



Project Report on
“Implementing and Administering Cisco Solution
[CCNA]”

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Declaration Certificate

This is to certify that **Y. Rohit sai, & Roll no: 10087**, a student of **JK-MNA 1451**, has done his project and submitted to the faculty **NIKHIL DUTH**.

The project work entitled **“Implementing and Administering Cisco Solution [CCNA]”** done by **Y. Rohit sai** during his training period of **module 2**.

Faculty Sign

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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 Ameerpet
Ameerpet(config)# password Jet@123#
Ameerpet(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 Ameerpet
Ameerpet(config)# enable secret Jet@123#
Ameerpet(config)# exit

3. Console Password:

This password is used to enter on-premises.

Syntax:

Router> enable
Router# configure terminal
Router(config)# host Ameerpet

Ameerpet(config)# line console 0
Ameerpet(config-line)# password Jet@123#
Ameerpet(config-line)# login
Ameerpet(config-line)# exit

4. Auxiliary Password:

This password is used to enter into router remotely

Syntax:

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

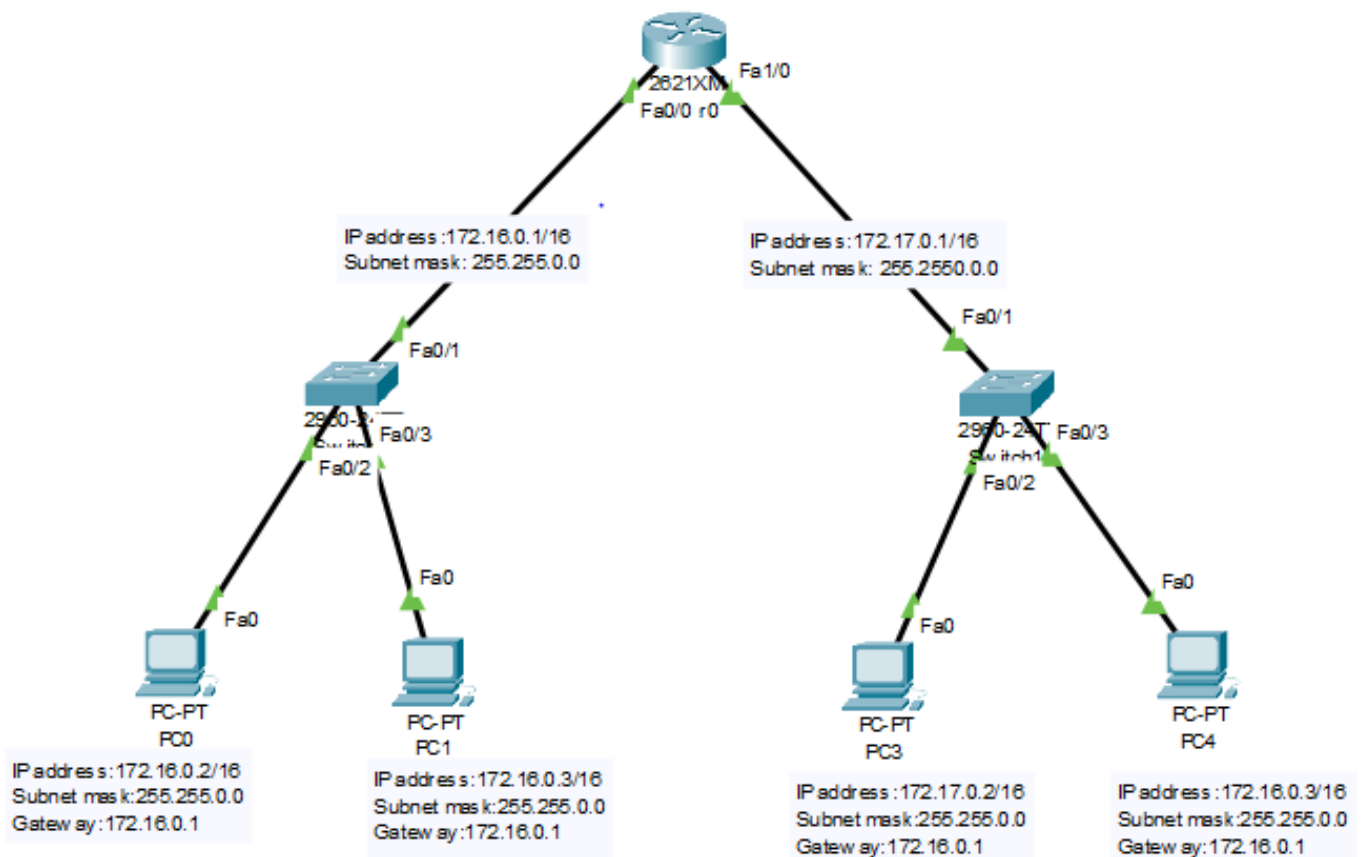
Routing

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



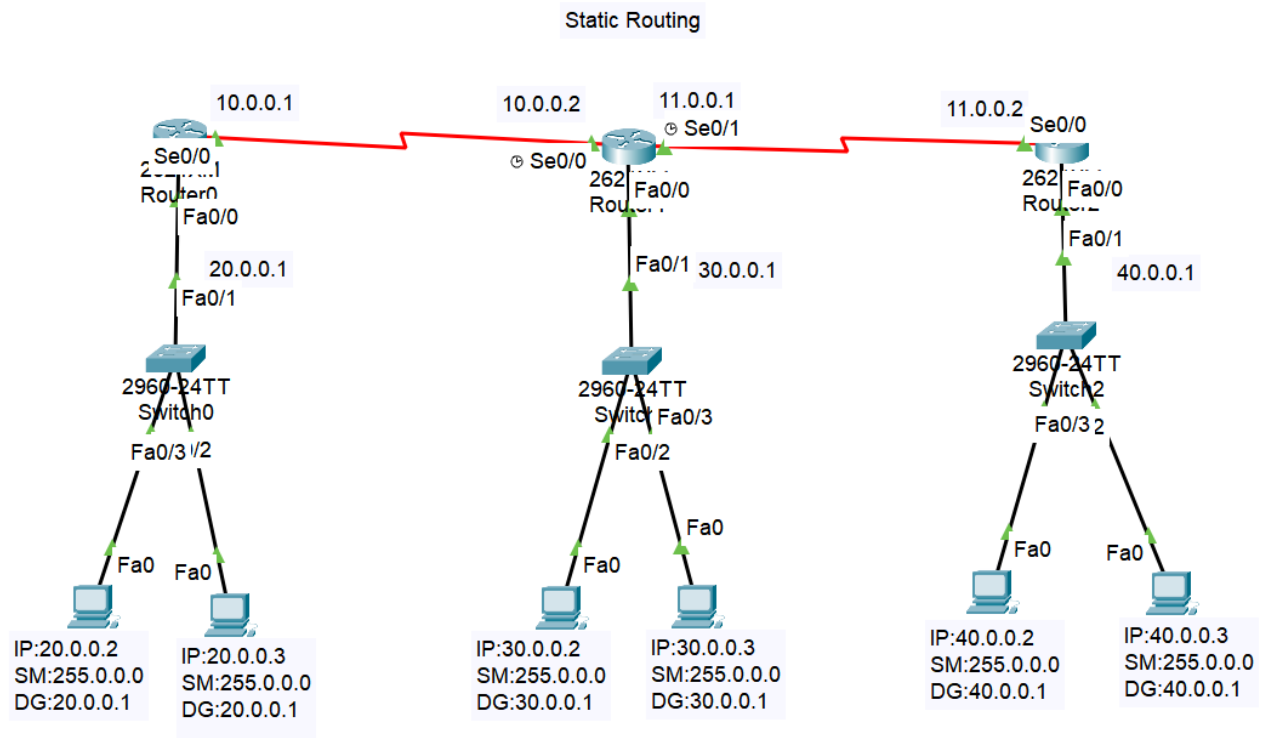
- In this case both the networks are directly connected router interface.
- In this following figure above PC0 is connected to 172.16.1.0/16 and it is directly connected to fast ethernet 0/0 and PC2 is connected to fast ethernet 0/1 with 192.16.1.0/24.
- A router will automatically route packets between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

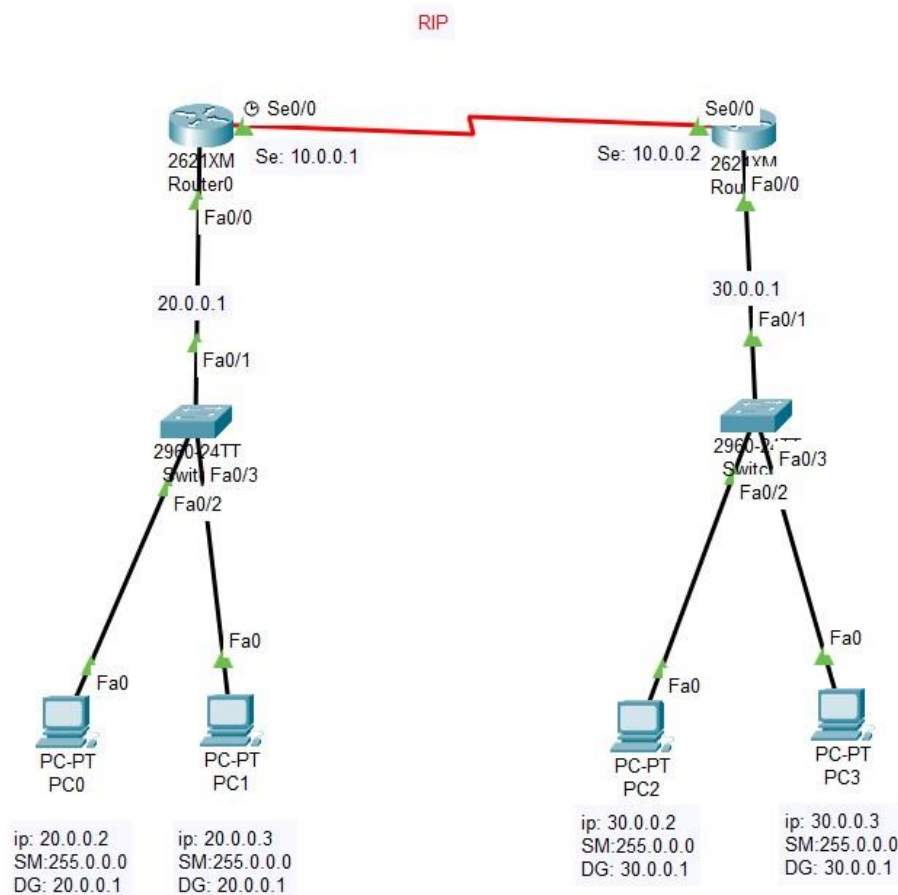
In dynamic routing the routing table will change based on the networks. Hence the administrator will only add the network to the router and the router figures out the best path. It will calculate the best path on routing protocols.

There are 3 types:

1. RIP
2. EIGRP
3. OSPF

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):

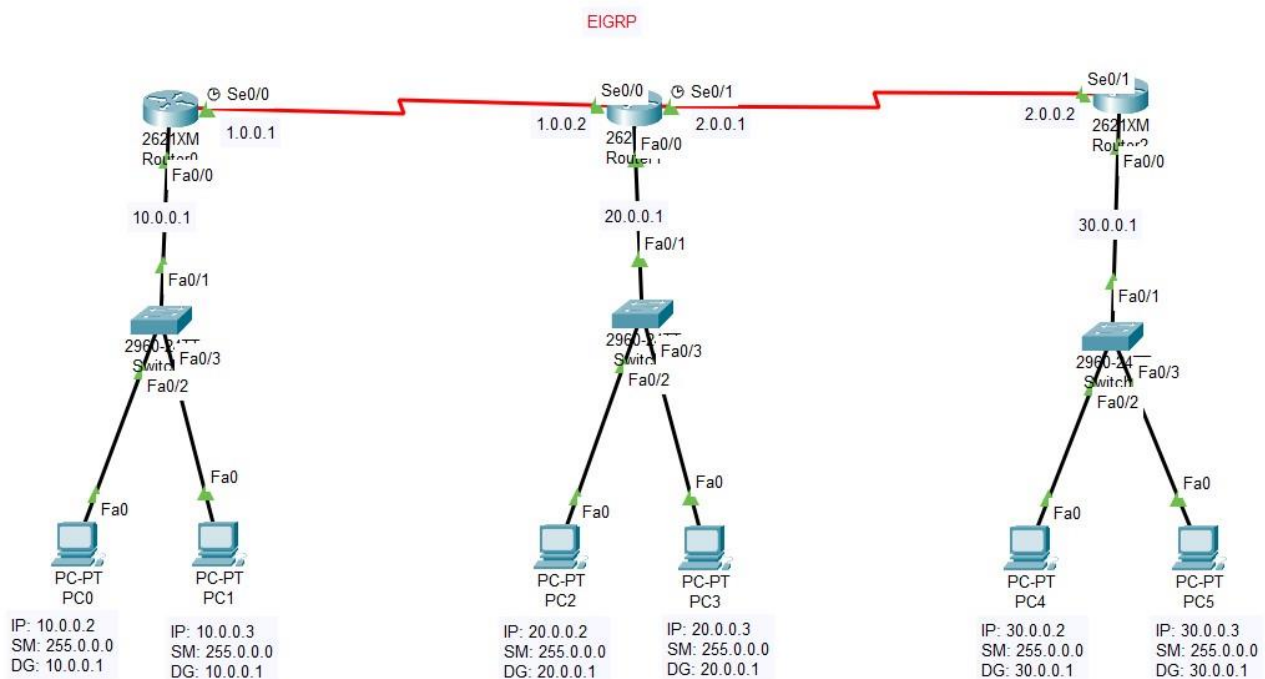
This is a cisco proprietary enhanced distance vector routing protocol EIGRP has faster convergence, & has fewer network overheads. It sends traditional distance vector updates containing info about network is including the cost of reaching then from perspective of the advertising routes.

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)#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:

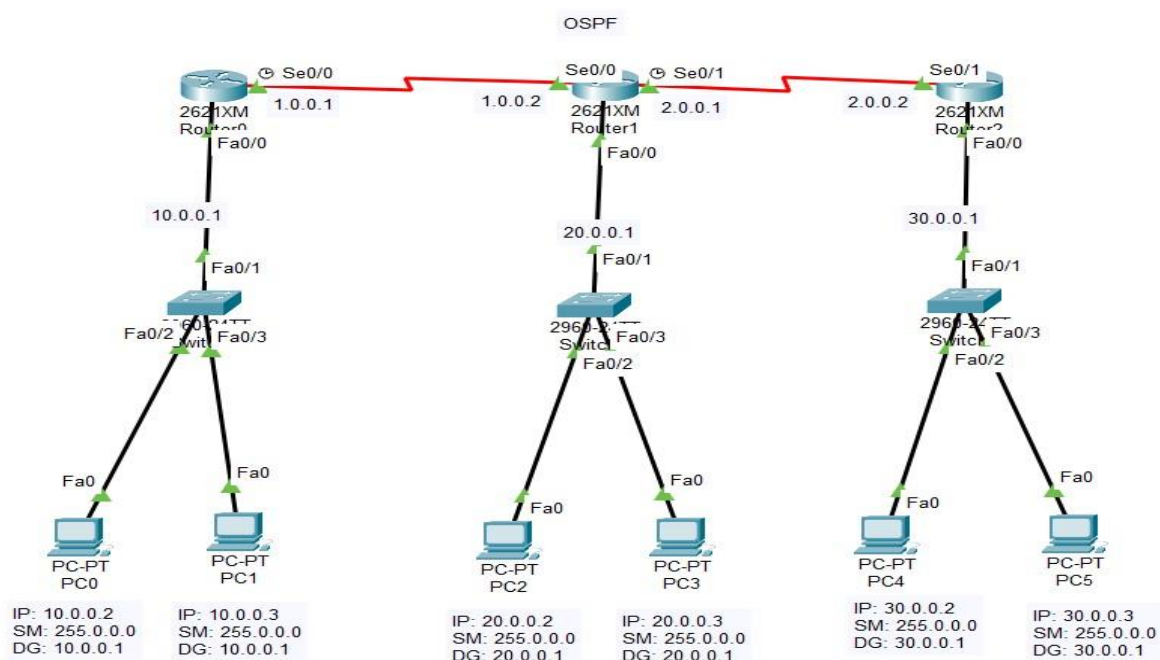
Wildcard mask are used to specify a range of network address. They are commonly used with routing protocol like OSPF and access lists. Wildcard mask is an opposite of subnet mask, wildcard mask is also a 32-Bit address.

Calculation of wildcard mask:

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

$$\begin{array}{r} \text{GSM } 255.255.255.255 \\ - \text{SM } 255.000.000.000 \\ \hline \end{array}$$

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

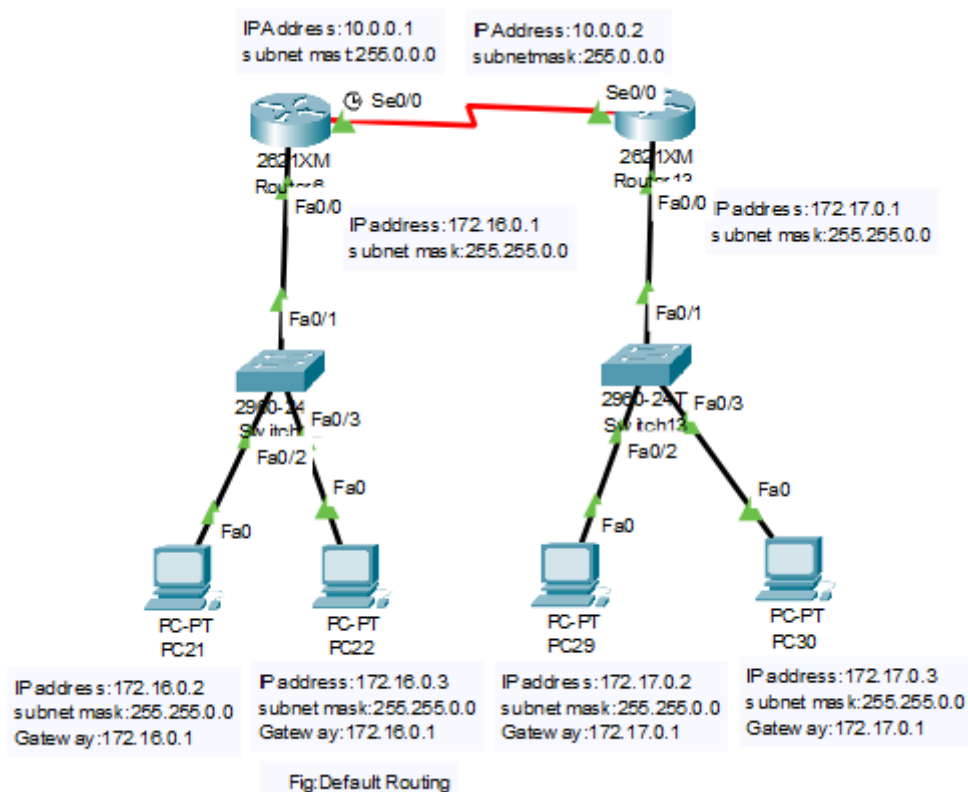
Codes: C - connected, S - static, I - IGRP, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
i - IS-IS, L1 - IS-IS level-1, L2 - IS-IS 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
```


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

REDISTRIBUTION

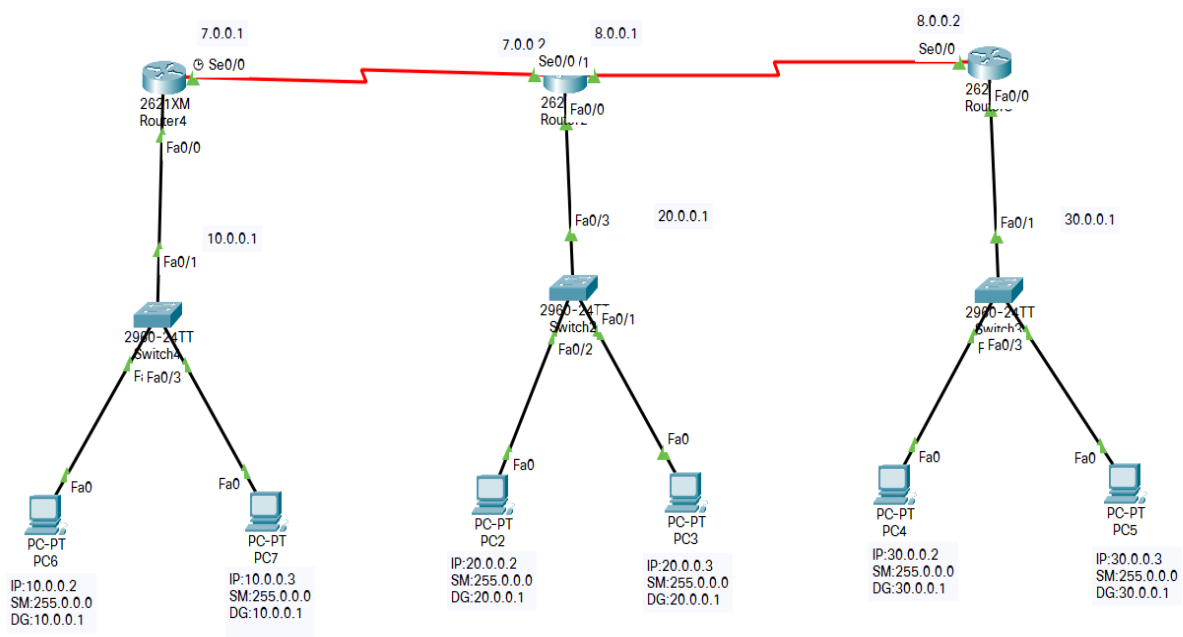
It is technique that allows routes learned by one routing protocol or one algorithm to be advertised into another routing protocol or algorithm.

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
```

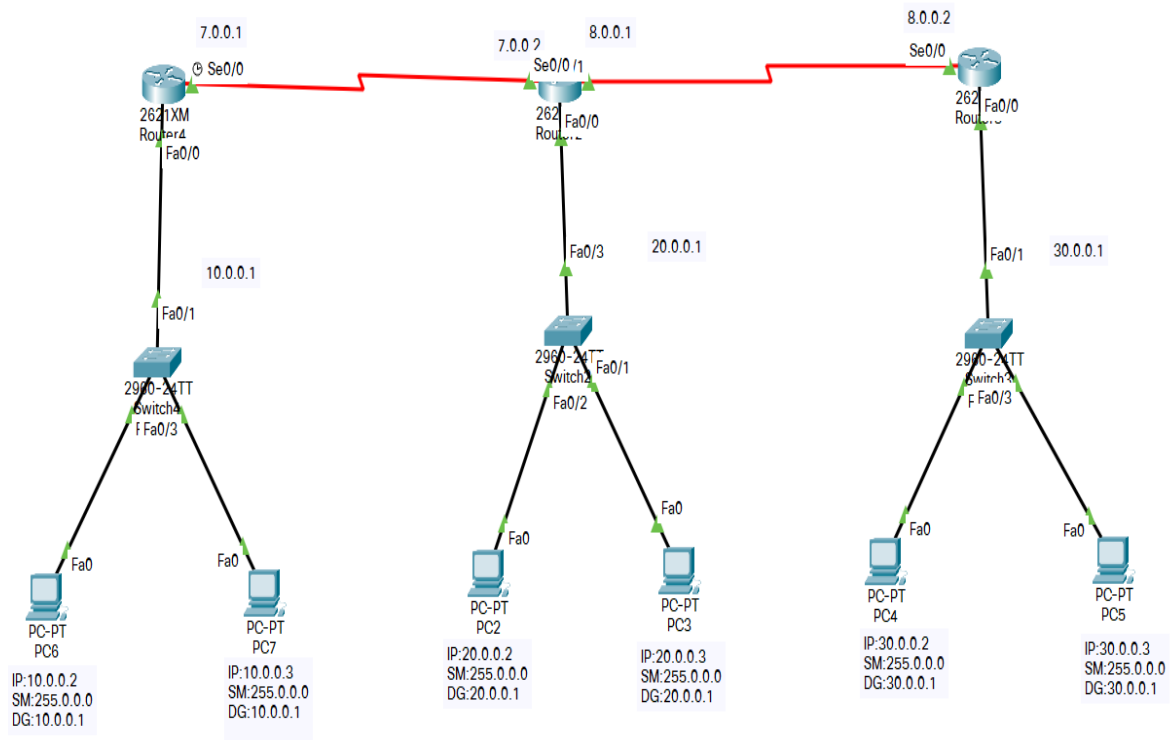
```
Pinging 30.0.0.3 with 32 bytes of data:
```

```
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 0/0
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 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:
```

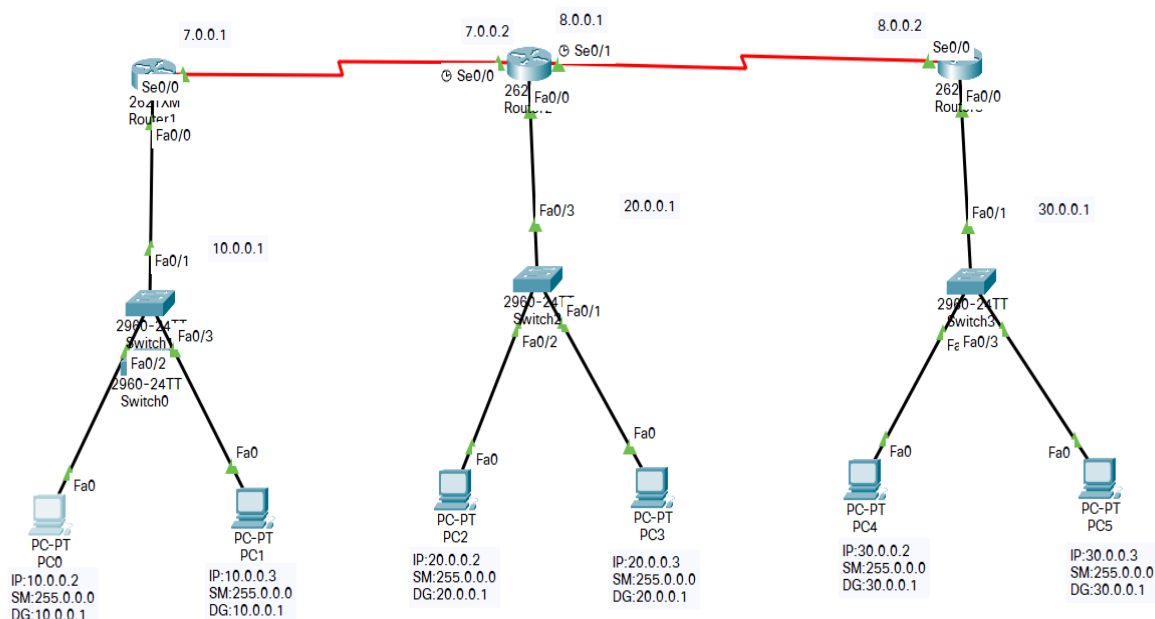
```
Reply from 30.0.0.3: bytes=32 time=26ms TTL=125
Reply from 30.0.0.3: bytes=32 time=22ms TTL=125
Reply from 30.0.0.3: bytes=32 time=157ms TTL=125
Reply from 30.0.0.3: bytes=32 time=17ms TTL=125
```

```
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-if)#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

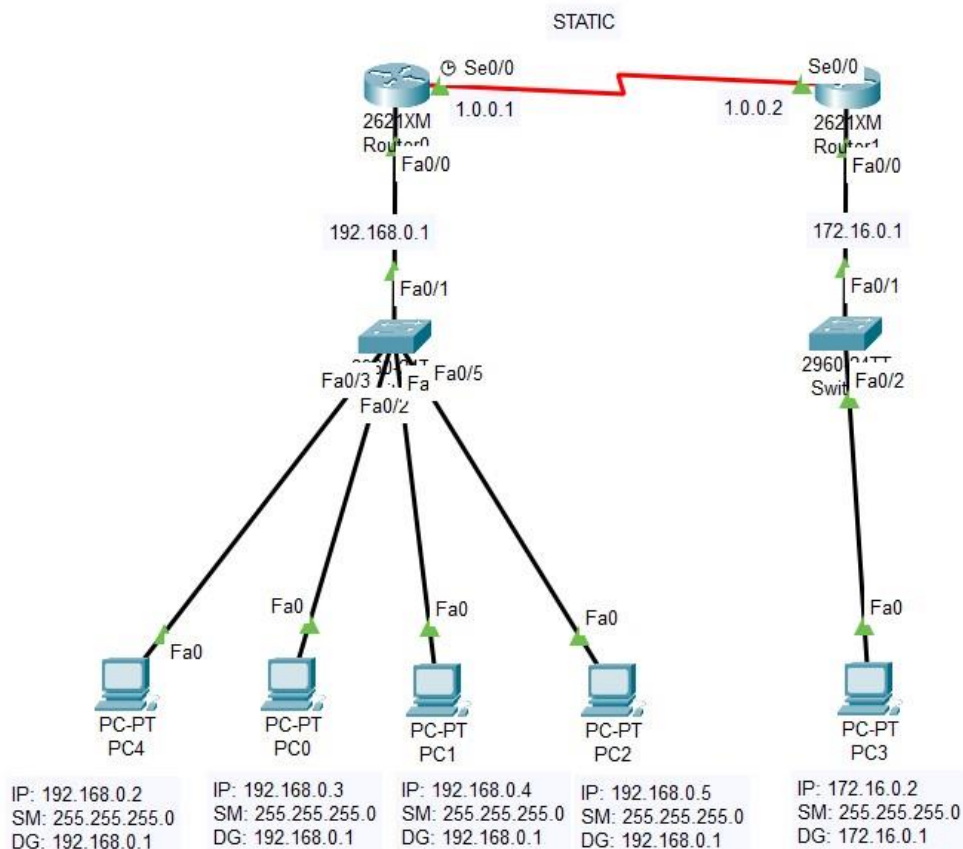
(Network Address Translation)

- 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
```

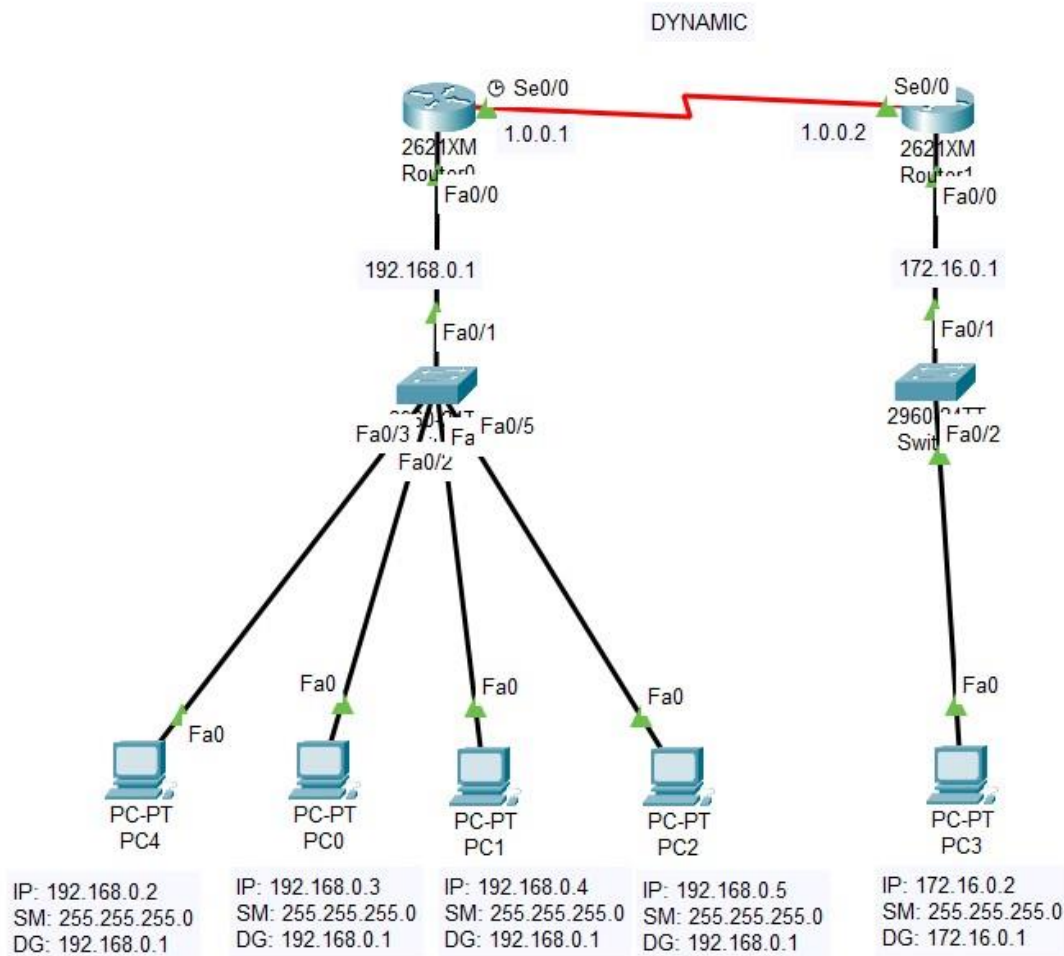
```
Ping statistics for 192.168.0.2:
```

```
    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
```

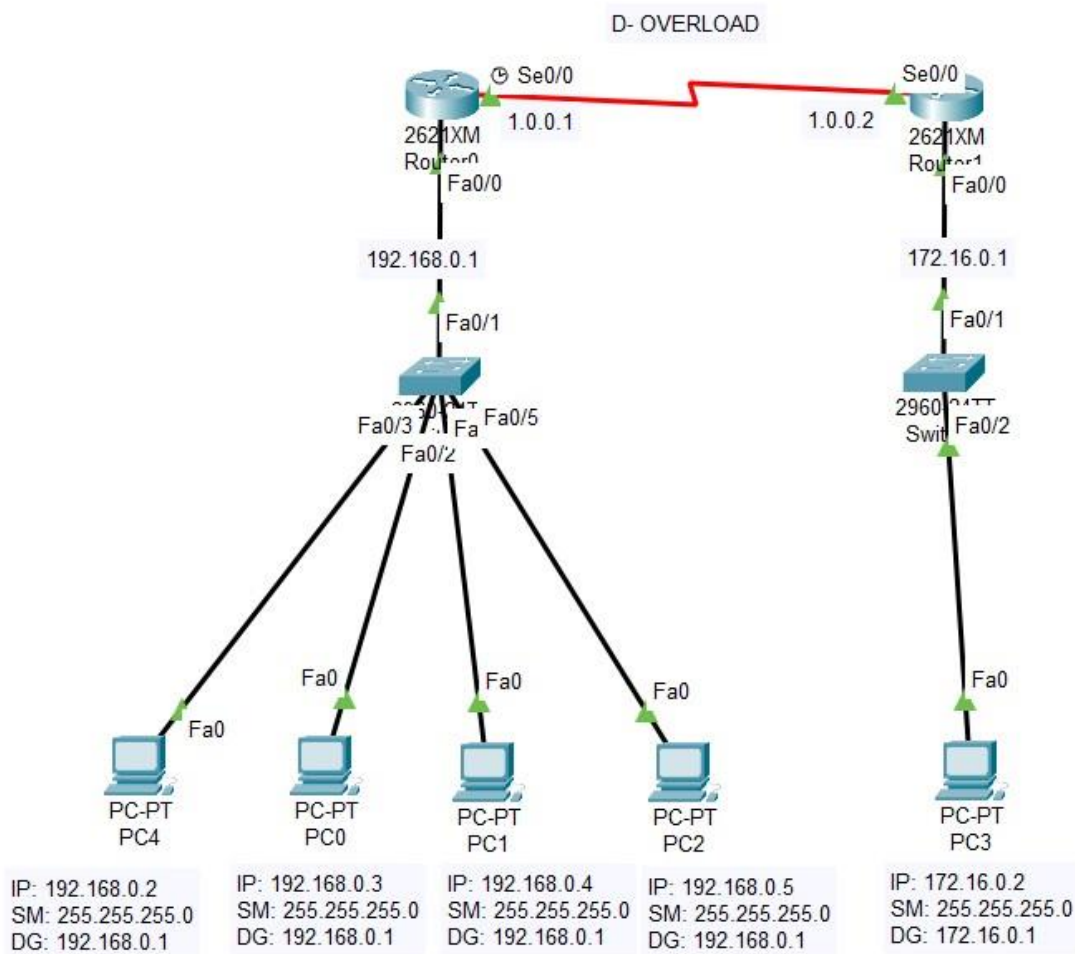
```
Pinging 192.168.0.3 with 32 bytes of data:
```

```
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

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