CONFIGURE AND TROUBLESHOOT OSPF & EIGRP

Team of The project(The Fable):

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- Ghadeer Mohamoud mahmoud
- Alaa Hussein Salem

Timetable:

- **Week 1: Setup and IP Configuration**
  - **Tasks:**
    - Set up the routers, switches, and PCs in GNS3 as per the design.
    - Plan and apply an IP addressing scheme (including subnets).
    - Configure static routes initially for connectivity testing.
    - Assign IP addresses to all routers, switches, and PCs.
    - Verify connectivity using ping tests between devices in the same and different networks.
    - Setup SSH access on routers.
  - **Deliverables:**

    Complete network topology with configured IPs, verified SSH access, and successful connectivity tests.

- **Week 2: EIGRP Router Configuration and Troubleshooting**
  - **Tasks:**
    - EIGRP on routers in Branch 2 and New Company with appropriate AS numbers.'.
    - Verify EIGRP topology *'show ip eigrp topology*.
    - Redistribute routes between OSPF and EIGRP at ASBRs.

- Fine-tune EIGRP using bandwidth, delay, and hop count parameters.
- Check route propagation across both routing protocols using *'show ip route'*

- **Deliverables:**

  Fully operational EIGRP, including correct redistribution between OSPF and EIGRP.

- **Week 3: OSPF Router Configuration and Troubleshooting**
  - **Tasks:**
    - Configure OSPF on HQ and Branch routers (R1, R2, R5, etc.).
    - Set up areas (Area 0, Area 1, etc.) and troubleshoot OSPF adjacency issues.
    - Set up virtual links for non-directly connected areas (e.g., Area 3).
    - Verify OSPF adjacencies using show ip ospf neighbor and check OSPF routes.
    - Verify OSPF routes using commands like *'show ip ospf*.
    - Troubleshoot OSPF issues: misconfigurations in area IDs or IP addressing.

  - **Deliverables:**

    Functional OSPF with correct routing tables and virtual links in place.

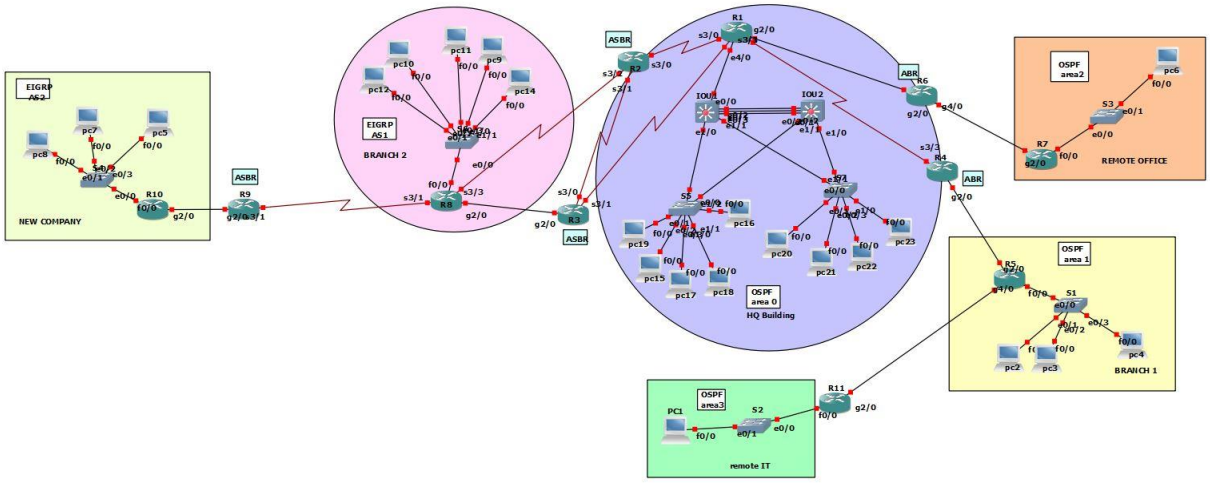
- **Week 4: Documentation and Presentation**
  - **Tasks:**
    - Document configurations, IP schemes, router settings, and OSPF/EIGRP parameters.
    - Record key troubleshooting steps and resolutions.
    - Create a network diagram showing the topology with details on routing protocols.
    - Prepare a presentation highlighting the project setup, configurations, and the real-life application.

  - **Deliverables:**

    Comprehensive documentation, network diagrams, and a ready-to-present project.

TASKS DISTRIBUTION:

- **Mayar & Samaa:**
  - Responsible for configuring routers, switches & pcs with IPv4 addressing scheme
  - Secure routers & switches by SSH.
  - Protect device configuration from unauthorized access with privileged exec passwords.
  - Documenting and troubleshooting their task.
- **Alaa:**
  - Configure EIGRP routing protocol as shown in the figure.
  - Documenting and troubleshooting her task.
- **Arwa & Ghadeer:**
  - Set up OSPF routing protocol as shown in the figure.
  - Documenting and troubleshooting their task.



INTRODUCTION:

Introduction to the Enterprise Network

This enterprise network consists of a centralized main headquarters (HQ) and several branch offices. The network infrastructure is designed to provide seamless communication between the HQ, remote offices, and a newly added company. The HQ serves as the backbone of the network, while different routing protocols and domains are used to manage traffic flow efficiently across different parts of the enterprise.

Main Headquarters (HQ)

The HQ is the core of the network, featuring 5 routers that are configured with IP addresses and are running OSPF (Open Shortest Path First) as the routing protocol. These routers are part of OSPF Area 0, which acts as the backbone of the entire network. Area 0 is critical in OSPF networks as it allows all other OSPF areas to communicate through it. This ensures fast and reliable routing decisions within the HQ and facilitates efficient data exchange between other areas.

Branch 1 & Remote Offices

Beyond the HQ, the network extends to Branch 1 and several remote locations, including an office and an IT department. These areas also use OSPF, but they are organized into different OSPF areas for optimized routing. Branch 1 is a part of OSPF Area 1, remote Office is a part of OSPF Area 2 and IT is a part of OSPF Area 3 by virtual link.

By segmenting the network into multiple OSPF areas, the network improves scalability and reduces the size of routing tables, enhancing overall performance.

Branch 2 & Newly Added Company

In contrast to the HQ and Branch 1, Branch 2 & a newly added company use EIGRP (Enhanced Interior Gateway Routing Protocol). EIGRP is an advanced distance-vector routing protocol that offers fast convergence and efficient handling of traffic. Since Branch 2 operates within a different routing domain (EIGRP), there is a need for proper integration and redistribution of routes between the EIGRP domain and the OSPF areas at the boundary of Branch 2 and the main network.

Network Infrastructure

- 11 routers in total are deployed across HQ, Branch 1, Branch 2, new company and remote locations, forming the backbone of the network.

- 7 switches are used to interconnect different network devices and provide local area networking (LAN) at each site.

- 22 PCs are distributed across HQ and the branches, serving employees and users within the enterprise.

Conclusion

This enterprise network is designed to support a dynamic and scalable environment. The use of OSPF in the main HQ and other branches ensures robust internal communication, while EIGRP in Branch 2 provides flexibility for the newly added company. The combination of routers, switches, and end-user devices creates a comprehensive infrastructure that can handle the growing demands of the enterprise.

Configuring Routers

1. Addressing Table:

Device	Interface	Address
R8(branch2)	Fa 0/0	192.168.1.1/27 255.255.255.224
	G 2/0	192.168.1.53/30 255.255.255.252
	S 3/1	192.168.1.50/30 255.255.255.252
	S 3/3	192.168.1.61/30 255.255.255.252
R10(new company)	Fa 0/0	192.168.1.33/28 255.255.255.240
	G 2/0	192.168.1.57/30 255.255.255.252
R2	S 3/1	192.168.1.66/30 255.255.255.252
	S 3/2	192.168.1.62/30 255.255.255.252
	S 3/0	172.16.3.2/30 255.255.255.252
R3	G 2/0	192.168.1.54/30 255.255.255.252
	S 3/0	192.168.1.65/30 255.255.255.252
	S 3/1	172.16.4.2/30 255.255.255.252
R9	G 2/0	192.168.1.58/30 255.255.255.252
	S 3/1	192.168.1.49/30 255.255.255.252
R1	G 2/0	172.16.1.1/30 255.255.255.252
	E 4/0	172.16.2.1/24 255.255.255.0
	S 3/0	172.16.3.1/30 255.255.255.252
	S 3/1	172.16.4.1/30 255.255.255.252
	S 3/3	172.16.5.1/30 255.255.255.252

R4	S 3/3	172.16.5.2/30 255.255.255.252
	G 2/0	172.16.45.1/30 255.255.255.252
R5	G 2/0	172.16.45.2/30 255.255.255.252
	G 4/0	172.16.51.1/30 255.255.255.252
	F 0/0	200.10.5.1/24 255.255.255.0
R6	G 2/0	172.16.1.2/30 255.255.255.252
	G 4/0	172.16.67.1/30 255.255.255.252
R7	G 2/0	172.16.67.2/30 255.255.255.252
	F 0/0	200.10.7.1/24 255.255.255.0
R11	G 2/0	172.16.51.2/30 255.255.255.252
	F 0/0	200.10.11.1/29 255.255.255.248

2. Configure routers with an ipv4 addressing scheme & ssh :

- **Branch 2 (R8):**

```
interface FastEthernet0/0
ip address 192.168.1.1 255.255.255.224

interface GigabitEthernet2/0
 ip address 192.168.1.53 255.255.255.252

interface Serial3/1
 ip address 192.168.1.50 255.255.255.252

interface Serial3/3
 ip address 192.168.1.61 255.255.255.252
```

```
hostname BRANCH2
enable password fable
ip domain name the-table.com
username the-fable password 0 fable

line vty 0 4
 login local
 transport input ssh
line vty 5 15
 login local
 transport input ssh
```

- **new company (R10):**

```
interface FastEthernet0/0
 ip address 192.168.1.33 255.255.255.240

interface GigabitEthernet2/0
 ip address 192.168.1.57 255.255.255.252
```

```
hostname new-company

enable password fable
```

- **R9:**

```
interface GigabitEthernet2/0                service password-encryption
 ip address 192.168.1.58 255.255.255.252    hostname R9
                                            security passwords min-length 10
interface Serial3/1                         enable password 7 094A4F0B1500
 ip address 192.168.1.49 255.255.255.252
```

- **R2:**

```
Interface Serial3/0                         service password-encryption
 ip address 172.16.3.2 255.255.255.252      hostname R2
                                            security passwords min-length 10
interface Serial3/1                         enable password 7 15140A0E082F
 ip address 192.168.1.66 255.255.255.252

interface Serial3/2
 ip address 192.168.1.62 255.255.255.252
```

- **R3:**

```
interface GigabitEthernet2/0                hostname R3
 ip address 192.168.1.54 255.255.255.252    enable password fable

interface Serial3/0
 ip address 192.168.1.65 255.255.255.252

interface Serial3/1
 ip address 172.16.4.2 255.255.255.252
```

- **HQ (R1):**

```
interface GigabitEthernet2/0                hostname HQ
 ip address 172.16.1.1 255.255.255.252      enable secret hqFable1234
                                            ip domain name the-fable.com
interface Serial3/0                         username hqfable password fablehq123
 ip address 172.16.3.1
255.255.255.252interface                    line vty 0 4
                                            login local
Serial3/1                                   transport input ssh
 ip address 172.16.4.1 255.255.255.252
                                            line vty 5 15
interface Serial3/3                          login local
 ip address 172.16.5.1 255.255.255.252      transport input ssh

interface Ethernet4/0
 ip address 172.16.2.1 255.255.255.0
```

R4:

```
interface GigabitEthernet2/0
 ip address 172.16.45.1 255.255.255.252

interface Serial3/3
 ip address 172.16.5.2 255.255.255.252
```

```
hostname R4
service password-encryption
security password min-length 10
enable secret fable12345
```

R6:

```
interface GigabitEthernet2/0
 ip address 172.16.1.2 255.255.255.252

interface GigabitEthernet4/0
 ip address 172.16.67.1 255.255.255.252
```

```
hostname R6
service password-encryption
security password min-length 10
enable secret fable12345
```

R5:

```
interface FastEthernet0/0
 ip address 200.10.5.1 255.255.255.0

interface GigabitEthernet2/0
 ip address 172.16.45.2 255.255.255.252

interface GigabitEthernet4/0
 ip address 172.16.51.1 255.255.255.252
```

```
hostname BRANCH1
enable secret fable
ip domain name the-fable.com
username the-fable password b1fable123

line vty 0 4
 login local
 transport input ssh

line vty 5 15
 login local
 transport input ssh
```

REMOTE OFFICE (R7):

```
interface FastEthernet0/0
 ip address 200.10.7.1 255.255.255.0

interface GigabitEthernet2/0
 ip address 172.16.67.2 255.255.255.252
```

```
hostname REMOTE OFFICE
enable secret fableOFF123
service password-encryption
security password min-length 10
```

- **remoteIT(R11):**

interface FastEthernet0/0 ip address 200.10.11.1 255.255.255.248 interface GigabitEthernet2/0 ip address 172.16.51.2 255.255.255.252	Hostname remoteIT Service password-encryption Security password min-length 10 enable secret fable12345

Configuring switches

Switch(S2):

interface Vlan1 ip address 200.10.11.2 255.255.255.0 ip default-gateway 200.10.11.1 line vty 0 4 login local transport input ssh	hostname S2 enable secret theFableS222 username the-fable password remITfable ip domain-name the-fable.com

Switch(S3):

interface Vlan1 ip address 200.10.7.2 255.255.255.0 ip default-gateway 200.10.7.1 line vty 0 4 login local transport input ssh	hostname S3 enable secret theFableS333 username the-fable password remofficefable ip domain-name the-fable.com

Switch(S4):

interface Vlan1 ip address 192.168.1.34 255.255.255.240 ip default-gateway 192.168.1.33 line vty 0 4 login local transport input ssh	hostname S4 enable secret 5 1R8Q8$6iFM91k.w91FuK5ND8uXr/ username the-fable password 0 fable ip domain-name the-fable.com

Multi-Layer Switch (ML-SW1):

interface Port-channel1 no switchport ip address 172.16.2.2 255.255.255.0	hostname ML-SW1 enable secret thefableMS1 username the-fable password fableSW1234 ip domain name the-fable.com service password-encryption

Multi-Layer Switch (ML-SW2):

interface Port-channel1 no switchport ip address 172.16.2.12 255.255.255.0	hostname ML-SW2 enable secret thefableMS2 username the-fable password fableSW1234 ip domain name the-fable.com service password-encryption

PCs Configuring

PC5	Fa 0/0	192.168.1.35/28 255.255.255.240	IP default-gateway 192.168.1.33
PC7	Fa 0/0	192.168.1.37/28 255.255.255.240	
PC8	Fa 0/0	192.168.1.36/28 255.255.255.240	
PC9	Fa 0/0	192.168.1.6/27 255.255.255.224	IP default-gateway 192.168.1.0
PC10	Fa 0/0	192.168.1.4/27 255.255.255.224	
PC11	Fa 0/0	192.168.1.5/27 255.255.255.224	
PC12	Fa 0/0	192.168.1.3/27 255.255.255.224	
PC14	Fa 0/0	192.168.1.7/27 255.255.255.224	
PC15	Fa 0/0	172.16.2.3	IP default-gateway 172.16.2.1
PC16	Fa 0/0	172.16.2.4	
PC17	Fa 0/0	172.16.2.5	
PC18	Fa 0/0	172.16.2.6	
PC19	Fa 0/0	172.16.2.7	
PC20	Fa 0/0	172.16.2.8	
PC21	Fa 0/0	172.16.2.9	
PC22	Fa 0/0	172.16.2.10	
PC23	Fa 0/0	172.16.2.11	
PC2	Fa 0/0	200.10.5.3	IP default-gateway 200.10.5.1
PC3	Fa 0/0	200.10.5.4	
PC4	Fa 0/0	200.10.5.5	
PC6	Fa 0/0	200.10.7.3	IP default-gateway 200.10.7.1
PC1	Fa 0/0	200.10.11.3	IP default-gateway 200.10.11.1

Configuring EIGRP

- **Branch 2 (R8):**

```
BRANCH2(config)#router eigrp 1
BRANCH2(config-router)#net 192.168.1.1 0.0.0.0
BRANCH2(config-router)#net 192.168.1.53 0.0.0.0
BRANCH2(config-router)#net 192.168.1.50 0.0.0.0
BRANCH2(config-router)#net 192.168.1.61 0.0.0.0
BRANCH2(config-router)#no auto-summary
```

- **R9 (ASBR):**

```
R9(config)#router eigrp 1
R9(config-router)#net 192.168.1.49 0.0.0.0
R9(config-router)#no auto-summary
R9(config-router)#router eigrp 2
R9(config-router)#net 192.168.1.58 0.0.0.0
R9(config-router)#no auto-summary
```

Redistribution

```
R9(config)#router eigrp 1
R9(config-router)#redistribute eigrp 2 metric 1 1 1 1 1
R9(config-router)#router eigrp 2
R9(config-router)#redistribute eigrp 1 metric 1 1 1 1 1
```

- **new company (R10):**

```
new-company(config)#router eigrp 2
new-company(config-router)#net
new-company(config-router)#network 0.0.0.0
new-company(config-router)#no auto-summary
```

- **R2(ASBR):**

```
R2(config)#router eigrp 1
R2(config-router)#net 192.168.1.62 0.0.0.0
R2(config-router)#net 192.168.1.66 0.0.0.0
R2(config-router)#no auto-summary
```

Redistribution

```
R2(config)#router eigrp 1
R2(config-router)#redistribute ospf 1 metric 1 1 1 1 1
R2(config-router)#router ospf 1
R2(config-router)#redistribute eigrp 1 metric-t
R2(config-router)#redistribute eigrp 1 metric-type 1
subnets
```

- **R3:**

```
R3(config)#router eigrp 1
R3(config-router)#net 192.168.1.54 0.0.0.0
R3(config-router)#net 192.168.1.65 0.0.0.0
R3(config-router)#no auto-summary
```

```
R3(config)#router eigrp 1
R3(config-router)#redistribute ospf 1 metric 1 1 1 1 1
R3(config-router)#router ospf 1
R3(config-router)#redistribute eigrp 1 metric-ty
R3(config-router)#redistribute eigrp 1 metric-type 1
subnets
```

Troubleshooting:

New Company PINGS Branch2:

```
new-company#ping 192.168.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 88/90/96 ms
new-company#ping 192.168.1.53
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.53, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 88/92/100 ms
new-company#ping 192.168.1.50
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.50, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 96/106/128 ms
new-company#ping 192.168.1.61
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.61, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 88/90/96 ms
```

New Company PINGS R2:

```
new-company#ping 192.168.1.62
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.62, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 132/133/140 ms
new-company#ping 192.168.1.66
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.66, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 124/132/144 ms
```

New Company PINGS R3:

```
new-company#ping 192.168.1.54
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.54, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 92/112/136 ms
new-company#ping 192.168.1.65
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 128/142/188 ms
```

Branch2 PINGS New Company:

```
BRANCH2#ping 192.168.1.33
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.33, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/104/128 m
BRANCH2#ping 192.168.1.57
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.57, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/58/96 ms
```

Branch2 PINGS R9:

```
BRANCH2#ping 192.168.1.49
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.49, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 48/84/108 ms
BRANCH2#ping 192.168.1.58
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.58, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/34/64 ms
```

Branch2 PINGS R2:

```
BRANCH2#ping 192.168.1.62
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.62, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/73/92 ms
BRANCH2#ping 192.168.1.66
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.66, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/39/76 ms
```

Branch2 PINGS R3:

```
BRANCH2#ping 192.168.1.65
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/38/96 ms
BRANCH2#ping 192.168.1.54
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.54, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/43/92 ms
```

R8 (Branch 2) route and topology table:

```
BRANCH2#sh ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      192.168.1.0/24 is variably subnetted, 9 subnets, 4 masks
C        192.168.1.0/27 is directly connected, FastEthernet0/0
L        192.168.1.1/32 is directly connected, FastEthernet0/0
D EX     192.168.1.32/28
           [170/2560512256] via 192.168.1.49, 01:02:05, Serial3/1
C        192.168.1.48/30 is directly connected, Serial3/1
L        192.168.1.50/32 is directly connected, Serial3/1
C        192.168.1.52/30 is directly connected, GigabitEthernet2/0
L        192.168.1.53/32 is directly connected, GigabitEthernet2/0
D EX     192.168.1.56/30
           [170/2560512256] via 192.168.1.49, 01:02:05, Serial3/1
D        192.168.1.64/30
           [90/2170112] via 192.168.1.54, 00:23:09, GigabitEthernet2/0
```

```
BRANCH2#sh ip eigrp topology
EIGRP-IPv4 Topology Table for AS(1)/ID(192.168.1.53)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.48/30, 1 successors, FD is 2169856
        via Connected, Serial3/1
P 192.168.1.52/30, 1 successors, FD is 2816
        via Connected, GigabitEthernet2/0
P 192.168.1.0/27, 1 successors, FD is 28160
        via Connected, FastEthernet0/0
P 192.168.1.56/30, 1 successors, FD is 2560512256
        via 192.168.1.49 (2560512256/2560000256), Serial3/1
P 192.168.1.64/30, 1 successors, FD is 2170112
        via 192.168.1.54 (2170112/2169856), GigabitEthernet2/0
P 192.168.1.32/28, 1 successors, FD is 2560512256
        via 192.168.1.49 (2560512256/2560000256), Serial3/1
```

R9(ASBR) route and topology table:

```
R9#sh ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      192.168.1.0/24 is variably subnetted, 9 subnets, 4 masks
D        192.168.1.0/27 [90/2172416] via 192.168.1.50, 00:14:29, Serial3/1
D        192.168.1.32/28
           [90/28416] via 192.168.1.57, 00:14:48, GigabitEthernet2/0
C        192.168.1.48/30 is directly connected, Serial3/1
L        192.168.1.49/32 is directly connected, Serial3/1
D        192.168.1.52/30 [90/2170112] via 192.168.1.50, 00:14:29, Serial3/1
C        192.168.1.56/30 is directly connected, GigabitEthernet2/0
L        192.168.1.58/32 is directly connected, GigabitEthernet2/0
D        192.168.1.60/30 [90/2681856] via 192.168.1.50, 00:01:57, Serial3/1
D        192.168.1.64/30 [90/2682112] via 192.168.1.50, 00:14:29, Serial3/1
```

```
R9#sh ip eigrp topology
EIGRP-IPv4 Topology Table for AS(1)/ID(192.168.1.58)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.48/30, 1 successors, FD is 2169856
        via Connected, Serial3/1
P 192.168.1.52/30, 1 successors, FD is 2170112
        via 192.168.1.50 (2170112/2816), Serial3/1
P 192.168.1.0/27, 1 successors, FD is 2172416
        via 192.168.1.50 (2172416/28160), Serial3/1
P 192.168.1.56/30, 1 successors, FD is 2560000256
        via Redistributed (2560000256/0)
P 192.168.1.64/30, 1 successors, FD is 2682112
        via 192.168.1.50 (2682112/2170112), Serial3/1
P 192.168.1.32/28, 1 successors, FD is 2560000256
        via Redistributed (2560000256/0)
P 192.168.1.60/30, 1 successors, FD is 2681856
        via 192.168.1.50 (2681856/2169856), Serial3/1

EIGRP-IPv4 Topology Table for AS(2)/ID(192.168.1.58)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.48/30, 1 successors, FD is 2560000256
        via Redistributed (2560000256/0)
P 192.168.1.52/30, 1 successors, FD is 2560000256
        via Redistributed (2560000256/0)
P 192.168.1.0/27, 1 successors, FD is 2560000256
        via Redistributed (2560000256/0)
P 192.168.1.56/30, 1 successors, FD is 2816
        via Connected, GigabitEthernet2/0
P 192.168.1.64/30, 1 successors, FD is 2560000256
        via Redistributed (2560000256/0)
P 192.168.1.32/28, 1 successors, FD is 28416
        via 192.168.1.57 (28416/28160), GigabitEthernet2/0
P 192.168.1.60/30, 1 successors, FD is 2560000256
        via Redistributed (2560000256/0)
```

R10(New Company) route and topology table:

```
new-company#sh ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      192.168.1.0/24 is variably subnetted, 9 subnets, 4 masks
D EX     192.168.1.0/27
           [170/2560000512] via 192.168.1.58, 00:16:26, GigabitEthernet2/0
C        192.168.1.32/28 is directly connected, FastEthernet0/0
L        192.168.1.33/32 is directly connected, FastEthernet0/0
D EX     192.168.1.48/30
           [170/2560000512] via 192.168.1.58, 00:16:53, GigabitEthernet2/0
D EX     192.168.1.52/30
           [170/2560000512] via 192.168.1.58, 00:16:26, GigabitEthernet2/0
C        192.168.1.56/30 is directly connected, GigabitEthernet2/0
L        192.168.1.57/32 is directly connected, GigabitEthernet2/0
D EX     192.168.1.60/30
           [170/2560000512] via 192.168.1.58, 00:03:59, GigabitEthernet2/0
D EX     192.168.1.64/30
           [170/2560000512] via 192.168.1.58, 00:16:26, GigabitEthernet2/0
```

```
new-company#sh ip eigrp topology
EIGRP-IPv4 Topology Table for AS(2)/ID(192.168.1.57)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.48/30, 1 successors, FD is 2560000512
        via 192.168.1.58 (2560000512/2560000256), GigabitEthernet2/0
P 192.168.1.52/30, 1 successors, FD is 2560000512
        via 192.168.1.58 (2560000512/2560000256), GigabitEthernet2/0
P 192.168.1.0/27, 1 successors, FD is 2560000512
        via 192.168.1.58 (2560000512/2560000256), GigabitEthernet2/0
P 192.168.1.56/30, 1 successors, FD is 2816
        via Connected, GigabitEthernet2/0
P 192.168.1.64/30, 1 successors, FD is 2560000512
        via 192.168.1.58 (2560000512/2560000256), GigabitEthernet2/0
P 192.168.1.32/28, 1 successors, FD is 28160
        via Connected, FastEthernet0/0
P 192.168.1.60/30, 1 successors, FD is 2560000512
        via 192.168.1.58 (2560000512/2560000256), GigabitEthernet2/0
```

R2(ASBR) route and topology table:

```
R2#sh ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      192.168.1.0/24 is variably subnetted, 9 subnets, 4 masks
D        192.168.1.0/27 [90/2172416] via 192.168.1.61, 00:05:26, Serial3/2
D EX     192.168.1.32/28
           [170/2561024256] via 192.168.1.61, 00:05:26, Serial3/2
D        192.168.1.48/30 [90/2681856] via 192.168.1.61, 00:05:26, Serial3/2
D        192.168.1.52/30 [90/2170112] via 192.168.1.65, 00:05:26, Serial3/1
                         [90/2170112] via 192.168.1.61, 00:05:26, Serial3/2
D EX     192.168.1.56/30
           [170/2561024256] via 192.168.1.61, 00:05:26, Serial3/2
C        192.168.1.60/30 is directly connected, Serial3/2
L        192.168.1.62/32 is directly connected, Serial3/2
C        192.168.1.64/30 is directly connected, Serial3/1
L        192.168.1.66/32 is directly connected, Serial3/1
```

```
R2#sh ip eigrp topology
EIGRP-IPv4 Topology Table for AS(1)/ID(192.168.1.66)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.48/30, 1 successors, FD is 2681856
        via 192.168.1.61 (2681856/2169856), Serial3/2
        via 192.168.1.65 (2682112/2170112), Serial3/1
P 192.168.1.52/30, 2 successors, FD is 2170112
        via 192.168.1.61 (2170112/2816), Serial3/2
        via 192.168.1.65 (2170112/2816), Serial3/1
P 192.168.1.0/27, 1 successors, FD is 2172416
        via 192.168.1.61 (2172416/28160), Serial3/2
        via 192.168.1.65 (2172672/28416), Serial3/1
P 192.168.1.56/30, 1 successors, FD is 2561024256
        via 192.168.1.61 (2561024256/2560512256), Serial3/2
        via 192.168.1.65 (2561024512/2560512512), Serial3/1
P 192.168.1.64/30, 1 successors, FD is 2169856
        via Connected, Serial3/1
P 192.168.1.32/28, 1 successors, FD is 2561024256
        via 192.168.1.61 (2561024256/2560512256), Serial3/2
        via 192.168.1.65 (2561024512/2560512512), Serial3/1
P 192.168.1.60/30, 1 successors, FD is 2169856
        via Connected, Serial3/2
```

R3(ASBR) route and topology table:

```
R3#sh ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      192.168.1.0/24 is variably subnetted, 9 subnets, 4 masks
D        192.168.1.0/27
           [90/28416] via 192.168.1.53, 00:06:55, GigabitEthernet2/0
D EX     192.168.1.32/28
           [170/2560512512] via 192.168.1.53, 00:06:55, GigabitEthernet2/0
D        192.168.1.48/30
           [90/2170112] via 192.168.1.53, 00:06:55, GigabitEthernet2/0
C        192.168.1.52/30 is directly connected, GigabitEthernet2/0
L        192.168.1.54/32 is directly connected, GigabitEthernet2/0
D EX     192.168.1.56/30
           [170/2560512512] via 192.168.1.53, 00:06:55, GigabitEthernet2/0
D        192.168.1.60/30
           [90/2170112] via 192.168.1.53, 00:06:56, GigabitEthernet2/0
C        192.168.1.64/30 is directly connected, Serial3/0
L        192.168.1.65/32 is directly connected, Serial3/0
```

```
R3#sh ip eigrp topology
EIGRP-IPv4 Topology Table for AS(1)/ID(192.168.1.65)
Codes: P - Passive, A - Active, U - Update, Q - Query, R - Reply,
       r - reply Status, s - sia Status

P 192.168.1.48/30, 1 successors, FD is 2170112
        via 192.168.1.53 (2170112/2169856), GigabitEthernet2/0
P 192.168.1.52/30, 1 successors, FD is 2816
        via Connected, GigabitEthernet2/0
P 192.168.1.0/27, 1 successors, FD is 28416
        via 192.168.1.53 (28416/28160), GigabitEthernet2/0
P 192.168.1.56/30, 1 successors, FD is 2560512512
        via 192.168.1.53 (2560512512/2560512256), GigabitEthernet2/0
P 192.168.1.64/30, 1 successors, FD is 2169856
        via Connected, Serial3/0
P 192.168.1.32/28, 1 successors, FD is 2560512512
        via 192.168.1.53 (2560512512/2560512256), GigabitEthernet2/0
P 192.168.1.60/30, 1 successors, FD is 2170112
        via 192.168.1.53 (2170112/2169856), GigabitEthernet2/0
        via 192.168.1.66 (2681856/2169856), Serial3/0
```

Configuring OSPF

-Router(R1):

```
R1(config)# router ospf 1
R1(config-router)# network 172.16.1.0 0.0.0.3 area 0
R1(config-router)# network 172.16.2.0 0.0.0.255 area 0
R1(config-router)# network 172.16.3.0 0.0.0.3 area 0
R1(config-router)# network 172.16.4.0 0.0.0.3 area 0
R1(config-router)# network 172.16.5.0 0.0.0.3 area 0
```

-Router(R2):

```
R2(config)# router ospf 1
R2(config-router)# network 172.16.3.0 0.0.0.3 area 0
```

-Router(R3):

```
R3(config)# router ospf 1
R3(config-router)# network 172.16.4.0 0.0.0.3 area 0
```

-Router(R4):

```
R4(config)# router ospf 1
R4(config-router)# network 172.16.5.0 0.0.0.3 area 0
R4(config-router)# network 172.16.45.0 0.0.0.3 area 1
```

-Router(R6):

```
R6(config)# router ospf 1
R6(config-router)# network 172.16.1.0 0.0.0.3 area 0
R6(config-router)# network 172.16.67.0 0.0.0.3 area 2
```

-Router4(R4):

```
R4#config terminal
R4(config)#router ospf 1
 R4(config-router)#router-id 4.4.4.4
R4(config-router)# area 1 virtual-link 5.5.5.5
R4(config-router)# network 172.16.5.0 0.0.0.3 area 0
 R4(config-router)#network 172.16.45.0 0.0.0.3 area 1
```

-Router(R5):

```
R5#config terminal
R5(config)#router ospf 1
R5(config-router)#router-id 5.5.5.5
 R5(config-router)#area 1 virtual-link 4.4.4.4
 R5(config-router)#network 172.16.45.0 0.0.0.3 area 1
R5(config-router)#network 172.16.51.0 0.0.0.3 area 3
R5(config-router)#network 200.10.5.0 0.0.0.255 area 1
```

-Router(R11)

```
R11(config)#router ospf 1
 R11(config-router)#network 172.16.51.0 0.0.0.3 area 3
R11(config-router)# network 200.10.11.0 0.0.0.7 area 3
```

-Router(R7)

```
R7# configure terminal
R7(config)# router ospf 1
R7(config-router)# network 172.16.67.0 0.0.0.3 area 2
R7(config-router)#network 200.10.7.1 0.0.0.255 area 2
```

Troubleshooting:

-Router 1 ping devices:

```
HQ#ping 172.16.3.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.3.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/87/92 ms
HQ#ping 172.16.4.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.4.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 12/48/92 ms
HQ#ping 192.168.1.65
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/78/92 ms
HQ#ping 172.16.5.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.5.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/85/120 ms
HQ#ping 172.16.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/76/92 ms
HQ#ping 192.168.1.61
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.61, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 52/78/92 ms
```

-Router 2 ping devices:

```
R2#ping 172.16.3.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.3.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/89/100 ms
R2#ping 172.16.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 88/108/132 ms
R2#ping 172.16.5.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.5.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/86/132 ms
R2#ping 192.168.1.65
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.65, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/86/88 ms
R2#ping 192.168.1.61
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.61, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/84/92 ms
```

-Router 3 ping devices:

```
R3#ping 172.16.2.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.2.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 104/121/132 ms
R3#ping 172.16.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 88/94/100 ms
R3#ping 172.16.5.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.5.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/103/120 ms
R3#ping 192.168.1.66
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.66, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 104/125/156 ms
R3#ping 192.168.1.53
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.53, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 88/91/96 ms
```

-Router 6 ping devices:

```
R6#ping 172.16.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 108/125/152 ms
R6#ping 172.16.3.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.3.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/110/128 ms
R6#ping 172.16.4.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.4.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 84/104/124 ms
R6#ping 172.16.5.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.5.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 88/106/132 ms
```

-Branch2 ping devices (EIGRP):

```
BRANCH2#ping 172.16.3.0
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.3.0, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 56/70/84 ms
BRANCH2#ping 172.16.5.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.5.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 92/105/128 ms
BRANCH2#ping 172.16.1.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 76/119/176 ms
BRANCH2#ping 192.168.1.62
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.62, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 32/67/92 ms
BRANCH2#ping 192.168.1.54
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.54, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 88/91/96 ms
```

-Router 4 ping devices:

```
R4#ping 172.16.45.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.45.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/34/60 ms
R4#ping 192.168.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 60/76/96 ms
R4#ping 172.16.51.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.51.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 40/67/124 ms
R4#ping 172.16.67.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.67.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 68/89/140 ms
```

-Router 5 ping devices:

```
BRANCH1#ping 192.168.1.53
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.53, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 116/147/208 ms
BRANCH1#ping 172.16.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/63/84 ms
BRANCH1#ping 172.16.51.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.51.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 24/38/76 ms
BRANCH1#ping 172.16.67.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.67.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 124/142/172 ms
BRANCH1#ping 172.16.45.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.45.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/28/36 ms
```

-Router 11 ping devices:

```
remoteIT#ping 192.168.1.53
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.53, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 112/170/196 ms
remoteIT#ping 172.16.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/98/148 ms
remoteIT#ping 172.16.45.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.45.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 60/88/128 ms
remoteIT#ping 172.16.45.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.45.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 28/64/108 ms
remoteIT#ping 172.16.67.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.67.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 128/152/220 ms
remoteIT#
```

-Router 7 ping devices:

```
REMOTE-OFFICE#ping 192.168.1.53
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.1.53, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 168/177/188 ms
REMOTE-OFFICE#ping 172.16.1.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.1.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 60/109/132 ms
REMOTE-OFFICE#ping 172.16.45.1
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.45.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 64/107/152 ms
REMOTE-OFFICE#ping 172.16.45.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.45.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 68/135/180 ms
REMOTE-OFFICE#ping 172.16.51.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 172.16.51.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 156/183/220 ms
```

Show IP Route

-Router 4 :

```
R4#sh ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 10 subnets, 3 masks
O        172.16.1.0/30 [110/65] via 172.16.5.1, 00:02:02, Serial3/3
O        172.16.2.0/24 [110/74] via 172.16.5.1, 00:03:08, Serial3/3
O        172.16.3.0/30 [110/128] via 172.16.5.1, 00:03:08, Serial3/3
O        172.16.4.0/30 [110/128] via 172.16.5.1, 00:03:08, Serial3/3
C        172.16.5.0/30 is directly connected, Serial3/3
L        172.16.5.2/32 is directly connected, Serial3/3
C        172.16.45.0/30 is directly connected, GigabitEthernet2/0
L        172.16.45.1/32 is directly connected, GigabitEthernet2/0
O IA     172.16.51.0/30 [110/2] via 172.16.45.2, 00:03:03, GigabitEthernet2/0
O IA     172.16.67.0/30 [110/66] via 172.16.5.1, 00:01:51, Serial3/3
      192.168.1.0/24 is variably subnetted, 4 subnets, 2 masks
O E1     192.168.1.0/27 [110/148] via 172.16.5.1, 00:02:58, Serial3/3
O E1     192.168.1.52/30 [110/148] via 172.16.5.1, 00:03:03, Serial3/3
O E1     192.168.1.60/30 [110/148] via 172.16.5.1, 00:03:03, Serial3/3
O E1     192.168.1.64/30 [110/148] via 172.16.5.1, 00:03:03, Serial3/3
O     200.10.5.0/24 [110/2] via 172.16.45.2, 00:03:18, GigabitEthernet2/0
O IA  200.10.7.0/24 [110/67] via 172.16.5.1, 00:01:51, Serial3/3
      200.10.11.0/29 is subnetted, 1 subnets
O IA     200.10.11.0 [110/3] via 172.16.45.2, 00:03:03, GigabitEthernet2/0
```

-Router 5 :

```
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 10 subnets, 3 masks
O        172.16.1.0/30 [110/66] via 172.16.45.1, 00:04:15, GigabitEthernet2/0
O        172.16.2.0/24 [110/75] via 172.16.45.1, 00:05:14, GigabitEthernet2/0
O        172.16.3.0/30 [110/129] via 172.16.45.1, 00:05:14, GigabitEthernet2/0
O        172.16.4.0/30 [110/129] via 172.16.45.1, 00:05:14, GigabitEthernet2/0
O        172.16.5.0/30 [110/65] via 172.16.45.1, 00:05:14, GigabitEthernet2/0
C        172.16.45.0/30 is directly connected, GigabitEthernet2/0
L        172.16.45.2/32 is directly connected, GigabitEthernet2/0
C        172.16.51.0/30 is directly connected, GigabitEthernet4/0
L        172.16.51.1/32 is directly connected, GigabitEthernet4/0
O IA     172.16.67.0/30 [110/67] via 172.16.45.1, 00:04:03, GigabitEthernet2/0
      192.168.1.0/24 is variably subnetted, 4 subnets, 2 masks
O E1     192.168.1.0/27
           [110/149] via 172.16.45.1, 00:05:14, GigabitEthernet2/0
O E1     192.168.1.52/30
           [110/149] via 172.16.45.1, 00:05:14, GigabitEthernet2/0
O E1     192.168.1.60/30
           [110/149] via 172.16.45.1, 00:05:14, GigabitEthernet2/0
O E1     192.168.1.64/30
           [110/149] via 172.16.45.1, 00:05:14, GigabitEthernet2/0
      200.10.5.0/24 is variably subnetted, 2 subnets, 2 masks
C        200.10.5.0/24 is directly connected, FastEthernet0/0
L        200.10.5.1/32 is directly connected, FastEthernet0/0
O IA  200.10.7.0/24 [110/68] via 172.16.45.1, 00:04:03, GigabitEthernet2/0
      200.10.11.0/29 is subnetted, 1 subnets
O        200.10.11.0 [110/2] via 172.16.51.2, 00:05:24, GigabitEthernet4/0
```

-Router 11 :

```
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 9 subnets, 3 masks
O IA     172.16.1.0/30 [110/67] via 172.16.51.1, 00:07:29, GigabitEthernet2/0
O IA     172.16.2.0/24 [110/76] via 172.16.51.1, 00:07:29, GigabitEthernet2/0
O IA     172.16.3.0/30 [110/130] via 172.16.51.1, 00:07:29, GigabitEthernet2/0
O IA     172.16.4.0/30 [110/130] via 172.16.51.1, 00:07:29, GigabitEthernet2/0
O IA     172.16.5.0/30 [110/66] via 172.16.51.1, 00:07:29, GigabitEthernet2/0
O IA     172.16.45.0/30 [110/2] via 172.16.51.1, 00:07:34, GigabitEthernet2/0
C        172.16.51.0/30 is directly connected, GigabitEthernet2/0
L        172.16.51.2/32 is directly connected, GigabitEthernet2/0
O IA     172.16.67.0/30 [110/68] via 172.16.51.1, 00:06:19, GigabitEthernet2/0
      192.168.1.0/24 is variably subnetted, 4 subnets, 2 masks
O E1     192.168.1.0/27
           [110/150] via 172.16.51.1, 00:07:29, GigabitEthernet2/0
O E1     192.168.1.52/30
           [110/150] via 172.16.51.1, 00:07:29, GigabitEthernet2/0
O E1     192.168.1.60/30
           [110/150] via 172.16.51.1, 00:07:29, GigabitEthernet2/0
O E1     192.168.1.64/30
           [110/150] via 172.16.51.1, 00:07:29, GigabitEthernet2/0
O IA  200.10.5.0/24 [110/2] via 172.16.51.1, 00:07:34, GigabitEthernet2/0
O IA  200.10.7.0/24 [110/69] via 172.16.51.1, 00:06:19, GigabitEthernet2/0
      200.10.11.0/24 is variably subnetted, 2 subnets, 2 masks
C        200.10.11.0/29 is directly connected, FastEthernet0/0
L        200.10.11.1/32 is directly connected, FastEthernet0/0
```

Router 7

```
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 9 subnets, 3 masks
O IA     172.16.1.0/30 [110/2] via 172.16.67.1, 00:09:13, GigabitEthernet2/0
O IA     172.16.2.0/24 [110/12] via 172.16.67.1, 00:07:55, GigabitEthernet2/0
O IA     172.16.3.0/30 [110/66] via 172.16.67.1, 00:07:55, GigabitEthernet2/0
O IA     172.16.4.0/30 [110/66] via 172.16.67.1, 00:07:55, GigabitEthernet2/0
O IA     172.16.5.0/30 [110/66] via 172.16.67.1, 00:07:55, GigabitEthernet2/0
O IA     172.16.45.0/30 [110/67] via 172.16.67.1, 00:07:55, GigabitEthernet2/0
O IA     172.16.51.0/30 [110/68] via 172.16.67.1, 00:07:55, GigabitEthernet2/0
C        172.16.67.0/30 is directly connected, GigabitEthernet2/0
L        172.16.67.2/32 is directly connected, GigabitEthernet2/0
      192.168.1.0/24 is variably subnetted, 4 subnets, 2 masks
O E1     192.168.1.0/27 [110/86] via 172.16.67.1, 00:07:50, GigabitEthernet2/0
O E1     192.168.1.52/30
           [110/86] via 172.16.67.1, 00:07:50, GigabitEthernet2/0
O E1     192.168.1.60/30
           [110/86] via 172.16.67.1, 00:07:50, GigabitEthernet2/0
O E1     192.168.1.64/30
           [110/86] via 172.16.67.1, 00:07:50, GigabitEthernet2/0
O IA  200.10.5.0/24 [110/68] via 172.16.67.1, 00:07:55, GigabitEthernet2/0
      200.10.7.0/24 is variably subnetted, 2 subnets, 2 masks
C        200.10.7.0/24 is directly connected, FastEthernet0/0
L        200.10.7.1/32 is directly connected, FastEthernet0/0
      200.10.11.0/29 is subnetted, 1 subnets
O IA     200.10.11.0 [110/69] via 172.16.67.1, 00:07:55, GigabitEthernet2/0
REMOTE_OFFICE#
```

-Router 1:

```
HQ#show ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 12 subnets, 3 masks
C        172.16.1.0/30 is directly connected, GigabitEthernet2/0
L        172.16.1.1/32 is directly connected, GigabitEthernet2/0
C        172.16.2.0/24 is directly connected, Ethernet4/0
L        172.16.2.1/32 is directly connected, Ethernet4/0
C        172.16.3.0/30 is directly connected, Serial3/0
L        172.16.3.1/32 is directly connected, Serial3/0
C        172.16.4.0/30 is directly connected, Serial3/1
L        172.16.4.1/32 is directly connected, Serial3/1
C        172.16.5.0/30 is directly connected, Serial3/3
L        172.16.5.1/32 is directly connected, Serial3/3
O IA     172.16.45.0/30 [110/65] via 172.16.5.2, 00:19:01, Serial3/3
O IA     172.16.67.0/30 [110/2] via 172.16.1.2, 00:19:21, GigabitEthernet2/0
      192.168.1.0/24 is variably subnetted, 7 subnets, 3 masks
O E1     192.168.1.0/27 [110/84] via 172.16.4.2, 00:19:21, Serial3/1
                        [110/84] via 172.16.3.2, 00:19:21, Serial3/0
O E1     192.168.1.32/28 [110/84] via 172.16.3.2, 00:19:21, Serial3/0
O E1     192.168.1.48/30 [110/84] via 172.16.4.2, 00:19:21, Serial3/1
                         [110/84] via 172.16.3.2, 00:19:21, Serial3/0
O E1     192.168.1.52/30 [110/84] via 172.16.4.2, 00:19:21, Serial3/1
                         [110/84] via 172.16.3.2, 00:19:21, Serial3/0
O E1     192.168.1.56/30 [110/84] via 172.16.3.2, 00:19:21, Serial3/0
O E1     192.168.1.60/30 [110/84] via 172.16.4.2, 00:19:21, Serial3/1
                         [110/84] via 172.16.3.2, 00:19:21, Serial3/0
O E1     192.168.1.64/30 [110/84] via 172.16.4.2, 00:19:21, Serial3/1
                         [110/84] via 172.16.3.2, 00:19:21, Serial3/0
```

-Router 2:

```
R2#sh ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 8 subnets, 3 masks
O        172.16.1.0/30 [110/65] via 172.16.3.1, 00:17:28, Serial3/0
O        172.16.2.0/24 [110/74] via 172.16.3.1, 00:18:06, Serial3/0
C        172.16.3.0/30 is directly connected, Serial3/0
L        172.16.3.2/32 is directly connected, Serial3/0
O        172.16.4.0/30 [110/128] via 172.16.3.1, 00:17:39, Serial3/0
O        172.16.5.0/30 [110/128] via 172.16.3.1, 00:17:09, Serial3/0
O IA     172.16.45.0/30 [110/129] via 172.16.3.1, 00:16:59, Serial3/0
O IA     172.16.67.0/30 [110/66] via 172.16.3.1, 00:17:24, Serial3/0
      192.168.1.0/24 is variably subnetted, 9 subnets, 4 masks
D        192.168.1.0/27 [90/2172416] via 192.168.1.61, 00:17:35, Serial3/2
D EX     192.168.1.32/28
           [170/2560512256] via 192.168.1.65, 00:17:33, Serial3/1
D        192.168.1.48/30 [90/2681856] via 192.168.1.61, 00:17:35, Serial3/2
D        192.168.1.52/30 [90/2170112] via 192.168.1.65, 00:17:35, Serial3/1
                         [90/2170112] via 192.168.1.61, 00:17:35, Serial3/2
D EX     192.168.1.56/30
           [170/2560512256] via 192.168.1.65, 00:17:33, Serial3/1
C        192.168.1.60/30 is directly connected, Serial3/2
L        192.168.1.62/32 is directly connected, Serial3/2
C        192.168.1.64/30 is directly connected, Serial3/1
L        192.168.1.66/32 is directly connected, Serial3/1
```

-Router 3:

```
R3#sh ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 8 subnets, 3 masks
O        172.16.1.0/30 [110/65] via 172.16.4.1, 00:10:28, Serial3/1
O        172.16.2.0/24 [110/74] via 172.16.4.1, 00:10:43, Serial3/1
O        172.16.3.0/30 [110/128] via 172.16.4.1, 00:10:43, Serial3/1
C        172.16.4.0/30 is directly connected, Serial3/1
L        172.16.4.2/32 is directly connected, Serial3/1
O        172.16.5.0/30 [110/128] via 172.16.4.1, 00:10:11, Serial3/1
O IA     172.16.45.0/30 [110/129] via 172.16.4.1, 00:10:01, Serial3/1
O IA     172.16.67.0/30 [110/66] via 172.16.4.1, 00:10:28, Serial3/1
      192.168.1.0/24 is variably subnetted, 9 subnets, 4 masks
D        192.168.1.0/27
           [90/28416] via 192.168.1.53, 00:10:39, GigabitEthernet2/0
O E1     192.168.1.32/28 [110/148] via 172.16.4.1, 00:10:38, Serial3/1
D        192.168.1.48/30
           [90/2170112] via 192.168.1.53, 00:10:39, GigabitEthernet2/0
C        192.168.1.52/30 is directly connected, GigabitEthernet2/0
L        192.168.1.54/32 is directly connected, GigabitEthernet2/0
O E1     192.168.1.56/30 [110/148] via 172.16.4.1, 00:10:38, Serial3/1
D        192.168.1.60/30
           [90/2170112] via 192.168.1.53, 00:10:39, GigabitEthernet2/0
C        192.168.1.64/30 is directly connected, Serial3/0
L        192.168.1.65/32 is directly connected, Serial3/0
```

-Router 6:

```
R6#sh ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 9 subnets, 3 masks
C        172.16.1.0/30 is directly connected, GigabitEthernet2/0
L        172.16.1.2/32 is directly connected, GigabitEthernet2/0
O        172.16.2.0/24 [110/11] via 172.16.1.1, 00:12:04, GigabitEthernet2/0
O        172.16.3.0/30 [110/65] via 172.16.1.1, 00:12:04, GigabitEthernet2/0
O        172.16.4.0/30 [110/65] via 172.16.1.1, 00:12:04, GigabitEthernet2/0
O        172.16.5.0/30 [110/65] via 172.16.1.1, 00:11:47, GigabitEthernet2/0
O IA     172.16.45.0/30 [110/66] via 172.16.1.1, 00:11:37, GigabitEthernet2/0
C        172.16.67.0/30 is directly connected, GigabitEthernet4/0
L        172.16.67.1/32 is directly connected, GigabitEthernet4/0
      192.168.1.0/24 is variably subnetted, 7 subnets, 3 masks
O E1     192.168.1.0/27 [110/85] via 172.16.1.1, 00:12:04, GigabitEthernet2/0
O E1     192.168.1.32/28 [110/85] via 172.16.1.1, 00:12:04, GigabitEthernet2/0
O E1     192.168.1.48/30 [110/85] via 172.16.1.1, 00:12:04, GigabitEthernet2/0
O E1     192.168.1.52/30 [110/85] via 172.16.1.1, 00:12:04, GigabitEthernet2/0
O E1     192.168.1.56/30 [110/85] via 172.16.1.1, 00:12:04, GigabitEthernet2/0
O E1     192.168.1.60/30 [110/85] via 172.16.1.1, 00:12:04, GigabitEthernet2/0
O E1     192.168.1.64/30 [110/85] via 172.16.1.1, 00:12:04, GigabitEthernet2/0
```

-Router 8:

```
R9#sh ip rou
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 7 subnets, 2 masks
D EX     172.16.1.0/30 [170/2560512512] via 192.168.1.50, 00:15:14, Serial3/1
D EX     172.16.2.0/24 [170/2560512512] via 192.168.1.50, 00:15:14, Serial3/1
D EX     172.16.3.0/30 [170/2560512512] via 192.168.1.50, 00:15:14, Serial3/1
D EX     172.16.4.0/30 [170/2560512512] via 192.168.1.50, 00:15:14, Serial3/1
D EX     172.16.5.0/30 [170/2560512512] via 192.168.1.50, 00:14:51, Serial3/1
D EX     172.16.45.0/30 [170/2560512512] via 192.168.1.50, 00:14:41, Serial3/1
D EX     172.16.67.0/30 [170/2560512512] via 192.168.1.50, 00:15:07, Serial3/1
      192.168.1.0/24 is variably subnetted, 9 subnets, 4 masks
D        192.168.1.0/27 [90/2172416] via 192.168.1.50, 00:15:14, Serial3/1
D        192.168.1.32/28
           [90/28416] via 192.168.1.57, 00:15:40, GigabitEthernet2/0
C        192.168.1.48/30 is directly connected, Serial3/1
L        192.168.1.49/32 is directly connected, Serial3/1
D        192.168.1.52/30 [90/2170112] via 192.168.1.50, 00:15:14, Serial3/1
C        192.168.1.56/30 is directly connected, GigabitEthernet2/0
L        192.168.1.58/32 is directly connected, GigabitEthernet2/0
D        192.168.1.60/30 [90/2681856] via 192.168.1.50, 00:15:14, Serial3/1
D        192.168.1.64/30 [90/2682112] via 192.168.1.50, 00:15:14, Serial3/1
```

-Router 9:


```
R9#sh ip rou
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 7 subnets, 2 masks
D EX     172.16.1.0/30 [170/2560512512] via 192.168.1.50, 00:15:14, Serial3/1
D EX     172.16.2.0/24 [170/2560512512] via 192.168.1.50, 00:15:14, Serial3/1
D EX     172.16.3.0/30 [170/2560512512] via 192.168.1.50, 00:15:14, Serial3/1
D EX     172.16.4.0/30 [170/2560512512] via 192.168.1.50, 00:15:14, Serial3/1
D EX     172.16.5.0/30 [170/2560512512] via 192.168.1.50, 00:14:51, Serial3/1
D EX     172.16.45.0/30 [170/2560512512] via 192.168.1.50, 00:14:41, Serial3/1
D EX     172.16.67.0/30 [170/2560512512] via 192.168.1.50, 00:15:07, Serial3/1
      192.168.1.0/24 is variably subnetted, 9 subnets, 4 masks
D        192.168.1.0/27 [90/2172416] via 192.168.1.50, 00:15:14, Serial3/1
D        192.168.1.32/28
           [90/28416] via 192.168.1.57, 00:15:40, GigabitEthernet2/0
C        192.168.1.48/30 is directly connected, Serial3/1
L        192.168.1.49/32 is directly connected, Serial3/1
D        192.168.1.52/30 [90/2170112] via 192.168.1.50, 00:15:14, Serial3/1
C        192.168.1.56/30 is directly connected, GigabitEthernet2/0
L        192.168.1.58/32 is directly connected, GigabitEthernet2/0
D        192.168.1.60/30 [90/2681856] via 192.168.1.50, 00:15:14, Serial3/1
D        192.168.1.64/30 [90/2682112] via 192.168.1.50, 00:15:14, Serial3/1
```

-Router 10:

```
new-company#sh ip route
Codes: L - local, C - connected, S - static, 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
       i - IS-IS, su - IS-IS summary, 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, H - NHRP, l - LISP
       + - replicated route, % - next hop override

Gateway of last resort is not set

      172.16.0.0/16 is variably subnetted, 7 subnets, 2 masks
D EX     172.16.1.0/30
           [170/2560000512] via 192.168.1.58, 00:35:10, GigabitEthernet2/0
D EX     172.16.2.0/24
           [170/2560000512] via 192.168.1.58, 00:35:10, GigabitEthernet2/0
D EX     172.16.3.0/30
           [170/2560000512] via 192.168.1.58, 00:35:10, GigabitEthernet2/0
D EX     172.16.4.0/30
           [170/2560000512] via 192.168.1.58, 00:35:10, GigabitEthernet2/0
D EX     172.16.5.0/30
           [170/2560000512] via 192.168.1.58, 00:34:47, GigabitEthernet2/0
D EX     172.16.45.0/30
           [170/2560000512] via 192.168.1.58, 00:34:37, GigabitEthernet2/0
D EX     172.16.67.0/30
           [170/2560000512] via 192.168.1.58, 00:35:03, GigabitEthernet2/0
      192.168.1.0/24 is variably subnetted, 9 subnets, 4 masks
D EX     192.168.1.0/27
           [170/2560000512] via 192.168.1.58, 00:35:10, GigabitEthernet2/0
C        192.168.1.32/28 is directly connected, FastEthernet0/0
L        192.168.1.33/32 is directly connected, FastEthernet0/0
D EX     192.168.1.48/30
           [170/2560000512] via 192.168.1.58, 00:35:10, GigabitEthernet2/0
D EX     192.168.1.52/30
           [170/2560000512] via 192.168.1.58, 00:35:10, GigabitEthernet2/0
C        192.168.1.56/30 is directly connected, GigabitEthernet2/0
L        192.168.1.57/32 is directly connected, GigabitEthernet2/0
D EX     192.168.1.60/30
           [170/2560000512] via 192.168.1.58, 00:35:10, GigabitEthernet2/0
D EX     192.168.1.64/30
           [170/2560000512] via 192.168.1.58, 00:35:10, GigabitEthernet2/0
new-company#
```