config)# router eigrp 9
Router (config-router)#network 30.0.0.0

Router (config-router)#network 2.0.0.0
Router (config-router)# Exit
Router (config)#

OUTPUT:

```
C:\>PING 10.0.0.2
```

```
Pinging 10.0.0.2 with 32 bytes of data:
```

```
Reply from 10.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 10.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 10.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 10.0.0.2: bytes=32 time=4ms TTL=126
```

```
Ping statistics for 10.0.0.2:
```

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

```
C:\>PING 20.0.0.2
```

```
Pinging 20.0.0.2 with 32 bytes of data:
```

```
Reply from 20.0.0.2: bytes=32 time=2ms TTL=126
```

```
Reply from 20.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 20.0.0.2: bytes=32 time=2ms TTL=126
```

```
Reply from 20.0.0.2: bytes=32 time=2ms TTL=126
```

```
Ping statistics for 20.0.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
    Minimum = 1ms, Maximum = 2ms, Average = 1ms
```

```
C:\>PING 30.0.0.2
```

```
Pinging 30.0.0.2 with 32 bytes of data:
```

```
Reply from 30.0.0.2: bytes=32 time=2ms TTL=125
Reply from 30.0.0.2: bytes=32 time=2ms TTL=125
Reply from 30.0.0.2: bytes=32 time=3ms TTL=125
Reply from 30.0.0.2: bytes=32 time=11ms TTL=125
```

```
Ping statistics for 30.0.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 11ms, Average = 4ms
```

Router-1

```
Router#show ip route
```

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
```

```
Gateway of last resort is not set
```

```
C    1.0.0.0/8 is directly connected, Serial0/0
D    2.0.0.0/8 [90/2681856] via 1.0.0.2, 00:00:07, Serial0/0
C    10.0.0.0/8 is directly connected, FastEthernet0/0
D    20.0.0.0/8 [90/2172416] via 1.0.0.2, 00:00:07, Serial0/0
D    30.0.0.0/8 [90/2684416] via 1.0.0.2, 00:00:07, Serial0/0
```

Router-2

```
Router#show ip route
```

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
```

```
Gateway of last resort is not set
```

```
C    1.0.0.0/8 is directly connected, Serial0/0
C    2.0.0.0/8 is directly connected, Serial0/1
D    10.0.0.0/8 [90/2172416] via 1.0.0.1, 00:01:43, Serial0/0
C    20.0.0.0/8 is directly connected, FastEthernet0/0
D    30.0.0.0/8 [90/2172416] via 2.0.0.2, 00:01:43, Serial0/1
```

Router-3

Router#show ip route

Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

```
D   1.0.0.0/8 [90/2681856] via 2.0.0.1, 00:03:41, Serial0/1
C   2.0.0.0/8 is directly connected, Serial0/1
D   10.0.0.0/8 [90/2684416] via 2.0.0.1, 00:03:41, Serial0/1
D   20.0.0.0/8 [90/2172416] via 2.0.0.1, 00:03:41, Serial0/1
C   30.0.0.0/8 is directly connected, FastEthernet0/0
```

OSPF (Open Shortest Path First):

OSPF provides a fast coverage with incremental updates via link state advertisement (LSA's). OSPF is a classless protocol and allows a hierarchal design.

OSPF Syntax:

Router(config)#router ospf <ospf process id>
Router(config-router)#router id <manual router id>
Router(config-router)#end

Wildcard Mask:

Wildcard mask are used to specify a range of network address. They are commonly used with routing protocol like OSPF and access lists. Wildcard mask is an opposite of subnet mask, wildcard mask is also a 32-Bit address.

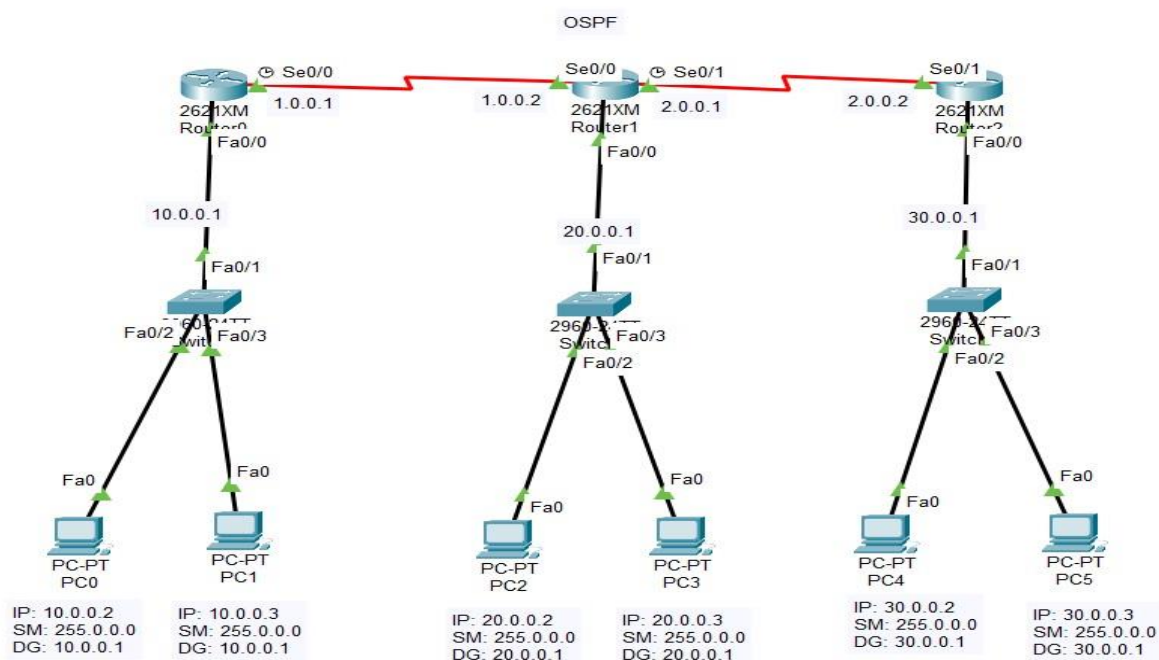
Calculation of wildcard mask:

Subtract the subnet mask from the global subnet mask (255.255.255.255) to get the wild card subnet mask.

GSM 255.255.255.255

- SM 255.000.000.000

WSM 000.255.255.255



ROUTER 1:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 1.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 10.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

ROUTER 2:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 1.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to serial Interface 0/1

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 2.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 20.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

ROUTER 3:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 2.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 30.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

Configuring OSPF: (Router 1)

Router (config)# router ospf 9
Router (config-router)#network 10.0.0.0 0.255.255.255 area 0
Router (config-router)#network 1.0.0.0 0.255.255.255 area 0
Router (config-router)# Exit
Router (config)#

Configuring OSPF: (Router 2)

Router (config)# router ospf 9
Router (config-router)#network 20.0.0.0 0.255.255.255 area 0
Router (config-router)#network 1.0.0.0 0.255.255.255 area 0

Router (config-router)#network 2.0.0.0 0.255.255.255 area 0
Router (config-router)# Exit
Router (config)#

Configuring OSPF: (Router 3)

Router (config)# router ospf 9
Router (config-router)#network 30.0.0.0 0.255.255.255 area 0
Router (config-router)#network 2.0.0.0 0.255.255.255 area 0
Router (config-router)# Exit
Router (config)#

```
C:\>PING 10.0.0.2
```

```
Pinging 10.0.0.2 with 32 bytes of data:
```

```
Reply from 10.0.0.2: bytes=32 time=2ms TTL=126
Reply from 10.0.0.2: bytes=32 time=1ms TTL=126
Reply from 10.0.0.2: bytes=32 time=11ms TTL=126
Reply from 10.0.0.2: bytes=32 time=2ms TTL=126
```

```
Ping statistics for 10.0.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 11ms, Average = 4ms
```

```
C:\>ping 20.0.0.3
```

```
Pinging 20.0.0.3 with 32 bytes of data:
```

```
Reply from 20.0.0.3: bytes=32 time=1ms TTL=126
Reply from 20.0.0.3: bytes=32 time=4ms TTL=126
Reply from 20.0.0.3: bytes=32 time=10ms TTL=126
Reply from 20.0.0.3: bytes=32 time=1ms TTL=126
```

```
Ping statistics for 20.0.0.3:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 1ms, Maximum = 10ms, Average = 4ms
```

```
C:\>ping 30.0.0.3
```

```
Pinging 30.0.0.3 with 32 bytes of data:
```

```
Reply from 30.0.0.3: bytes=32 time=2ms TTL=125
Reply from 30.0.0.3: bytes=32 time=16ms TTL=125
Reply from 30.0.0.3: bytes=32 time=3ms TTL=125
Reply from 30.0.0.3: bytes=32 time=11ms TTL=125
```

```
Ping statistics for 30.0.0.3:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 16ms, Average = 8ms
```

Router-1

```
Router#show ip route
```

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
```

```
Gateway of last resort is not set
```

```
C    1.0.0.0/8 is directly connected, Serial0/0
O    2.0.0.0/8 [110/128] via 1.0.0.2, 00:01:02, Serial0/0
C    10.0.0.0/8 is directly connected, FastEthernet0/0
O    20.0.0.0/8 [110/65] via 1.0.0.2, 00:01:02, Serial0/0
O    30.0.0.0/8 [110/129] via 1.0.0.2, 00:00:52, Serial0/0
```

Router-2

```
Router#show ip route
```

```
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
       i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
       * - candidate default, U - per-user static route, o - ODR
       P - periodic downloaded static route
```

```
Gateway of last resort is not set
```

```
C    1.0.0.0/8 is directly connected, Serial0/0
C    2.0.0.0/8 is directly connected, Serial0/1
O    10.0.0.0/8 [110/65] via 1.0.0.1, 00:02:11, Serial0/0
C    20.0.0.0/8 is directly connected, FastEthernet0/0
O    30.0.0.0/8 [110/65] via 2.0.0.2, 00:02:11, Serial0/1
```


Router-3

Router#show ip route

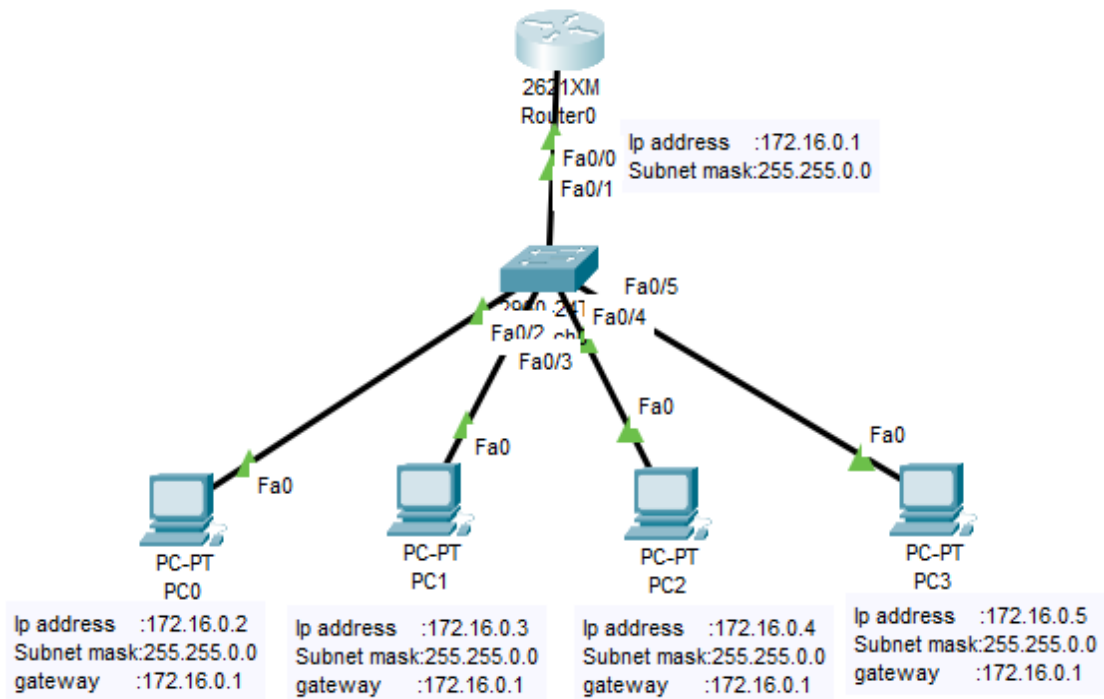
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS level-2, ia - IS-IS inter area
* - candidate default, U - per-user static route, o - ODR
P - periodic downloaded static route

Gateway of last resort is not set

```
O 1.0.0.0/8 [110/128] via 2.0.0.1, 00:03:33, Serial0/1
C 2.0.0.0/8 is directly connected, Serial0/1
O 10.0.0.0/8 [110/129] via 2.0.0.1, 00:03:33, Serial0/1
O 20.0.0.0/8 [110/65] via 2.0.0.1, 00:03:33, Serial0/1
C 30.0.0.0/8 is directly connected, FastEthernet0/0
```

DHCP

DHCP is widely used in LAN environment to dynamically assign host IP address from a centralized server, which assign significantly reduces the overhead of administration of IP addresses.



DHCP Configuration:

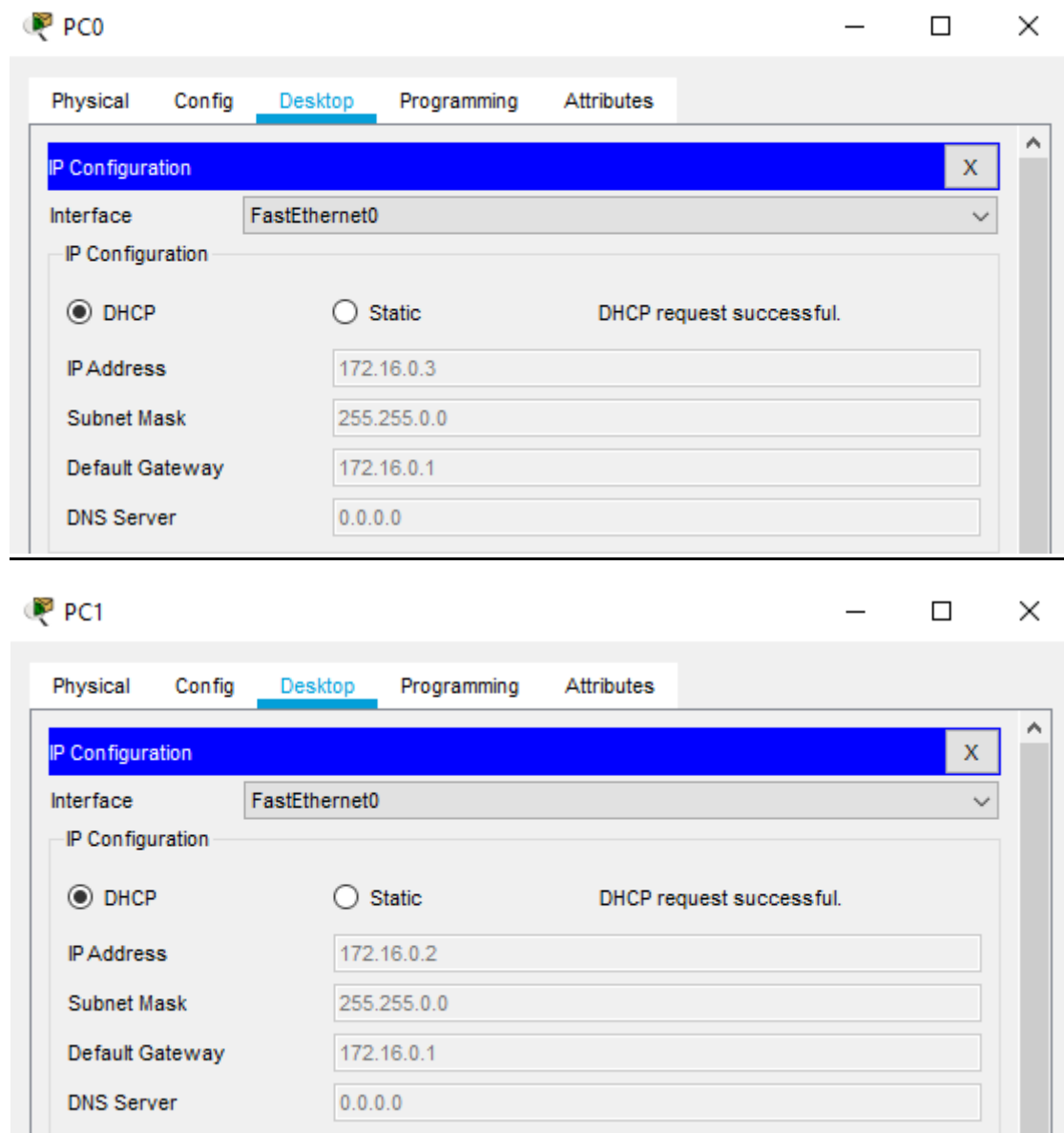
Assigning IP Address to Fast Ethernet0/0:

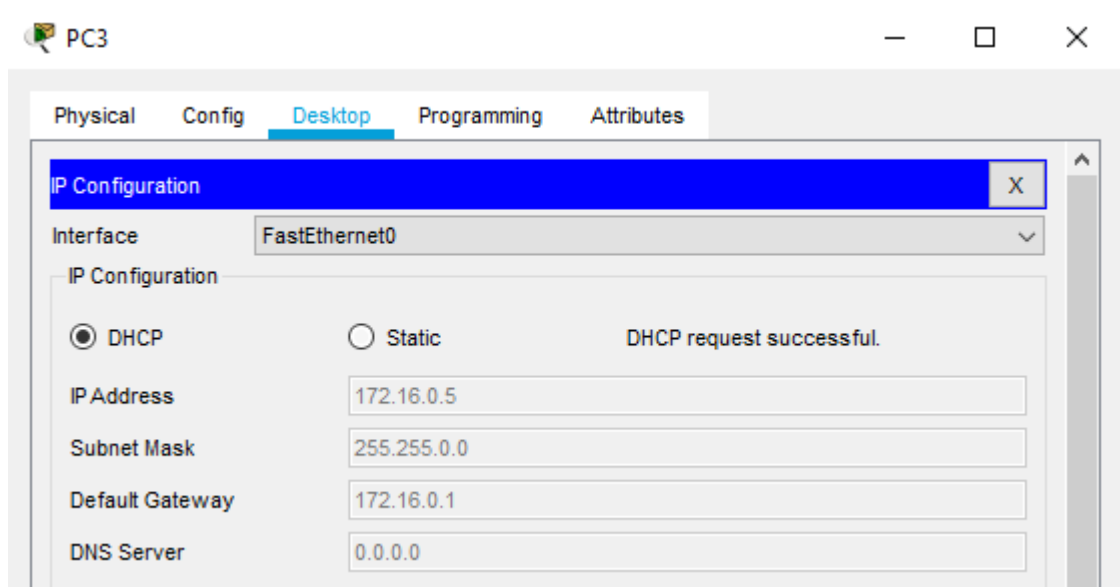
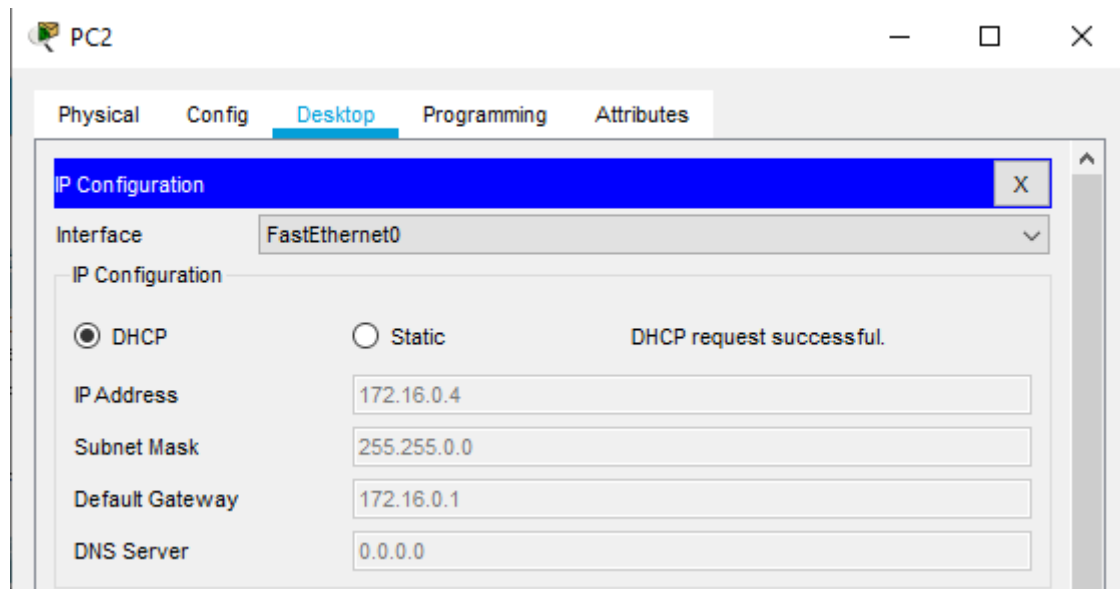
Router>enable
Router# config terminal
Router(config)#interface fastethernet 0/0
Router(config-int)#ip address 172.16.0.1 255.255.0.0
Router(config-int)#no shutdown
Router(config-int)#exit
Router(config)#

Assigning DHCP:

```
Router(config)#ip dhcp pool murali
Router(dhcp-config)#network 172.16.0.0 255.255.0.0
Router(dhcp-config)#default-router 172.16.0.1
Router(dhcp-config)#exit
Router(config)#
```

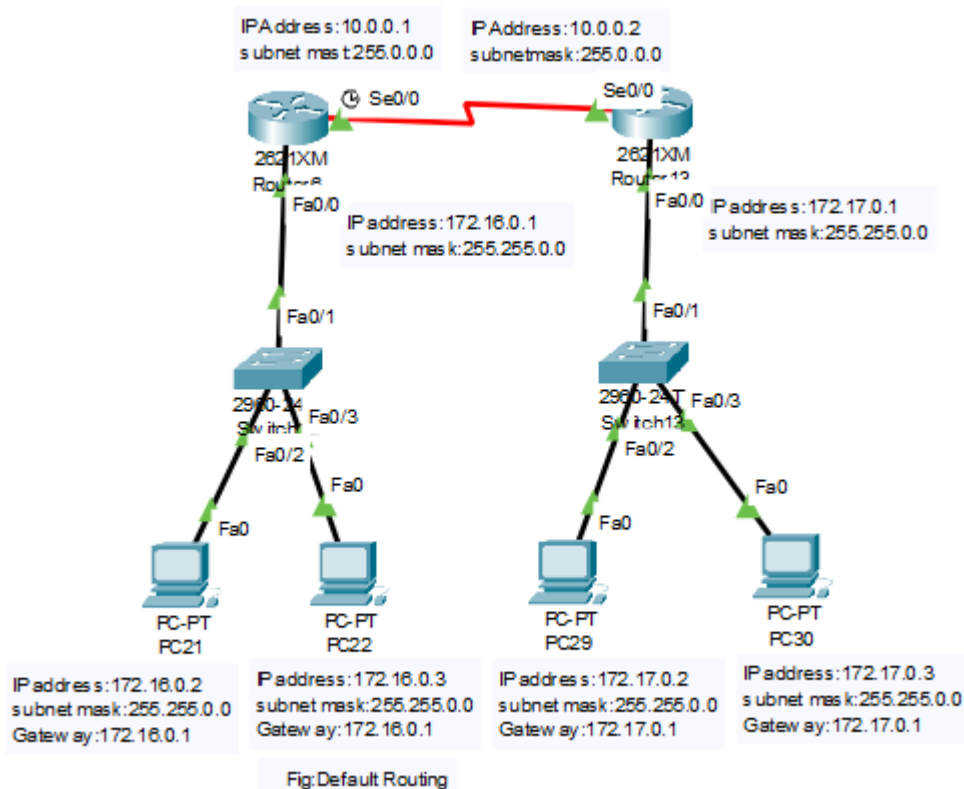
Verification:





Default routing

- It is similar to static routing
- A solution for unknown destination is known as default routing
- A default routing is the packet forwarding method taking effect when no other route can be determined for a given destination address. All the packets for destination not established in the routing table are sent through default route.



Default Routing Configuration:

Router-1:

Assigning IP Address to Fast Ethernet0/0:

Router>enable
Router# config terminal
Router(config)#interface fastethernet 0/0
Router(config-int)#ip address 172.16.0.1 255.255.0.0
Router(config-int)#no shutdown
Router(config-int)#exit
Router(config)#

Assigning IP Address to Serial0/0:

Router(config)# Serial interface0/0
Router(config-int)#ip address 10.0.0.1 255.0.0.0
Router(config-int)#no shutdown
Router(config-int)#exit
Router(config)#

Default Routing:

Router(config)#IP route 0.0.0.0 0.0.0.0 10.0.0.2
--

Router-2:

Assigning IP Address to Fast Ethernet0/0:

Router>enable
Router# config terminal
Router(config)#interface fastethernet 0/0
Router(config-int)#ip address 172.17.0.1 255.255.0.0
Router(config-int)#no shutdown
Router(config-int)#exit
Router(config)#

Assigning IP Address to Serial0/0:

Router(config)# Serial interface0/0
Router(config-int)#ip address 10.0.0.2 255.0.0.0
Router(config-int)#no shutdown
Router(config-int)#exit
Router(config)#

Default Routing:

Router(config)#IP route 0.0.0.0 0.0.0.0 10.0.0.2
--

```
Packet Tracer PC Command Line 1.0
```

```
C:\>ping 172.17.0.2
```

```
Pinging 172.17.0.2 with 32 bytes of data:
```

```
Reply from 172.17.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 172.17.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 172.17.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 172.17.0.2: bytes=32 time=1ms TTL=126
```

```
Ping statistics for 172.17.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 1ms, Maximum = 1ms, Average = 1ms
```

```
Packet Tracer PC Command Line 1.0
```

```
C:\>ping 172.16.0.2
```

```
Pinging 172.16.0.2 with 32 bytes of data:
```

```
Reply from 172.16.0.2: bytes=32 time=2ms TTL=126
```

```
Reply from 172.16.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 172.16.0.2: bytes=32 time=2ms TTL=126
```

```
Reply from 172.16.0.2: bytes=32 time=1ms TTL=126
```

```
Ping statistics for 172.16.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 1ms, Maximum = 2ms, Average = 1ms
```

Router-1

Router#sh 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 10.0.0.2 to network 0.0.0.0

```
C    10.0.0.0/8 is directly connected, Serial0/0
C    172.16.0.0/16 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 10.0.0.2
```

Router-2

Router#sh 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 10.0.0.1 to network 0.0.0.0

```
C    10.0.0.0/8 is directly connected, Serial0/0
C    172.17.0.0/16 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 10.0.0.1
```


ROUTE REDISTRIBUTION

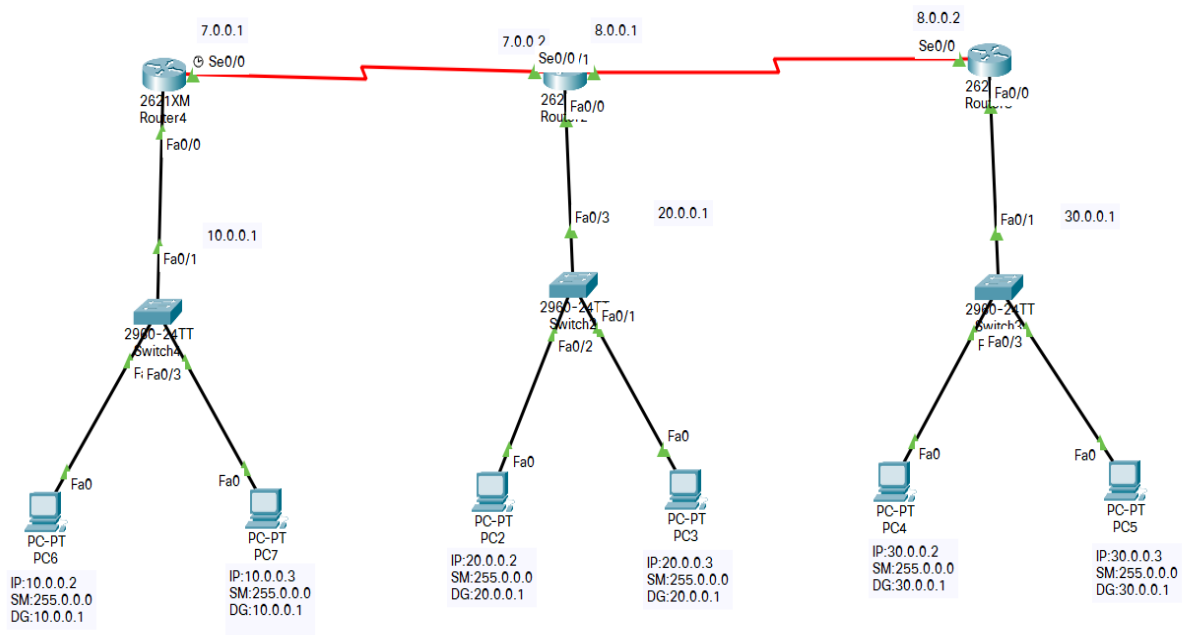
It is technique that allows routes learned by one routing protocol or one algorithm to be advertised into another routing protocol or algorithm.

The routes learned by the route redistribution technique are marks as external routes in the routing table.

There are 3 types of redistributions:

1. RIP – EIGRP
2. EIGRP – OSPF
3. OSPF – RIP

RIP – EIGRP



ROUTER 1:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 7.0.0.1 255.0.0.0
Router (config-if)#no shutdown

Router (config-if)#exit

Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0

Router (config-if)# ip address 10.0.0.1 255.0.0.0

Router (config-if)# no shutdown

Router (config-if)# Exit

Router (config)#

ROUTER 2:

Assigning IP Address to serial Interface 0/0

Router > enable

Router # configure terminal

Router (config) #interface 0/0

Router (config)#ip address 7.0.0.2 255.0.0.0
--

Router (config-if)#no shutdown

Router (config-if)#exit

Router (config)#

Assigning IP Address to serial Interface 0/1

Router > enable

Router # configure terminal

Router (config) #interface 0/0

Router (config)#ip address 8.0.0.1 255.0.0.0
--

Router (config-if)#no shutdown

Router (config-if)#exit

Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0

Router (config-if)# ip address 20.0.0.1 255.0.0.0

Router (config-if)# no shutdown

Router (config-if)# Exit

Router (config)#

ROUTER 3:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 8.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 30.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

Configuring RIP (R-1)

Router (config)# network 7.0.0.0
Router (config)# network 10.0.0.0
Router (config)# Exit

Configuring RIP (R-2)

Router (config-router)# network 7.0.0.0
Router (config-router)# network 8.0.0.0
Router (config-router)# network 20.0.0.0
Router (config)# Exit

Configuring EIGRP: (R-2)

Router (config)# router eigrp 10
Router (config-router)#network 10.0.0.0
Router (config-router)# network 7.0.0.0
Router (config-router)#network 8.0.0.0
Router (config-router)# Exit

Router (config)#

Configuring EIGRP: (R-3)

Router (config)# router eigrp 10

Router (config-router)#network 10.0.0.0

Router (config-router)# network 8.0.0.0

Router (config-router)#network 8.0.0.0
--

Router (config-router)# Exit

Configuring redistribution of RIP – EIGRP:

Router(config)# router rip

Router(config-router)# redistribute eigrp 10 metric 15
--

Router(config-router)# exit

Router(config)#router eigrp 10

Router(config-router)#redistribute rip metric 5000 1 255 255 5000

Router(config-router)# exit

```
C:\>PING 30.0.0.3
```

```
Pinging 30.0.0.3 with 32 bytes of data:
```

```
Reply from 30.0.0.3: bytes=32 time=30ms TTL=125
```

```
Reply from 30.0.0.3: bytes=32 time=30ms TTL=125
```

```
Reply from 30.0.0.3: bytes=32 time=21ms TTL=125
```

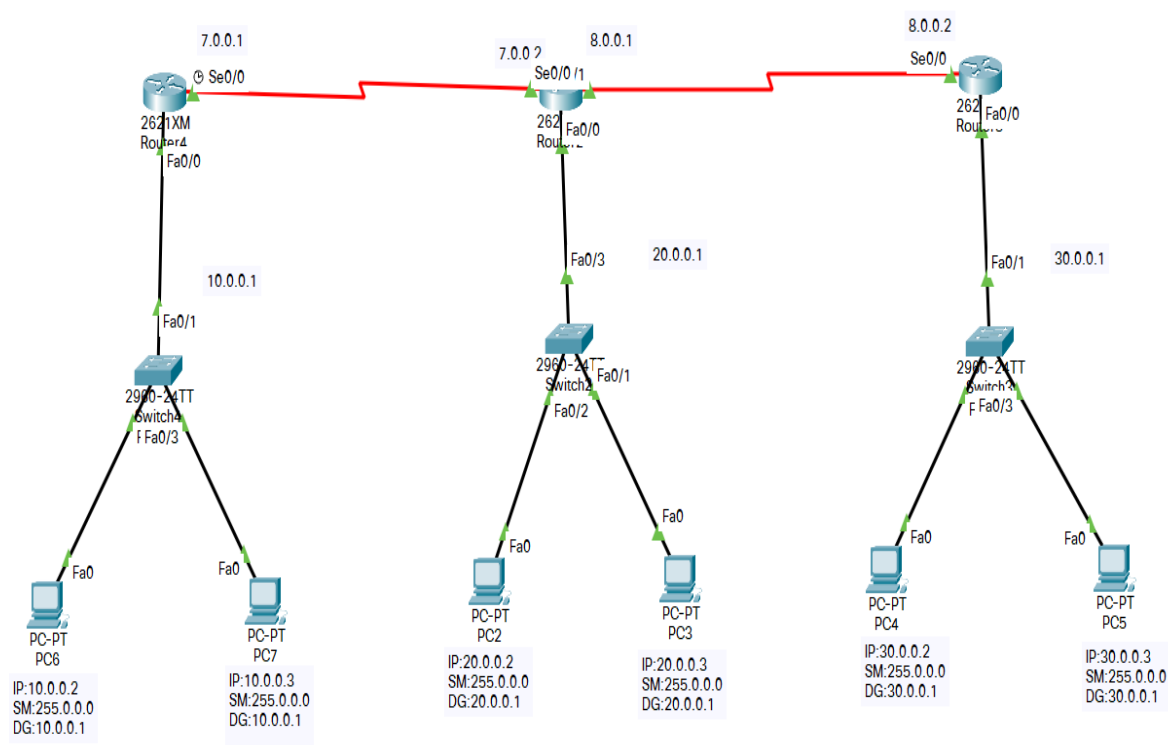
```
Reply from 30.0.0.3: bytes=32 time=30ms TTL=125
```

```
Ping statistics for 30.0.0.3:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:
```

```
    Minimum = 21ms, Maximum = 30ms, Average = 27ms
```

EIGRP – OSPF



ROUTER 1:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 7.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 10.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

ROUTER 2:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 7.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to serial Interface 0/1

Router > enable
Router # configure terminal
Router (config) #interface 0/1
Router (config)#ip address 8.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 20.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

ROUTER 3:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 8.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 30.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

Configuring EIGRP: (R-1)

Router (config)# router eigrp 10
Router (config-router)#network 10.0.0.0
Router (config-router)# network 7.0.0.0
Router (config-router)#network 8.0.0.0
Router (config-router)# Exit
Router (config)#

Configuring EIGRP: (R-2)

Router (config)# router eigrp 10
Router (config-router)#network 10.0.0.0
Router (config-router)# network 8.0.0.0
Router (config-router)#network 8.0.0.0
Router (config-router)# Exit

Configuring OSPF: (R-2)

Router (config)# router ospf 9
Router (config-router)#network 10.0.0.0 0.255.255.255 area 0
Router (config-router)#network 7.0.0.0 0.255.255.255 area 0
Router (config-router)# Exit
Router (config)#

Configuring OSPF: (R-3)

Router (config)# router ospf 9
Router (config-router)#network 20.0.0.0 0.255.255.255 area 0
Router (config-router)#network 8.0.0.0 0.255.255.255 area 0

Router (config-router)#network 8.0.0.0 0.255.255.255 area 0
Router (config-router)# Exit
Router (config)#

Configuring redistribution of EIGRP – OSPF:

Router(config)# router eigrp 10
Router(config-router)# redistribute eigrp 100 metric 5000 1 255 255 5000
Router(config-router)# exit
Router(config)#router ospf 1
Router(config-router)#redistribute eigrp 1 metric 15
Router(config-router)# exit

```
C:\>PING 30.0.0.3
```

```
Pinging 30.0.0.3 with 32 bytes of data:
```

```
Reply from 30.0.0.3: bytes=32 time=26ms TTL=125
```

```
Reply from 30.0.0.3: bytes=32 time=22ms TTL=125
```

```
Reply from 30.0.0.3: bytes=32 time=157ms TTL=125
```

```
Reply from 30.0.0.3: bytes=32 time=17ms TTL=125
```

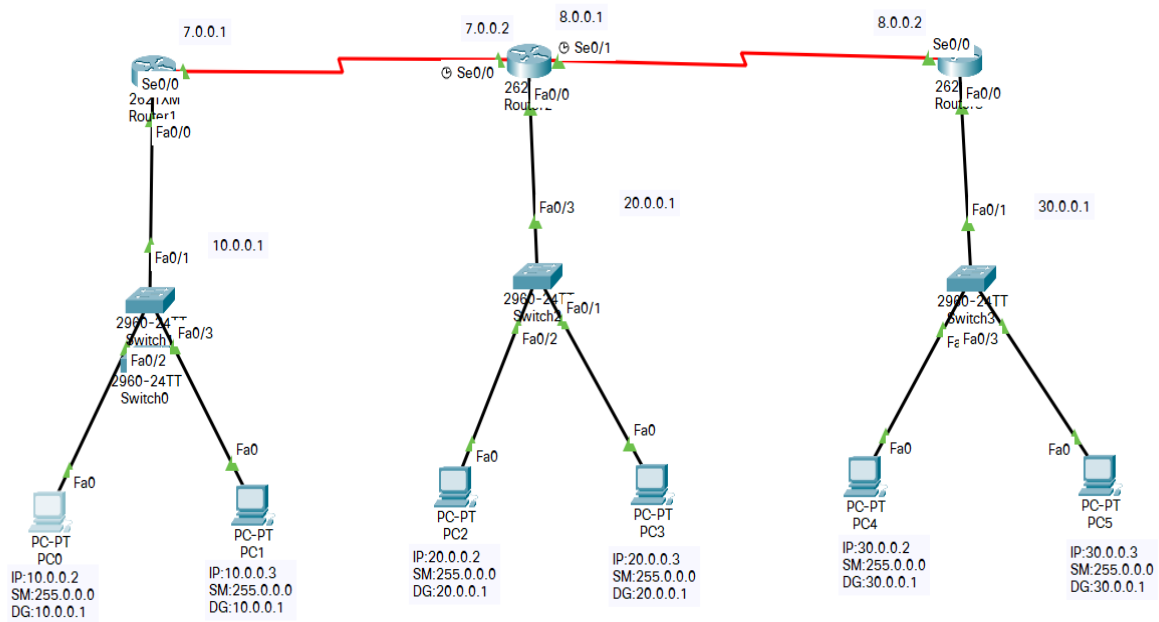
```
Ping statistics for 30.0.0.3:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:
```

```
    Minimum = 17ms, Maximum = 157ms, Average = 55ms
```

```
C:\>
```


OSPF – RIP



ROUTER 1:

Assigning IP Address to serial Interface 0/0

```
Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 7.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#
```

Assigning IP Address to FastEthernet Interface 0/0

```
Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 10.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#
```

ROUTER 2:

Assigning IP Address to serial Interface 0/0

```
Router > enable
Router # configure terminal
```

Router (config) #interface 0/0
Router (config)#ip address 7.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to serial Interface 0/1

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 8.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 20.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

ROUTER 3:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 8.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 30.0.0.1 255.0.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

Configuring OSPF: (R-1)

Router (config)# router ospf 9
Router (config-router)#network 10.0.0.0 0.255.255.255 area 0
Router (config-router)#network 7.0.0.0 0.255.255.255 area 0
Router (config-router)# Exit
Router (config)#

Configuring OSPF: (R-2)

Router (config)# router ospf 9
Router (config-router)#network 20.0.0.0 0.255.255.255 area 0
Router (config-router)#network 7.0.0.0 0.255.255.255 area 0
Router (config-router)#network 8.0.0.0 0.255.255.255 area 0
Router (config-router)# Exit
Router (config)#

Configuring RIP (R-2)

Router (config-router)# network 7.0.0.0
Router (config-router)# network 8.0.0.0
Router (config-router)# network 20.0.0.0
Router (config)# Exit

Configuring RIP (R-3)

Router (config)# network 8.0.0.0
Router (config)# network 10.0.0.0
Router (config)# Exit

Redistribution of OSPF – RIP:

Router(config)#router ospf 1
Router(config-router)#redistribute eigrp 1 metric 15 subnets
Router(config-router)# exit
Router(config)#router rip
Router(config-router)#redistribute ospf 1 metric 15
Router(config-router)#exit

```
C:\>PING 20.0.0.3
```

```
Pinging 20.0.0.3 with 32 bytes of data:
```

```
Reply from 20.0.0.3: bytes=32 time=15ms TTL=126
```

```
Reply from 20.0.0.3: bytes=32 time=10ms TTL=126
```

```
Reply from 20.0.0.3: bytes=32 time=6ms TTL=126
```

```
Reply from 20.0.0.3: bytes=32 time=6ms TTL=126
```

```
Ping statistics for 20.0.0.3:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:
```

```
    Minimum = 6ms, Maximum = 15ms, Average = 9ms
```

```
C:\>
```

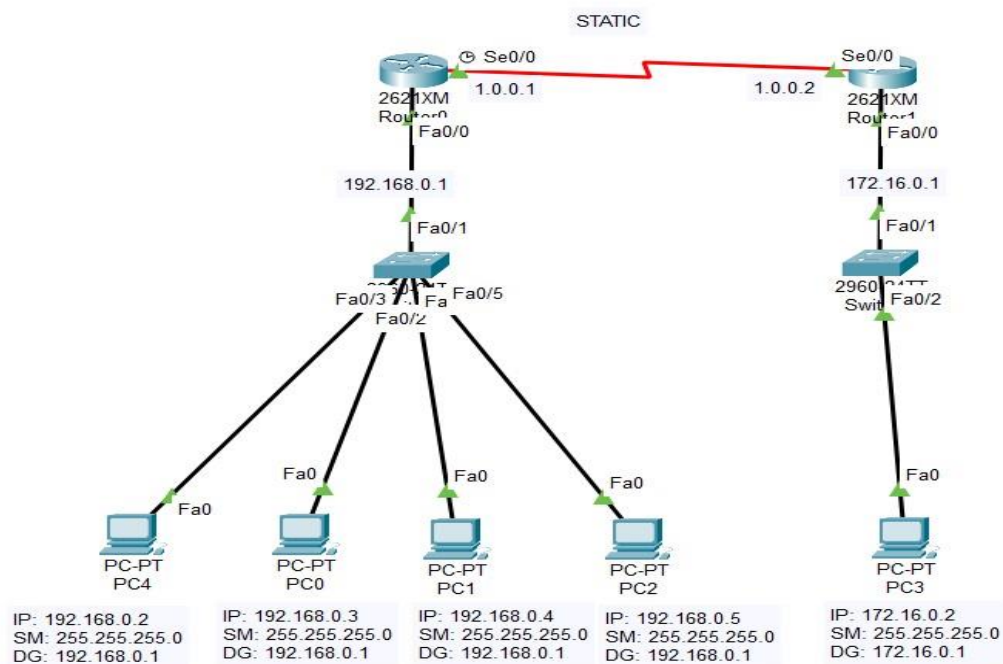
NAT (Network Address Translation)

- It is used to resolve a pvt ip to public ip and public ip to private ip.
- NAT maps a private ip to public ip as the private ip will not be routed over the internet.
- Hence, when ever a private ip uses need internet access NAT is used to map it to a public ip.

Types of NAT:

1. Static NAT
2. Dynamic NAT
3. Dynamic overload/PAT

Static NAT



Router-1

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 1.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 192.168.0.1 255.255.255.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

ROUTER 2:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 1.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 172.16.0.1 255.255.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

Config static NAT in (R-1)

Router>enable
Router#config terminal
Router(config)#ip nat inside source static 192.168.1.2 50.0.0.1
Router(config)#ip nat inside source static 192.168.1.3 50.0.0.2
Router(config)#ip nat inside source static 192.168.1.4 50.0.0.3
Router(config)#ip nat inside source static 192.168.1.5 50.0.0.4

Implementing:

Router(config)#int fastethernet 0/0
Router(config)#ip nat inside
Router(config)#exit

Router(config)#int fastethernet 0/0
Router(config)#ip nat inside
Router(config)#exit

```
Router#show ip nat translation
Pro  Inside global      Inside local      Outside local      Outside global
icmp 5.0.0.2:14         192.168.0.3:14   172.16.0.2:14     172.16.0.2:14
icmp 5.0.0.2:15         192.168.0.3:15   172.16.0.2:15     172.16.0.2:15
icmp 5.0.0.2:16         192.168.0.3:16   172.16.0.2:16     172.16.0.2:16
icmp 50.0.0.1:10        192.168.0.2:10   172.16.0.2:10     172.16.0.2:10
icmp 50.0.0.1:11        192.168.0.2:11   172.16.0.2:11     172.16.0.2:11
icmp 50.0.0.1:12        192.168.0.2:12   172.16.0.2:12     172.16.0.2:12
icmp 50.0.0.1:9         192.168.0.2:9    172.16.0.2:9      172.16.0.2:9
```

```
C:\>PING 192.168.0.2
```

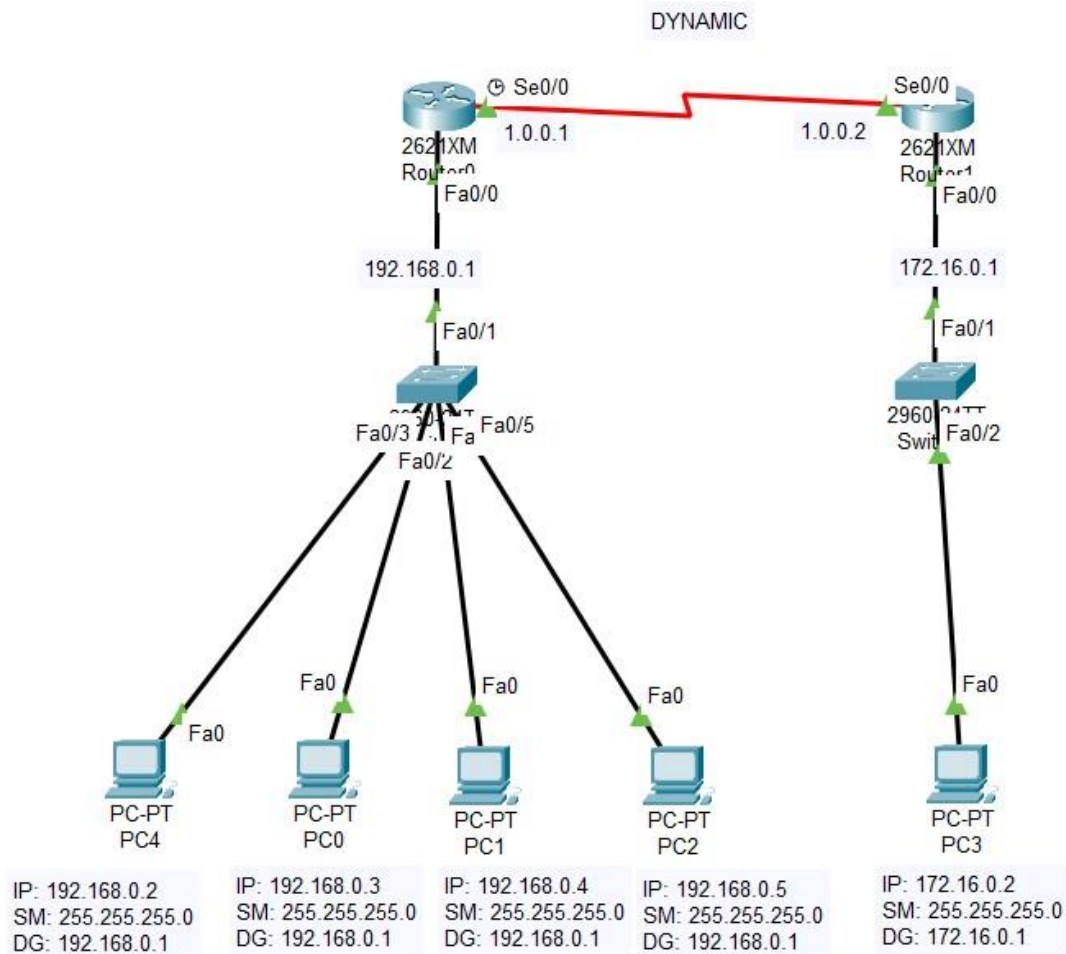
```
Pinging 192.168.0.2 with 32 bytes of data:
```

```
Reply from 50.0.0.1: bytes=32 time=2ms TTL=126
Reply from 50.0.0.1: bytes=32 time=2ms TTL=126
Reply from 50.0.0.1: bytes=32 time=4ms TTL=126
Reply from 50.0.0.1: bytes=32 time=10ms TTL=126
```

```
Ping statistics for 192.168.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
    Minimum = 2ms, Maximum = 10ms, Average = 4ms
```

Dynamic NAT



Router-1

Assigning IP Address to serial Interface 0/0

```
Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 1.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#
```

Assigning IP Address to FastEthernet Interface 0/0

```
Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 192.168.0.1 255.255.255.0
Router (config-if)# no shutdown
```


Router (config-if)# Exit
Router (config)#

ROUTER 2:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 1.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 172.16.0.1 255.255.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

Config static NAT (R-1)

Router>enable
Router#config terminal
Router(config)#access-list 20 permit 192.168.0.0 0.0.0.255
Router(config)#ip nat pool Rohit 192.168.0.0 192.168.255.254
Router(config)#ip nat inside source list 20 pool Rohit

Implementing:

Router(config)#int fastethernet 0/0
Router(config)#ip nat inside
Router(config)#exit

```
Router(config)#int fastethernet 0/0
```

```
Router(config)#ip nat inside
```

```
Router(config)#exit
```

```
Router#show ip nat translation
```

Pro	Inside global	Inside local	Outside local	Outside global
icmp	50.0.0.1:2	192.168.0.2:2	172.16.0.2:2	172.16.0.2:2
icmp	50.0.0.1:3	192.168.0.2:3	172.16.0.2:3	172.16.0.2:3
icmp	50.0.0.1:4	192.168.0.2:4	172.16.0.2:4	172.16.0.2:4
icmp	50.0.0.2:6	192.168.0.3:6	172.16.0.2:6	172.16.0.2:6
icmp	50.0.0.2:7	192.168.0.3:7	172.16.0.2:7	172.16.0.2:7
icmp	50.0.0.2:8	192.168.0.3:8	172.16.0.2:8	172.16.0.2:8

```
C:\>ping 192.168.0.2
```

```
Pinging 192.168.0.2 with 32 bytes of data:
```

```
Reply from 50.0.0.3: bytes=32 time=1ms TTL=126
```

```
Reply from 50.0.0.3: bytes=32 time=13ms TTL=126
```

```
Reply from 50.0.0.3: bytes=32 time=4ms TTL=126
```

```
Reply from 50.0.0.3: bytes=32 time=11ms TTL=126
```

```
Ping statistics for 192.168.0.2:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 1ms, Maximum = 13ms, Average = 7ms
```

```
C:\>ping 192.168.0.3
```

```
Pinging 192.168.0.3 with 32 bytes of data:
```

```
Reply from 50.0.0.2: bytes=32 time=2ms TTL=126
```

```
Reply from 50.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 50.0.0.2: bytes=32 time=1ms TTL=126
```

```
Reply from 50.0.0.2: bytes=32 time=12ms TTL=126
```

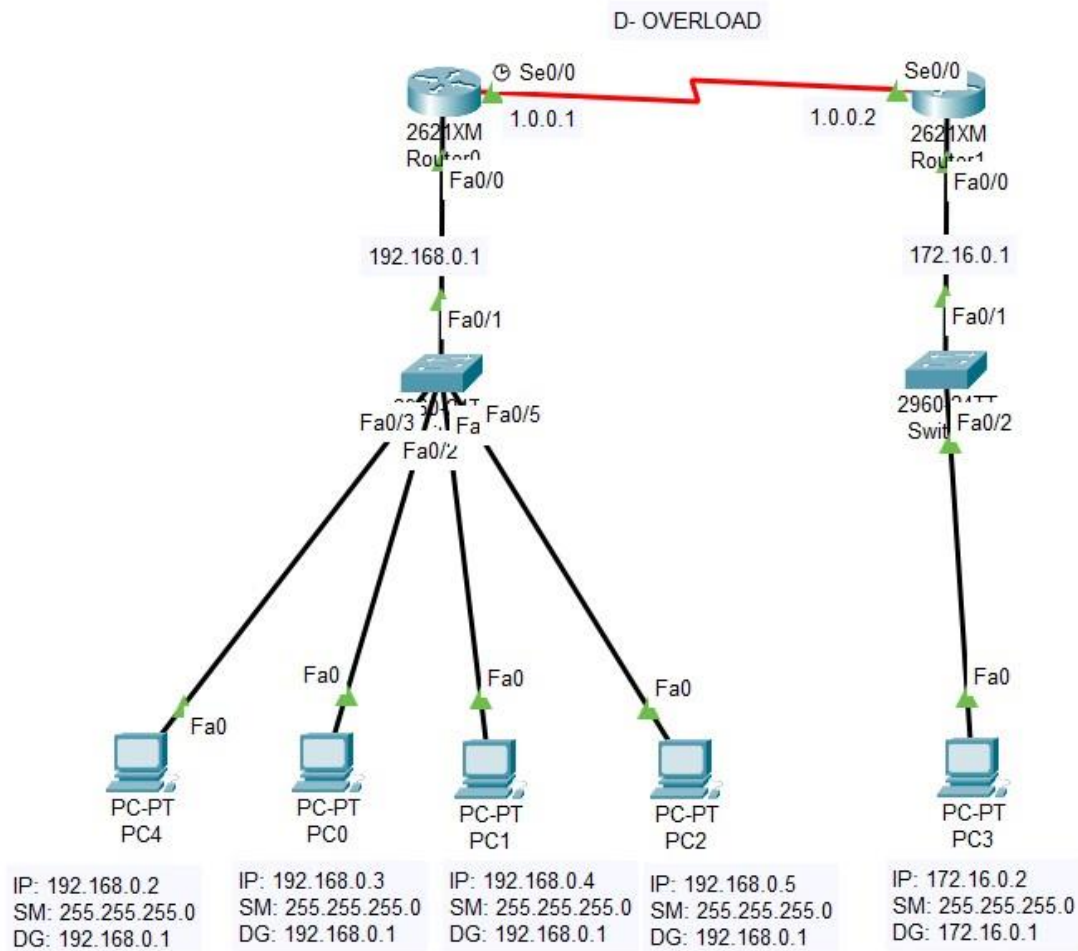
```
Ping statistics for 192.168.0.3:
```

```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
```

```
Approximate round trip times in milli-seconds:
```

```
    Minimum = 1ms, Maximum = 12ms, Average = 4ms
```

Dynamic overload/PAT



Router-1

Assigning IP Address to serial Interface 0/0

```
Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 1.0.0.1 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#
```

Assigning IP Address to FastEthernet Interface 0/0

```
Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 192.168.0.1 255.255.255.0
Router (config-if)# no shutdown
Router (config-if)# Exit
```

Router (config)#

ROUTER 2:

Assigning IP Address to serial Interface 0/0

Router > enable
Router # configure terminal
Router (config) #interface 0/0
Router (config)#ip address 1.0.0.2 255.0.0.0
Router (config-if)#no shutdown
Router (config-if)#exit
Router (config)#

Assigning IP Address to FastEthernet Interface 0/0

Router (config)# interface fastethernet 0/0
Router (config-if)# ip address 172.16.0.1 255.255.0.0
Router (config-if)# no shutdown
Router (config-if)# Exit
Router (config)#

Config static NAT in (R-1)

Router>enable
Router#config terminal
Router(config)#access-list 20 permit 192.168.0.0 0.0.0.255
Router(config)#ip nat pool Rohit 192.168.0.0 192.168.255.254
Router(config)#ip nat inside source list 20 pool Rohit overload

Implementing:

Router(config)#int fastethernet 0/0
Router(config)#ip nat inside
Router(config)#exit

```
C:\>ping 192.168.0.2
```

```
Pinging 192.168.0.2 with 32 bytes of data:
```

```
Reply from 50.0.0.1: bytes=32 time=3ms TTL=126  
Reply from 50.0.0.1: bytes=32 time=10ms TTL=126  
Reply from 50.0.0.1: bytes=32 time=4ms TTL=126  
Reply from 50.0.0.1: bytes=32 time=11ms TTL=126
```

```
Ping statistics for 192.168.0.2:
```

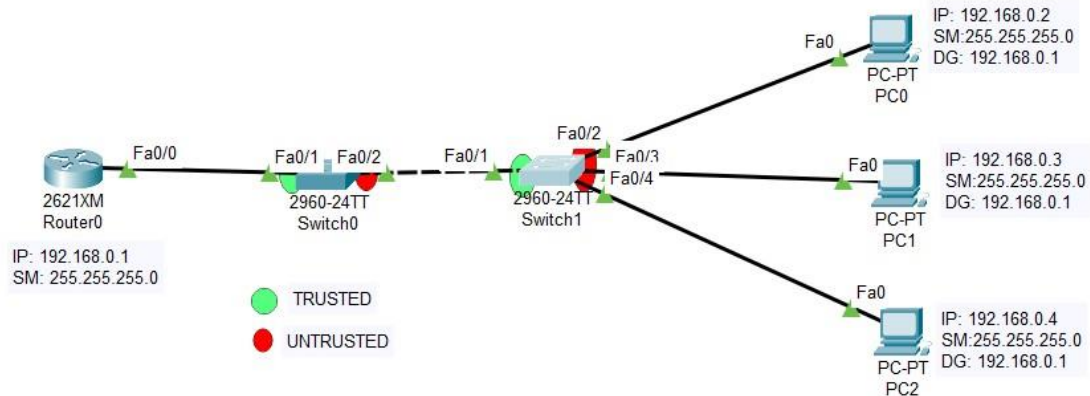
```
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),  
Approximate round trip times in milli-seconds:  
    Minimum = 3ms, Maximum = 11ms, Average = 7ms
```

```
Router#show ip nat translation
```

Pro	Inside global	Inside local	Outside local	Outside global
icmp	50.0.0.1:23	192.168.0.2:23	172.16.0.2:23	172.16.0.2:23
icmp	50.0.0.1:24	192.168.0.2:24	172.16.0.2:24	172.16.0.2:24
icmp	50.0.0.1:25	192.168.0.2:25	172.16.0.2:25	172.16.0.2:25
icmp	50.0.0.1:26	192.168.0.2:26	172.16.0.2:26	172.16.0.2:26

DHCP SNOOPING

- It is a security feature that is used to filter DHCP messages received on untrusted ports.
- By default, all ports are untrusted.



DHCP snooping config:

Switch 1:

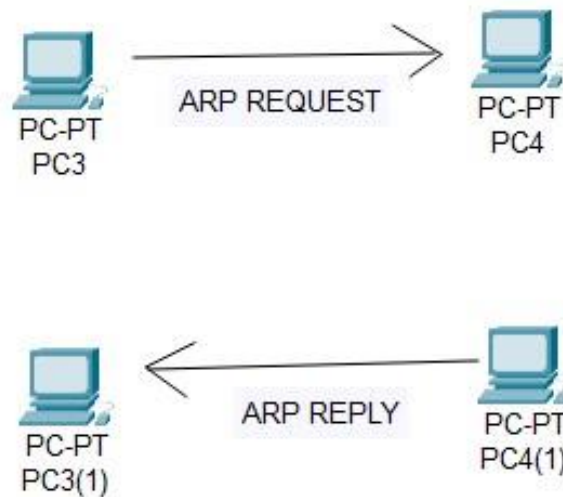
Switch>enable
Switch#config t
Switch(config)#ip dhcp snooping
Switch(config)#ip dhcp snooping VLAN 1
Switch(config)#no ip dhcp snooping info option
Switch(config)#interface fastethernet 0/1
Switch(config-if)#ip dhcp

Switch 2:

Switch>enable
Switch#config t
Switch(config)#ip dhcp snooping
Switch(config)#ip dhcp snooping VLAN 1
Switch(config)#no ip dhcp snooping info option
Switch(config)#interface fastethernet 0/1
Switch(config-if)#ip dhcp

Address Resolution Protocol (ARP)

- It resolves ip add to a know physical address or hardware address
- In a network each system maintains ARP table which consists mappings or obtained mac address and ip address
- Two resolves an ip address the ARP sends a broadcast message to entire nodes.
- On getting a reply message from particular host, ARP creates & maintains ARP table.



SYSLOGS

- It is an industry standard protocol for message logging
- Syslogs message format:
- Sequence: time stamp: % facility- severity level-mnemonic: description

Syslogs severity level:

S.no	Keyword	Description
0	emergency	System unusable
1	alert	Action taking immediately
2	critical	Critical condition
3	error	Error condition
4	warning	Warning condition
5	notice	A notification
6	informational	Info message display
7	debugging	Debug level messages

PORT SECURITY

- It is a security feature of cisco switches.
- It allows you to control which source mac address to enter into the switch port.

Enabling port security:.

```
Switch#show port-security interface fa0/1
Port Security           : Enabled
Port Status             : Secure-up
Violation Mode          : Shutdown
Aging Time              : 0 mins
Aging Type              : Absolute
SecureStatic Address Aging : Disabled
Maximum MAC Addresses   : 1
Total MAC Addresses     : 0
Configured MAC Addresses : 0
Sticky MAC Addresses    : 0
Last Source Address:Vlan : 0000.0000.0000:0
Security Violation Count : 0
```

```
Switch#show interfaces status
Port      Name      Status      Vlan      Duplex  Speed  Type
Fa0/1     Fa0/1     connected   1         auto    auto   10/100BaseTX
Fa0/2     Fa0/2     connected   1         auto    auto   10/100BaseTX
Fa0/3     Fa0/3     connected   1         auto    auto   10/100BaseTX
```

```
Switch#show interfaces fastEthernet 0/1 switchport
Name: Fa0/1
Switchport: Enabled
Administrative Mode: static access
Operational Mode: static access
Administrative Trunking Encapsulation: dot1q
Operational Trunking Encapsulation: native
Negotiation of Trunking: Off
Access Mode VLAN: 1 (default)
Trunking Native Mode VLAN: 1 (default)
Voice VLAN: none
Administrative private-vlan host-association: none
Administrative private-vlan mapping: none
Administrative private-vlan trunk native VLAN: none
Administrative private-vlan trunk encapsulation: dot1q
Administrative private-vlan trunk normal VLANs: none
Administrative private-vlan trunk private VLANs: none
Operational private-vlan: none
Trunking VLANs Enabled: All
Pruning VLANs Enabled: 2-1001
Capture Mode Disabled
Capture VLANs Allowed: ALL
Protected: false
Unknown unicast blocked: disabled
Unknown multicast blocked: disabled
Appliance trust: none
```

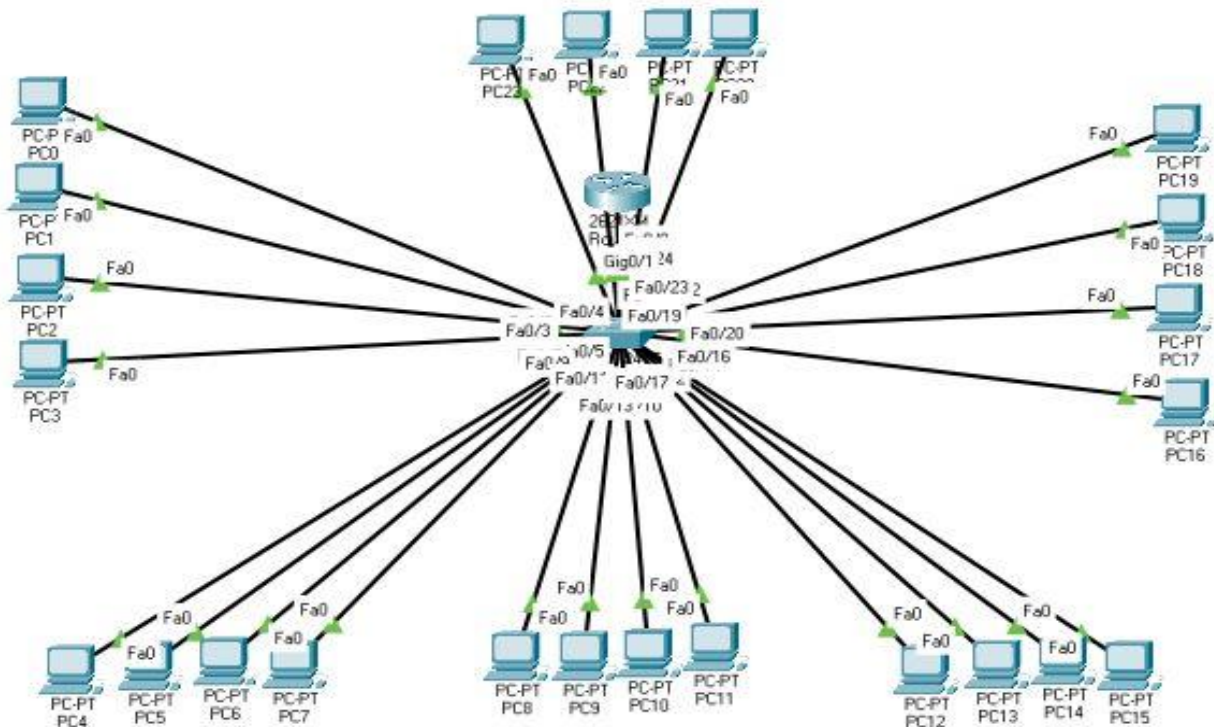
Virtual Local Area Network (VLAN)

VLAN: Dividing single broadcast domain into multiple domains

Create a VLAN:

S(config)#VLAN 10
S(config-VLAN)#name hr
S(config-VLAN)#exit
S(config)#int fa 0/2
S(config-if)#switchport mode access
S(config-if)#switchport access VLAN 10

- VLAN: A logical grouping of devices in the same broadcast domain.
- VLAN's are configured on switches by phasing some interfaces into one broadcast domain and some into other broadcast domain.

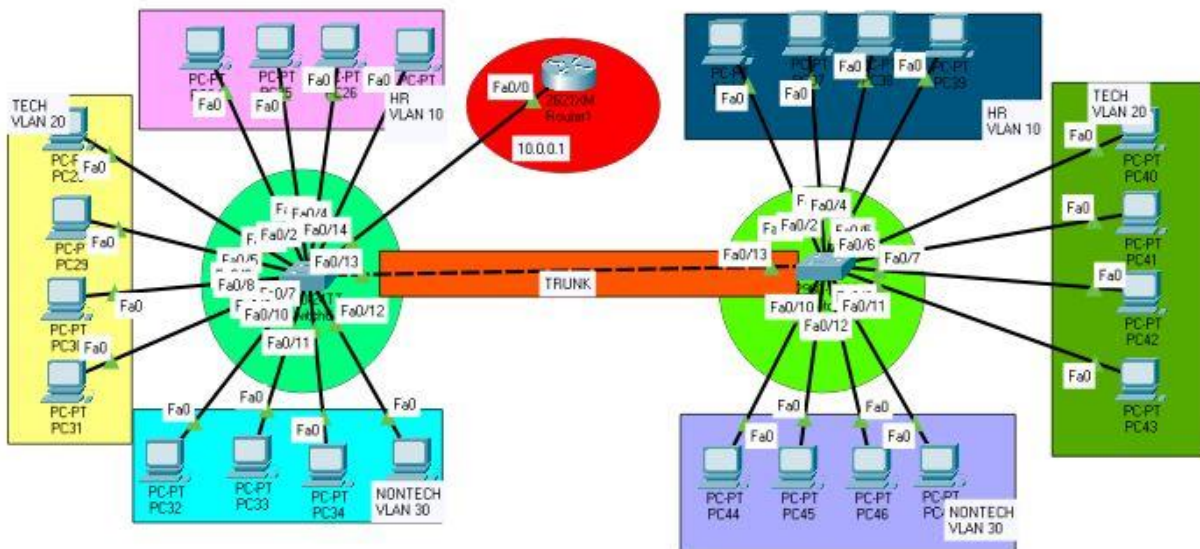


VLAN	Name	Status	Ports
1	default	active	Fa0/1, Gig0/2
10	campus1	active	Fa0/2, Fa0/3, Fa0/4, Fa0/5
20	campus2	active	Fa0/6, Fa0/7, Fa0/8, Fa0/9
30	campus3	active	Fa0/10, Fa0/11, Fa0/12, Fa0/13
40	campus4	active	Fa0/14, Fa0/15, Fa0/16, Fa0/17
50	campus5	active	Fa0/18, Fa0/19, Fa0/20, Fa0/21
60	campus6	active	Fa0/22, Fa0/23, Fa0/24, Gig0/1
1002	fddi-default	active	
1003	token-ring-default	active	
1004	fddinet-default	active	
1005	trnet-default	active	

Trunking

A port that is connected to another switch

This type of interface can be used to carry traffic of multiple VLAN.



Configuring trunk port:

```
Switch> enable
```

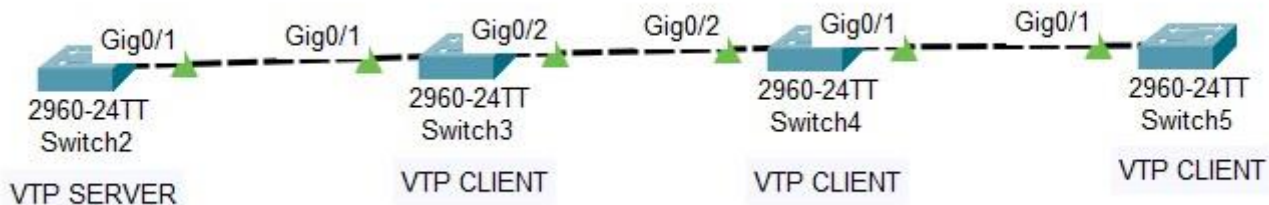
```
Switch#config t
```

```
Switch(config)#int fastethernet 0/1
```

```
Switch(config-if)#switchport mode trunk
```


VIRTUAL TRUNKING PROTOCOL

- VTP is a proprietary used by cisco switches to exchange VLAN information.
- We can synchronize VLAN info such as VLAN id with switches inside the same VTP domain.
- VTP domain is a set of trunked switches with the matching VTP settings like domain mail password and VTP version.
- Switches with in the same domain can share this VLAN info with each other



VTP modes :

1. VTP server mode:

- a switch using the server mode can creat and delete VLAN's
- This is a default mode for cisco switches.
- A vty server switch can propogate VLAN

2. VTP client mode:

- A switch using VTP client mode cant change VLAN config
- This switch cant create and delete VLAN's.
- This switch receives the VLAN info from from server in the form of VTP updates.
- This mode receives the updates, the received updates area processed and forwarded.

3. VTP transparent mode:

- A switch using this mode will not share VLAN database, but it forwards, the received VTP updates.

- We can create and delete the VLAN on VTP transparent switch but these changes will not send to the other switches.

4. VTP mode off:

- Similar to VTP transparent mode, but a switch using this mode will not forward the received updates from VTP server
- It supports only in version 3.

VLAN configuration:

- A switch has to be configured as server or client.
- VTP domain name has to be same in both switches
- VTP domain passwords has to be same in all switches
- Trunking should be configured



Switch 2:

Switch> enable
Switch#config t
Switch(config)#VTP domain rohit
Switch(config)#VTP password 123456
Switch(config)#VTP version 3

Switch 3:

Switch> enable
Switch#config t
Switch(config)#VTP mode client
Switch(config)#VTP domain rohit
Switch(config)#VTP password 123456

```
Switch(config)#VTP version 3
```

Switch 4:

```
Switch> enable
```

```
Switch#config t
```

```
Switch(config)#VTP mode client
```

```
Switch(config)#VTP domain rohit
```

```
Switch(config)#VTP password 123456
```

```
Switch(config)#VTP version 3
```

Switch 2:

```
Switch#show cdp neighbors
```

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge  
                  S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone
```

Device ID	Local Intrfce	Holdtme	Capability	Platform	Port ID
Switch	Gig 0/1	140	S	2960	Gig 0/1

Switch 3:

```
Switch#show cdp neighbors
```

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge  
                  S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone
```

Device ID	Local Intrfce	Holdtme	Capability	Platform	Port ID
Switch	Gig 0/1	152	S	2960	Gig 0/1
Switch	Gig 0/2	174	S	2960	Gig 0/2

Switch 4:

```
Switch#show cdp neighbors
```

```
Capability Codes: R - Router, T - Trans Bridge, B - Source Route Bridge  
                  S - Switch, H - Host, I - IGMP, r - Repeater, P - Phone
```

Device ID	Local Intrfce	Holdtme	Capability	Platform	Port ID
Switch	Gig 0/2	131	S	2960	Gig 0/2

-----THE END-----